विद्युत VIDYUT

◆ वर्ष ३७ ◆ अंक १ ◆ भाद्र २०८३

नेपाल विद्युत प्राधिकरण

दरबारमार्ग, काठमाडौं

Joint Inauguration of Markichowk and Mulpani Substation from LDC by ADB President, Hon'ble Minister and Norwegian Ambassador

13th Meeting of the Joint Steering Committee (JSC) & Joint Working Group (JWG) on Nepal-India Cooperration in the Power Sector

विद्युत VIDYUT

◆ वर्ष ३७ ◆ अंक १ ◆ भाद्र २०८३

प्रकाशक:
नेपाल विद्युत प्राधिकरण

प्रकाशन/व्यवस्थापन
पुनम जोशी
मिनु थापा
बिमला महर्जन
अलिसा बरुवाल
कुसुम कुमारी शर्मा
मिना कुमारी देवकोटा
जनसम्पर्क तथा गुनासो
व्यवस्थापन शाखा
दरबारमार्ग, काठमाडौं ।
फोन: ४१५३०२१, ४१५३०२२
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क्लासिक प्रिन्टिङ सर्भिस

मुद्रण:
क्लासिक प्रिन्टिङ सर्भिस
फोन: ०१४१०२६०२
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संरक्षक

दीर्घायू कुमार श्रेष्ठ
का.मु. कार्यकारी निर्देशक

सल्लाहकार

मदन तिम्सिना
उपकार्यकारी निर्देशक
उत्पादन निर्देशनालय

राजन ऋषि कडेल
उपकार्यकारी निर्देशक
अर्थ निर्देशनालय

नवराज ओझा
उपकार्यकारी निर्देशक
प्रसारण निर्देशनालय

सम्पादन समिति

शिव कुमार अधिकारी
प्रमुख
प्रशासन निर्देशनालय

राजन ढकाल
प्रमुख
वितरण तथा ग्राहक सेवा निर्देशनालय

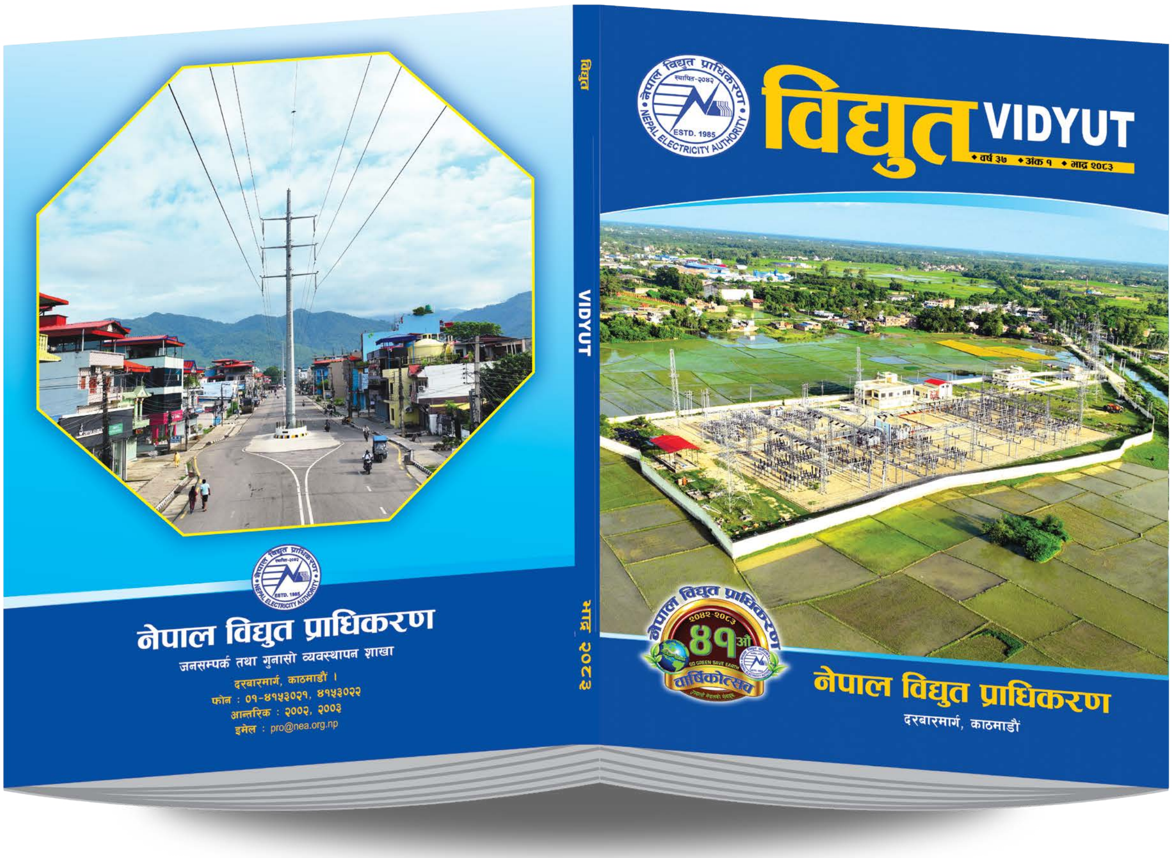
अच्युत वाबु घिमिरे
निर्देशक
मध्यम भोल्टेज ग्रिड विकास विभाग

राजा भाइ शिल्पकार
निर्देशक
उत्पादन विकास तथा सहायता विभाग

रमेश कुमार घिमिरे
निर्देशक
जनसाधन विभाग

केशवराज वली
प्रमुख
सामान्य सेवा विभाग
कार्यकारी सम्पादक

सर्वजित कुमार चौधरी
प्रमुख
जनसम्पर्क तथा गुनासो व्यवस्थापन शाखा



आवरण तस्विर: निर्माणाधीन १३२ के.भी. प्रसौनी सबस्टेशन, बारा

आवरण अन्तिम तस्विर: विद्युत प्रसारणका लागि प्रयोग गरिएको मोनोपोल, बुटवल

नेपाल विद्युत प्राधिकरण

(नेपाल सरकारको स्वामित्व)

प्रधान कार्यालय, दरबारमार्ग, काठमाडौं

शुभकामना

नेपाल विद्युत प्राधिकरणको नियमित अर्धवार्षिक प्रकाशन "विद्युत" (वर्ष ३७ अंक १) प्रकाशन हुन लागेकोमा खुसी व्यक्त गर्दछु ।

विद्युतको पहुँच दूरदराजका आम जनतासम्म पुऱ्याउने प्राधिकरणको लक्ष्य करिब-करिब पूरा हुने चरणमा छ । कर्णाली तथा सुदूरपश्चिम प्रदेशका उच्च पहाडी एवम् हिमाली जिल्लाका बाँकी क्षेत्रहरूमा समेत विद्युतीकरणको कार्यलाई अन्तिम चरणमा पुऱ्याइएको छ । प्राधिकरणले आफ्नो नीतिगत, संरचनागत, प्रक्रियागत र व्यवहारगत कार्यप्रणालीमा उल्लेखनीय सुधार गर्दै मुलुकलाई ऊर्जा क्षेत्रमा आत्मनिर्भर र सुरक्षित बनाउनुका साथै सेवा प्रवाहलाई थप गुणस्तरीय, विश्वश्नीय, सरल एवम् प्रविधिमैत्री बनाउन निरन्तर क्रियाशील रहँदै आएको छ ।

मुलुकभित्र उत्पादित विद्युत स्वदेशमै खपत गर्ने व्यवस्था मिलाई सामाजिक-आर्थिक रुपान्तरण तथा हरित अर्थतन्त्र प्रवर्द्धन अभियानमा जुटेको प्राधिकरणले स्वदेशमा खपत हुन नसकेको अतिरिक्त ऊर्जा मित्रराष्ट्र भारत र बङ्गलादेशमा निर्यात सुनिश्चित गरी जलविद्युतलाई मुलुकको अर्थतन्त्रको महत्वपूर्ण मेरुदण्डका रुपमा विकास गर्न सफल भएको छ ।

नेपाल सरकारले जारी गरेको ऊर्जा विकास मार्गचित्र, २०८१ अन्तर्गत तयार पारिएको कार्ययोजनाको मुख्य कार्यान्वयनकर्ता नेपाल विद्युत प्राधिकरणले संस्थाको दिगो र मजबुत आर्थिक सुधारमार्फत ऊर्जा सुरक्षाको अवस्थालाई सुदृढ गर्दै विश्वसनीय विद्युत उपलब्ध गराउन Battery Energy Storage System (BESS) र Pumped Storage Plant को निर्माण कार्ययोजना अगाडि बढाएको छ ।

नियमित,गुणस्तरीय र भरपर्दो विद्युत आपूर्तिलाई सुनिश्चित गर्दै अन्तरदेशीय विद्युत व्यापारबाट राष्ट्रको अर्थतन्त्रलाई टेवा पुऱ्याउन सरकारको प्राथमिकतामा परेका ६७० मेगावाटको दुधकोशी जलाशययुक्त, १०६३ मेगावाटको माथिल्लो अरुण, २१० मेगावाटको चैनपुर-सेती, ८२८ मेगावाटको उत्तरगंगा जलाशय, ६८३ मेगावाटको सुनकोशी-३ जलाशय, ७०.३७ मेगावाटको जावा तीला आंशिक जलाशयजस्ता रुपान्तरणकारी जलविद्युत आयोजनाहरूको निर्माण कार्य अगाडि बढाइएको छ । साथै ऊर्जा सम्मिश्रण (Energy Mix) कार्यक्रम अन्तर्गत सौर्य ऊर्जालाई प्राथमिकतामा राखिएको छ । १०० मेगावाटको कुलेखानी-सिस्नेरी, ४९५ मेगावाटको हुलिडटार एवम् ३३४ मेगावाटको स्यार्फुदह जस्ता पम्पस्टोरेज आयोजना निर्माणका लागि लाइसेन्स प्राप्ति गर्ने प्रक्रिया अगाडि बढाइएको छ । ऊर्जा आयात-निर्यातका लागि अन्तरदेशीय प्रसारण लाइनहरूको विकास, विस्तार एवम् स्तरोन्नतिमा विशेष जोड दिनुका साथै निजी क्षेत्रलाई प्रोत्साहन हुनेगरी ऊर्जा विकासमा लगानीको वातावरण सिर्जना गर्नु पनि उत्तिकै आवश्यक देखिन्छ ।

हिउँद र वर्षाको विद्युत आपूर्तिमा सन्तुलन कायम गर्न तथा ऊर्जा सुरक्षा प्रवर्द्धन गर्न प्राधिकरणले आफ्नो लगानीसँगै नेपाल सरकार र विभिन्न दातृ निकायहरूको आर्थिक सहयोगमा प्राधिकरणको सहायक कम्पनीहरू मार्फत ३७६ मेगावाट भन्दा बढी क्षमताका विभिन्न जलविद्युत आयोजनाहरू द्रुत गतिमा अगाडि बढाई सम्पन्न हुने चरणमा पुऱ्याएको छ ।

प्राधिकरणको सेवालाई अझ प्रभावकारी बनाउन, प्रणालीलाई स्वचालित बनाई भरपर्दो र गुणस्तरीय विद्युत आपूर्ति सुनिश्चित गर्न, कर्मचारीलाई तालिम तथा संस्थालाई डिजिटाइजेसन गर्ने कार्यलाई उच्च प्राथमिकतामा राखिएको छ । आधुनिक डिजिटल प्रविधि र कृत्रिम बौद्धिक प्रविधि (AI) समेत प्रयोग गर्दै हरेक क्रियाकलापलाई डिजिटल प्रविधिमा रुपान्तरण गर्न सुरु गरिएको छ ।

नेपाल विद्युत प्राधिकरणको ४१औँ वार्षिकोत्सवको शुभ अवसरमा प्राधिकरणलाई एक विशिष्ट र सफल व्यवसायिक संस्थाको रुपमा स्थापित गराउन सदैव सहयोग र मार्गनिर्देश गर्ने नेपाल सरकार, ऊर्जा, जलस्रोत तथा सिंचाई मन्त्रालय, दातृ निकाय, कार्यरत कर्मचारी, क्रियाशील ट्रेड युनियन, पूर्व कर्मचारी एवम् आम उपभोक्ता लगायत सम्बद्ध सबैप्रति हार्दिक आभार प्रकट गर्दै अगामी दिनमा समेत निरन्तर सहयोगको अपेक्षा गर्दछु ।

अन्त्यमा, विद्युत पत्रिकाको यस अंकलाई पूर्णता दिनका लागि स्तरीय लेख-रचना उपलब्ध गराउनुहुने सर्जकहरू, सम्पादक मण्डल एवं प्रकाशन व्यवस्थापनमा संलग्न सबैलाई हार्दिक धन्यवाद ज्ञापन गर्दछु ।

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दीर्घायु कुमार श्रेष्ठ

का.मु. कार्यकारी निर्देशक

१ भदौ, २०८३

सम्पर्क फोन : ०१४१५३००७, ०१४१५३०१२, ०१४१५३१९३, ०१४१५३०८२, फ्याक्स : ०१४१५३००९

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सम्पादकीय

नेपाल विद्युत प्राधिकरणको अर्धवार्षिक नियमित प्रकाशन **"विद्युत"** (वर्ष ३७, अंक १)को भाद्र अंक प्रकाशित गर्न पाउँदा सम्पादन समिति हर्षित छ । ऊर्जा क्षेत्रका विविध पक्षहरू समेटिएको यस पत्रिकाले आम उपभोक्ता, नागरिक समाज, शोधकर्ता र जिज्ञासुहरूलाई नवीन तथा खोजमूलक जानकारी उपलब्ध गराउनेछ भन्नेमा सम्पादन समिति विश्वस्त छ ।

नेपाल सरकारले ऊर्जा क्षेत्रको सुव्यवस्थित विकासका लागि ऊर्जा विकास मार्गचित्र, २०८१ तयार गरी सोको कार्यान्वयनका निम्ति कार्ययोजना समेत स्वीकृत गरिसकेको छ । सन् २०३५ सम्मको प्रक्षेपित आर्थिक वृद्धिलाई आधार मानी विद्युत मागको प्रक्षेपण, माग पूर्ति गर्ने तथा छिमेकी मुलुकहरूसम्म विद्युत निर्यात गरी अन्तरदेशीय व्यापारका सम्भाव्य प्रतिफलहरू हासिल गर्ने लक्ष्यका साथ ऊर्जा विकासका योजनाहरू कार्यान्वयनमा ल्याइएका छन् ।

त्यसैगरी, ऊर्जा मिश्रणको विश्वव्यापी अभ्यासलाई आत्मसात् गर्दै देश भित्रको मौसमी माग र आपूर्तिमा सन्तुलन ल्याउन जलाशययुक्त आयोजनाहरूको विकासमा निजी क्षेत्रलाई आकर्षित गर्ने प्रयास भइरहेको छ । जलाशययुक्त विद्युत उत्पादन केन्द्रको विद्युत खरिद बिक्री सम्बन्धी निर्देशिका,२०८२ जारी गरी विद्युत खरिद दर निर्धारणको आधार तय गरिएको छ । यसबाट निजी क्षेत्रको लगानीमा जलाशययुक्त आयोजनाहरूको द्रुत विकास भई ऊर्जा क्षेत्रले थप गति लिने विश्वास लिइएको छ ।

पछिल्लो समयमा भएको राजनीतिक/सामाजिक परिवर्तन पश्चात मुलुकमा स्पष्ट बहुमत सहितको स्थिर सरकार निर्माण भएको छ । विद्यमान सरकारले विद्युत क्षेत्रको विकासमा बाधकका रुपमा रहेका नीतिगत तथा कानूनी अड्चनहरूमा सुधार ल्याई सार्वजनिक-निजी साझेदारी (PPP) मार्फत समग्र विद्युत क्षेत्रको दिगो विकास हुने विश्वासिलो वातावरण सिर्जना गर्नेछ भन्ने अपेक्षा गर्न सकिन्छ ।

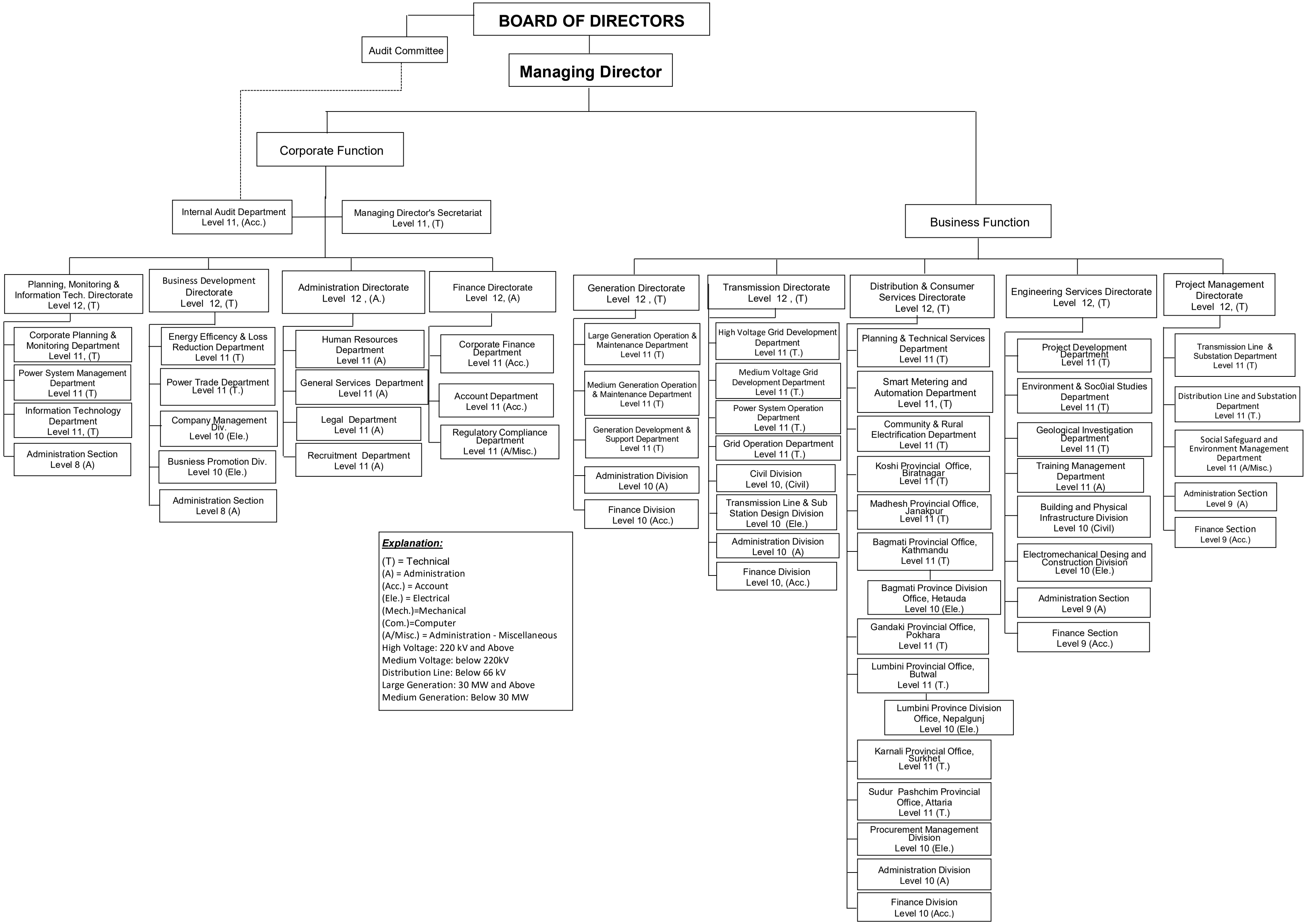
विद्युतको पहुँच दूरदराजका आम जनतासम्म पुऱ्याउने नेपाल सरकारको लक्ष्य करिब-करिब पूरा भइसकेको छ । तथापि, अबको मुख्य प्राथमिकता विद्युतको निरन्तर, विश्वसनीय र गुणस्तरीय आपूर्ति सुनिश्चित गर्नुमा हुनुपर्छ । यसका निम्ति जलाशययुक्त तथा पम्पस्टोरेज आयोजनाहरूको विकासलाई प्राथमिकता दिने, प्रसारण तथा वितरण सवस्टेशनहरूको विस्तार गर्ने र प्रसारण तथा वितरण लाइनहरूको स्तरोन्नति (Upgradation) गर्ने कार्यमा विशेष जोड दिनु आवश्यक देखिन्छ । साथै जनशक्तिको दक्षता अभिवृद्धिका लागि तालिम र क्षमता विकासका अवसरहरू प्रदान गर्नुका साथै विद्युतको सुरक्षित र प्रभावकारी प्रयोगबारे उपभोक्ताहरूमा आधारभूत सचेतना फैलाउनु उत्तिकै जरुरी छ । यसका अतिरिक्त, आधुनिक सूचना प्रविधिको अधिकतम प्रयोग गरी ग्राहक सेवालाई थप प्रभावकारी वनाउन जरुरी देखीन्छ । प्राधिकरणका नियमित कामकार्वाहीहरूलाई कागग विहिन प्रणाली (Paperless System) मा रुपान्तरण गर्न विद्युतीय माध्यमबाट सञ्चालित एकिकृत कार्यालय व्यवस्थापन प्रणाली (Integrated Office Management System) कार्यान्वयन गर्न ढिलाई भैसकेको छ ।

अन्त्यमा, सदाझैं विद्युत अर्धवार्षिक पत्रिकाको यस अंकलाई ज्ञानवर्धक, खोजमूलक र पठनीय बनाउन रचनात्मक एवं अनुसन्धानमूलक लेख-रचनाहरू उपलब्ध गराउनुहुने सम्पूर्ण आदरणीय सर्जक/लेखकहरूप्रति हार्दिक आभार व्यक्त गर्दछौँ । आगामी अंकहरूमा पनि यस्तै उपयोगी तथा स्तरीय सामग्रीहरूको अपेक्षा राख्दै यस अंकको सम्पादन तथा प्रकाशन प्रक्रियामा प्रत्यक्ष वा अप्रत्यक्ष रुपमा सहयोग पुऱ्याउनुहुने सम्बद्ध सबै पक्षप्रति हार्दिक धन्यवाद ज्ञापन गर्दछौं ।

सम्पादन समिति

रचनाक्रम

Nepal Electricity Authority
Organization Structure



मध्यस्थ निर्णय (Award) कार्यान्वयनमा प्राधिकरणको अवस्था

राजकुमार पोखरेल
उपनिर्देशक
ने.वि.प्रा.

परिचय

कुनै दुई पक्ष वीचमा देखिएको मत भिन्नता परस्परमा लिइएका विपरीत अडान वा कानूनको फरक फरक व्याख्या वा असहमति वा दुई पक्ष वीच मुख नमिलेको कुरालाई विवाद भन्न सकिन्छ। राज्यको कानून र कानून प्रणालीले सम्बोधन नगर्ने औपचारिक बाहेकका उपायहरूलाई वैकल्पिक उपाय मान्ने गरिएको छ। विवाद समाधानका वैकल्पिक उपायहरू मध्ये मध्यस्थता एक उपाय हो।

करारका पक्षहरूले करारबाट सिर्जित विवाद समाधानको लागि मध्यस्थकर्ता नियुक्ति गर्ने र मध्यस्तकर्ताको निर्णयलाई स्वीकार गर्ने गरी करारमा नै विवाद समाधान सम्बन्धी प्रावधान उल्लेख गरेको अवस्थामा त्यस्तो विवाद मध्यस्थबाट नै निरूपण गरिनु पर्दछ।

सार्वजनिक अन्तर्राष्ट्रिय कानूनको सन्दर्भमा यसलाई विवादको शान्तिपूर्ण समाधानको माध्यम र निजी अन्तर्राष्ट्रिय कानूनको सन्दर्भमा यसलाई विवाद समाधानको वैकल्पिक उपाय मानिन्छ। सार्वजनिक अन्तर्राष्ट्रिय कानूनको हेग स्थित मध्यस्थता सम्बन्धी स्थायी अदालत एक स्थायी संस्था हो भने निजी अन्तर्राष्ट्रिय कानूनको सन्दर्भमा पेरिसमा रहेको International Chamber of Commerce (ICC), लण्डनमा रहेको London Court of Arbitration, संयुक्त राज्य अमेरिकामा रहेको American Arbitration Association जस्ता संस्था प्रमुख छन्। त्यस्तै नेपालमा नेपाल मध्यस्थता परिषद् (Nepca), DRC Nepal जस्ता संस्थाहरूले Seat of Arbitration in Nepal भनेको अवस्थामा मध्यस्थहरूको कार्य गर्दै आएका छन्।

मध्यस्थहरूले (मध्यस्थकर्ता) निर्णय गरी विवाद समाधान गर्दछन्। विवादका पक्षहरूले पेश गरेको दाबी (Claim), प्रतिदाबी (Defense), प्रतियुक्ति (rejuinder) का विषयमा निर्णय गरिने भएकोले मध्यस्थता अदालती जस्तै देखिन्छ। मध्यस्थले गरेको निर्णय केही सैद्धान्तिक अवस्थामा वाहेक अन्तिम हुन्छ र अदालतबाट यस्तो निर्णय कार्यान्वयन गराइन्छ। मध्यस्थको निर्णय बाध्यकारी हुन्छ। मध्यस्थले गरेको निर्णय केहि कानूनी सिद्धान्तलाई (मध्यस्थता ऐन, २०५५ को दफा (३०) टेकेर अदालत जान पाइन्छ तर मध्यस्थले गरेको निर्णयमा पुनरावेदन लाग्दैन। नेपालको संविधानको धारा १२७ (२) को उपदफा (१) मा लेखिएदेखि बाहेक कानून बमोजिम मुद्दा हेर्न स्थानीय स्तरमा न्यायिक निकाय वा विवाद समाधानका वैकल्पिक उपाय अवलम्बन गर्न आवश्यकता अनुसार अन्य निकाय गठन गर्न सकिनेछ भन्ने संवैधानिक व्यवस्था अनुसार नै नेपालमा हाल प्रचलित मध्यस्थता ऐन २०५५ रहेको छ। यो

ऐन अन्तर्राष्ट्रिय व्यपार कानून सम्बन्धी संयुक्त राष्ट्र संघीय आयोग (UNCITRAL) द्वारा सन् १९८५ बमोजिमको Modern Law Commercial Arbitration मा आधारित छ। यसले पक्षहरूलाई पर्याप्त स्वायत्तता दिएको छ। हाल यस्तै खालका सार्वजनिक खरिद सम्बन्धी विवाद हेर्नको लागि पूर्वाधार न्यायाधिकरणको व्यवस्था गर्न सरकार लागि परेको देखिन्छ।

मध्यस्थता (Arbitration) बाट भएका निर्णय न्यायिक प्रकियामा प्रवेश गर्ने आधारहरू

दुई पक्ष बीच भएको सम्झौताको सम्बन्धमा उत्पन्न विवाद सम्झौताका पक्षहरूले आ-आफ्नो तर्फबाट छुट्टाछुट्टै वा सहमतिमा एकल मध्यस्थको नियुक्ति गरी मध्यस्थबाट विवादको निरूपण हुने प्रकियालाई वैकल्पिक उपाय (Alternative Dispute Resolution) को रूपमा मध्यस्थतालाई मानिन्छ।

मुलुकका साधारण अदालतबाट नियमित तथा सामान्य कार्यविधि अवलम्बन गरी विवादको निरूपण गर्दा कार्यविधिगत प्रकिया सम्पन्न गर्न लामो समय लाग्ने भई निर्णय हुन ढिलो हुने, सम्झौताको कतिपय अवस्थामा विवाद समाधानको लागि सम्बन्धीत विषयमा विज्ञता हासिल गरेका व्यक्तिबाट विवाद समाधान गराउनु उपयुक्त हुने कारणले व्यापार वाणिज्य तथा आर्थिक कारोवार सम्बन्धी सम्झौतासँग सम्बन्धीत विवाद सम्झौतामा उल्लिखित शर्त अनुसार विषय विज्ञबाट शीघ्र, सरल र सहज रूपमा समाधान गर्न मध्यस्थतालाई मानिन्छ। सामान्यत: मध्यस्थबाट भएको निर्णय अन्तिम हुन्छ। त्यस्तो निर्णय केही सीमित आधारमा मात्र सम्मानित अदालतबाट परीक्षण हुन सक्छ।

मध्यस्थता ऐन, २०५५ को दफा ३० को उपदफा (२) मा उच्च अदालतले मध्यस्थको निर्णय बदर गर्न वा आवश्यकतानुसार पुन: निर्णय गराउन आदेश दिन सक्ने आधारहरू उल्लेख भएको छ।

(क) सम्झौताका कुनै पक्ष सम्झौता गर्दाका बखत कुनै कारणले सम्झौता गर्न असक्षम रहेको वा पक्षहरू जुन मुलुकको कानूनको अधीनमा रहेका छन्, सो कानून अनुसार वा त्यस्तो कानून स्पष्ट हुन नसकेकोमा नेपाल कानून बमोजिम सो सम्झौता वैध नरहेको।

(ख) निवेदन गर्ने पक्षलाई मध्यस्थ नियुक्ति गर्नका लागि वा मध्यस्थताको कारवाहीका सम्बन्धमा समयमा नै रीतपूर्वक सूचना नदिएको।

(ग) मध्यस्थलाई नसुम्पिएको विवादसँग सम्बन्धीत विषयमा वा मध्यस्थलाई सुम्पिएको शर्त विपरीत वा मध्यस्थलाई सुम्पिएको क्षेत्रबाहिर गई निर्णय भएको,

(घ) नेपाल कानून प्रतिकूल सम्झौता भएकोमा बाहेक मध्यस्थताको गठन विधि वा त्यसको काम कारवाही पक्षहरू बीच सम्पन्न सम्झौता अनुरूप नभएको वा त्यस्तो सम्झौता नभएकोमा यस ऐन अनुसार नभएको।

सोही दफाको उपदफा (३) उच्च अदालतले देहायका अवस्थामा मध्यस्थताको निर्णय बदर गर्न सक्नेछ:-

(क) मध्यस्थले निर्णय गरेको विवाद नेपाल कानून बमोजिम मध्यस्थद्वारा निरूपण हुन नसक्ने भएमा।

(ख) मध्यस्थले गरेको निर्णय सार्वजनिक हित वा नीति प्रतिकूल हुने भएमा।

मध्यस्थको निर्णय (Award) विरूद्धमा प्राधिकरण अदालत प्रवेश गरेका विषयहरू:-

नेपाल विद्युत प्राधिकरण नेपाल सरकारको पूर्ण स्वमित्व भएको सरकारी संस्था हो। यसले गर्ने खरिद प्रकिया प्रतिस्पर्धी, स्वच्छ, जवाफदेही र विश्वसनीय बनाउन

सार्वजनिक खरिद ऐन, २०६३ र प्रचलित ने.वि.प्रा. आर्थिक प्रशासन विनियमावली अनुसारको विधि र प्रक्रिया अपनाउँछ। खरिद प्रक्रिया अगाडि बढाउँदा विवाद आएमा विवाद समाधानका वैकल्पिक उपाय (ADR) अन्तर्गत मध्यस्थता (Arbitration) अपनाउने कुरा समेत सम्झौतामा नै उल्लेख भएको हुन्छ। प्राधिकरणले खरिद प्रक्रिया अपनाउँदा उत्पन्न भएका उल्लिखित विवादहरू केही विवाद समाधानको लागि विवाद मध्यस्थता समक्ष न्यायिक प्रक्रियामा रहेका छन् भने केही विवाद समाधान भई कार्यान्वयनको चरणमा छन्। ने.वि.प्रा.को ठेक्का सम्झौता भएको सबै विवादमा मध्यस्थताको प्रक्रिया ठेकेदारवाट शुरू भएको र अधिकाशं विवादमा मध्यस्थताको निर्णय ठेकेदारकै पक्षमा आएको रेकर्डबाट देखिन्छ।

प्राधिकरणका अधिकांश विवाद निर्माण ठेक्का (Construction Contract), र खरिद प्रक्रिया (Procurement Procedure), थप समय (Extension of Time), मूल्य समायोजन (Price Adjustment), अतिरिक्त कार्य (Variation) क्षतिपूर्ति तथा भुक्तानीसंग सम्बन्धीत हुन्छन्। त्यसैगरी मेशिनरी सामान खरिद र पूर्वाधार सम्बन्धी ठेक्काहरूमा प्राधिकरण र ठेकेदार वीच विवाद उत्पन्न हुने गरेका छन्। उक्त विवादमा मध्यस्थले दिएको निर्णय अन्तिम र पक्षहरूलाई वाध्यकारी हुने भएतापनि नेपालको संविधान, कानून र सर्वोच्च अदालतबाट प्रतिपादित सिद्धान्तहरू समेतलाई अध्ययन गर्दा निश्चित अवस्थामा मात्र मध्यस्थताको निर्णय (Award) लाई अदालतमा चुनौती दिन सकिने व्यवस्था गरिएको छ। त्यसैले प्राधिकरणबाट मध्यस्थको निर्णय विरुद्ध अदालतमा प्रवेश गर्दा कानूनले तोकेको आधार लिएर मात्र आफ्नो दाबी पेश गरिएको छ तर दाबी पेश गर्दैमा अदालतमा मध्यस्थको निर्णयको गुण दोष (Merits, Dimerits) को आधारमा परिक्षण गर्ने होइन। कानूनी आधार मात्र हेर्ने सिद्धान्त प्रतिपादन गरिसकेको छ। नेपाल विद्युत प्राधिकरणको ठेकेदारसँग हुने विवादमा आर्थिक दायित्व देखिने हुँदा निम्न आयोजनाहरूमा विवाद भै Arbitration Tribunal बाट हुने निर्णय प्रकिया र निर्णय भई अदालती प्रकियामा रहेका छन्।

सि. नं.	खरिद सम्झौता (ठेक्का प्राप्त) गर्ने पक्षको नाम	आयोजना/कार्यक्रम/ क्रियाकलापको नाम	मध्यस्थतामा रहेका विवाद	अदालतमा विचाराधीन मुद्दा
१	कस्मिक इलेक्ट्रिकल लि.	विद्युत प्रणाली संचालन विभाग	डि आर सि नेपाल	
२	KC–EG Infra–Human JV	भवन तथा भौतिक निर्माण आयोजना	डि आर सि नेपाल	
३	मोहन इनर्जी कम्पनी लि.	सोलु कोरिडोर १३२ के. भी. प्रशारण लाइन आयोजना	डि आर सि नेपाल	
४	सिनो हाइड्रोपावर कर्पोरेसन	त्रिशूली ३ ए जलविद्युत आयोजना	डि आर सि नेपाल	
५	चाइना गेजुवा ग्रुप	कुलेखानी तेस्रो जलविद्युत आयोजना	नेप्का	
६	न्यू सताकृ खिम्ती कन्स्ट्रक्सन:	मुडे माझीफेदा ३३ केभी प्रशारण लाइन आयोज	नेप्का	
७	झोण्डिङ कम्पनी लिमिटेड	नेपाल भारत प्रशारण लाइन अन्तर्गतको सवस्टेशन निर्माण	डि आर सि नेपाल	
८	Marsyangdi Kathmandu 220 KV Transmission Line Project	TATA Company Limited	डि आर सि नेपाल	
९	Larsen and Tubro Ltd India	काठमाडौं उपत्यका पश्चिम वितरण प्रणाली सुदृढीकरण आयोजना	नेप्का	

सि. नं.	खरिद सम्झौता (ठेक्का प्राप्त) गर्ने पक्षको नाम	आयोजना/कार्यक्रम/क्रियाकलापको नाम	मध्यस्थतामा रहेका विवाद	अदालतमा विचाराधीन मुद्दा
१०	Larsen and Tubro Ltd India	लप्सिफेदी,चागुनारायण सवस्टेशन परियोजना	नेप्का	
११	मुडभरी एण्ड जोशी कन्स्ट्रक्सन प्रा.लि	ने. वि. प्रा. दमक पाडाजुङ्गी प्रसारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१२	न्यू सताकृ खिम्ती कन्स्ट्रक्सन	ने.वि.प्रा. - जुम्ला ३३ केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१३	न्यू सताकृ खिम्ती कन्स्ट्रक्सन	दुहवी - दुहवी औद्योगिक क्षेत्र ३३ केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१४	न्यू सताकृ खिम्ती कन्स्ट्रक्सन	धनुषाधाम - यदुकुवा ३३ केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१५	न्यू सताकृ खिम्ती कन्स्ट्रक्सन	जाजरकोट कुदु- चौखा ३३ केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१६	न्यू सताकृ खिम्ती कन्स्ट्रक्सन	चौखा - डोल्पा ३३ केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१७	कोरियन हाइड्रो एण्ड न्यूक्लियर पावर कम्पनी लि.	चमेलिया जलविद्युत आयोजना		सर्वोच्च अदालतमा विचाराधीन
१८	टाटा चिन्ट जेभी	कालीगण्डकी कोरिडोर २२० केभी प्रशारण लाइन आयोजना		उच्च अदालत पाटनबाट फैसला
१९	आइकम टेली लिमिटेड	नेपाल विद्युत प्राधिकरण हेटौडा भर तपुर २२० के.भी. प्रशारण लाइन		उच्च अदालत पाटनबाट फैसला
२०	China Gezhouba Group of Companies -CGGC_	चमेलिया जलविद्युत आयोजना		सर्वोच्च अदालतमा विचाराधीन
२१	Pinggao Wisdom Limited	ठिमी सवस्टेशन वितरण तथा ग्राहक सेवा निर्देशनालय		सर्वोच्च अदालतमा फैसला
२२	अपार इण्डस्ट्रिज लिमिटेड	नेपाल विद्युत प्राधिकरण		सर्वोच्च अदालतमा विचाराधिन
२३	के इ अइ इन्डस्ट्रिज	नेपाल विद्युत प्राधिकरण		
२४	माउन्टेन इनर्जी थापा खोला	नेपाल विद्युत प्राधिकरण	मध्यस्थको निर्णय कार्यान्वयन	
२५	टेस्ला ट्रान्सफरमर	नेपाल विद्युत प्राधिकरण	मध्यस्थको निर्णय कार्यान्वयन	
२६	महालक्ष्मी वायर इण्डस्ट्रिज	नेपाल विद्युत प्राधिकरण, सुदूर पश्चिम प्रादेशिक कार्यालय	मध्यस्थको निर्णय कार्यान्वयन	
२७	माउन्टेन इनर्जी-मिस्ट्री खो ला) लि	नेपाल विद्युत प्राधिकरण (विद्युत व्यापार विभाग)	मध्यस्थको निर्णय कार्यान्वयन	
२८	महाविर श्री इन्टरनेशनल	कालिगण्डकी ज.वि.	मध्यस्थको निर्णय कार्यान्वयन	
२९	A to Z Mountain JV	ग्रिड विभाग, वानेश्वर	मध्यस्थको निर्णय कार्यान्वयन	
३०	A to Z Mountain JV	ग्रिड विभाग, वानेश्वर	मध्यस्थको निर्णय कार्यान्वयन	

प्राधिकरणसँग भएका विवादमा सर्वोच्चमा अदालतबाट हेरिएका विषयहरू

मध्यस्थता ऐन २०५५ को दफा ३० को उपदफा (२) को खण्ड (ग) मा मध्यस्थले गरेको निर्णय सार्वजनिक हित नीतिको प्रतिकूल हुने भएमा उच्च अदालतले त्यस्तो निर्णय बदर गर्न सक्ने व्यवस्था गरेको छ। सार्वजनिक नीति स्पष्ट रूपमा परिभाषित गर्न नसकिने धारणा हो। त्यसैले यसलाई बेलगामको घोडा (Unruly Horse) पनि भनिएको छ। सारांशमा भन्दा मुलुकको कानून निर्णय गर्न वा न्याय सम्पादन गर्नको लागि मार्ग दर्शन गर्ने मुलुकको मुलभूत राजनीतिक, आर्थिक, सामाजिक, नैतिक वा धार्मिक सिद्धान्तलाई वृहतर अर्थमा सार्वजनिक नीति भनी हेर्ने गरिएको छ।

भारतको आर्विट्रेसन एण्ड कन्सिलिएसन एक्ट ,१९९३ को दफा ३४ (२) (वी) मा मध्यस्थको निर्णय भारतको सार्वजनिक नीति विरूद्व भएमा अदालतले मध्यस्थको निर्णय बदर गर्न सक्ने प्रावधान रहेको छ। संसार भरिका अदालतले मध्यस्थको निर्णयलाई उनीहरूका कानूनी प्रणालीका प्रधान मान्यताहरू वा उनीहरूका स्थानीय घरेलु नैतिकता र न्यायका मानकहरू र सार्वजनिक हितलाई ध्यानमा राखी पुनरावलोकन गर्छन्।

नेपालको संविधानले कानून तथा न्यायका मान्य सिद्धान्तहरूलाई न्याय प्रशासनको अभिन्न अंग रहने कुरा निर्देश गरेको छ (**धारा १२६**) त्यसै गरी देवानी संहिताले करार कानूनको मुलभूत सिद्धान्तको रूपमा करारको पक्षहरूको स्वयत्ततालाई अंगीकार गरेको छ। मध्यस्थबाट भएको निर्णय प्रचलित नेपाल कानूनको विपरीत भएको, कानून एवं सम्झौताको प्रतिकूल गई भएको निर्णयलाई क्षेत्राधिकार नाघेको (Excess of Jurisdiction) भएको र त्यस्तो निर्णय प्रचलित कानूनको समेत प्रतिकूल भई सार्वजनिक नीति विपरीत भएको भनी अपार इण्डष्ट्रिज, चाइना गेजुवा, पिडगावो विज्डम, लगायतका मुद्दाहरू सम्मानित सर्वोच्च अदालतबाट खारेज र केही विचाराधीन रहेका छन्। सबै मुद्दामा मध्यस्थता ऐन, २०५५ को दफा ३० को दाबी लिएर गएको हुन्छ तर दाबी लिनु मात्र पर्याप्त हुदैन। मध्यस्थको निर्णय सार्वजनिक हित वा नीति प्रतिकूल भएकोले बदर गर्न दाबी लिन मात्र पर्याप्त हुँदैन। त्यस्तो दाबी लिने पक्षले मध्यस्थताबाट भएको प्रचलित कानूनको समेत प्रतिकूल भई सार्वजनिक नीति विपरीत निर्णयमा प्रमाणित समेत गर्नु पर्दछ। सम्मानित सर्वोच्च अदालतले समेत यस विषयमा विभिन्न सिद्धान्त प्रतिपादन गरेका छन्।

निर्णय (Award) मा न्यायीक परीक्षणको विषयहरूः

मध्यस्थद्वारा विवाद समाधानको उपाय पक्षहरूको स्वेच्छाले अवलम्बन गरिने हुँदा कानूनद्वारा सुस्पष्ट रूपमा तोकिएको सीमित आधारमा बाहेक मध्यस्थको निर्णय तथ्यगत तथा कानूनी (Fact and Law) दुवै रूपमा अन्तिम हुन्छ। मध्यस्थले गलत निर्णय गरेको अवस्थामा पनि सीमित आधारमा बाहेक अदालतलाई त्यस्तो गलत निर्णयको प्रतिस्थापन गर्ने गरी वा सवुद प्रमाणको आधारमा निर्णय सच्याउने गरी निर्णय दिन सक्ने अधिकार कानूनले अदालतलाई दिएको हुँदैन। मातहतको अदालतको निर्णय जसरी मध्यस्थको निर्णयलाई कुनै माथिल्लो तहको अदालतले परीक्षण गर्न सक्दैन। तथापि मध्यस्थताको स्रोतको रूपमा पक्षहरू बीच भएको सम्झौता र मध्यस्थताको सीमा र विवादको अन्तर्वस्तु नियमित गर्ने सम्बन्धमा सारवान राष्ट्रिय कानून रहेकोले मध्यस्थले निर्णय गर्दा यी स्रोतहरूको सीमा नाघ्न मिल्दैन। मध्यस्थताको स्रोतको रूपमा रहेको सम्झौतानै कानून बमोजिम वैध नरहेको, सुनुवाइमा पक्षपात भएकोमा, अधिकार क्षेत्रभन्दा बाहिर गइ निर्णय भएकोमा, मध्यस्थको गठननै सम्झौता अनुरूप नभएकोमा, मध्यस्थबाट निरूपण हुन नसक्ने विवादमा निर्णय गरिएकोमा, मध्यस्थको निर्णयमा जालसाजी वा भ्रष्टाचार भएकोमा, सार्वजनिक नीतिका विरूद्व निर्णय

भएकोमा जस्ता केही खास अवस्थामा मात्र मध्यस्थताको निर्णय बदर हुन सक्दछ ।

सार्वजनिक नीतिको प्रतिकूल हुने गरी समेत मध्यस्थले निर्णय गर्न नमिल्ने भएकोले अदालतले न्यायिक परीक्षण गर्दा यी विषयहरूलाई गम्भीर रूपमा विचार गरेको हुन्छ ।

कानूनको कुनै खास प्रावधानको पालन नभएको वा सामान्य उल्लङ्घन भएको आधारमा नै मध्यस्थको निर्णयलाई सार्वजनिक नीतिको विरूद्ध मानिंदैन । मध्यस्थ कानूनको प्रावधानको गम्भीर उल्लङ्घन भएको (Patently Illegal) वा राष्ट्रिय कानूनको आधारभूत चरित्र वा नीतिको विरूद्ध मध्यस्थबाट भएको निर्णयलाई सार्वजनिक नीतिको आधारमा अदालतले बदर गर्न सक्दछ । सार्वजनिक नीतिको उल्लङ्घन कुन हद वा स्तरको छ भन्ने विषय पनि महत्वपूर्ण हुन्छ । सार्वजनिक नीतिको गम्भीर उल्लङ्घन भएको प्रष्ट र प्रत्यक्ष अवस्था प्रथम दृष्टिमै देखिनु पर्दछ ।

निष्कर्ष:

मध्यस्थले गरेको निर्णयलाई अन्तिम मानिन्छ र तत्कालै कार्यान्वयनमा लागिन्छ । मध्यस्थले गरेको निर्णय उपर कुनै अदालतमा पुरावेदन लाग्दैन । मध्यस्थबाट भएको निर्णयको परीक्षण गर्ने सवालमा अदालतलाई सीमित अधिकार क्षेत्र (Limited Jurisdiction) मात्र रहेको हुन्छ । अदालतले मध्यस्थको निर्णयको तोकिएको अवस्थामा मात्र न्यायिक परीक्षण गर्ने हो, पुनरावेदन (Exercise of Appellate Jurisdiction) सुन्ने होइन । न्यायिक परीक्षणमा निर्णयको अन्तरर्वस्तु (Content) भित्र प्रवेश गर्ने नभई निर्णयको वैद्यताको परीक्षण गरिन्छ । न्यायिक पुनरावलोकनमा तथ्यगत त्रुटि वा प्रमाण मूल्याकनमा भएको त्रुटिलाई (Error of Fact and Evidence) हेरिदैन । मध्यस्थको निर्णयको न्यायिक परीक्षण गर्ने आधार सीमित र परिभाषित (Limited and Defined) छन् ।

मध्यस्थबाट गलत प्रकृतिको निर्णय हुँदैन । यदि भईहाले अदालतले न्यायिक दृष्टिकोणले स्वीकार्य हुँदैन । मध्यस्थता सम्बन्धी अन्तर्राट्रिय रूपमा स्थापित सिद्धान्त र मान्यता तथा हाम्रो राष्ट्रिय कानूनले पनि केही खास अवस्थामा अदालतले मध्यस्थको निर्णय पूर्णरूपमा बदर गर्न वा बदर गरी पुन: निर्णय गर्नको लागि पठाउन सक्छ । पक्षहरू बीच भएको करारमा उल्लेखित शर्त भन्दा बाहिर गई मध्यस्थले निर्णय गरेमा, करारको मुलभूत मर्म विपरीत करारको अपव्याख्या भएकोमा, मध्यस्थको निर्णयमा गम्भीर कानूनी त्रुटि देखिएमा मध्यस्थको निर्णय सार्वजनिक हित र नीतिका विरूद्ध देखिएमा मध्यस्थको निर्णयको न्यायिक परीक्षण हुन्छ । नेपाल विद्युत प्राधिकरणले मध्यस्थताको निर्णय बदर गरी पाऊँ भनी दायर भएको निवेदनमा उच्च अदालत पाटनबाट निर्णय पूर्णरूपमा बदर गर्न वा बदर गरी पुन: निर्णय गर्नका लागि पठाउने फैसला भएको छ ।

मध्यस्थहरूले प्राविधिक ज्ञान र विशेषज्ञताको प्रयोग गरी अदालतको भन्दा तथ्यहरू सुक्ष्म रूपले केलाउने र लगानी तथा व्यापार एवं वाणिज्य सम्बन्धी हित र मान्यतालाई कार्यान्वयन गर्न सक्छन् भने बलियो विश्वास र अपेक्षाको मान्यतालाई अदालतले पूर्ण विश्वास गर्दछ र मध्यस्थबाट भएको निर्णयको तथ्यभित्र खोट हुँदैन, तथ्यहरूको सही प्रयोग र अर्थ भएको अनुमान गर्दछ । जसले गर्दा सारवान सार्वजनिक नीतिमा मध्यस्थको निर्णयको विवादसँग सम्बन्धित हुन्छ र सम्बन्धित मुलुकको मुलभूल कानून र सिद्धान्त उल्घङ्घन भएको छ/छैन हेरिन्छ । उदाहरणको लागि गैर कानूनी उपचार प्रदान गर्ने, दण्डात्मक क्षतिपूर्ति, अत्याधिक ब्याजदर प्रदान, घुसखोरी र भ्रष्ट्राचार, उपभोक्ता हित संरक्षण कानून, प्रतिस्पर्धा कानून, विदेशी विनिमय नियमन, निकासी बन्देज, विपरीत हुने निर्णयलाई सारभुत सार्वजनिक नीति विरूद्धका निर्णय मानिन्छ । ने.वि.प्रा ले खरिद विधि अनुसार मालसामान, निमार्ण कार्य वा सेवा खरिद गर्दा गरेका करारीय सम्झौतालाई अनुसरण

गरी ठेकेदारसँगको सहकार्यमा कार्य सम्पन्न गर्नु पर्दछ। आधुनिक विधि प्रक्रिया र पद्धतिलाई अनुसरण नगरी परम्परागत तरिकाले कार्य गर्दा प्राधिकरणको हित नहुने देखिन्छ। खरिद प्रक्रियामा समयको पावन्दीलाइ विचार नगरी विवादलाई समयमा नै समाधान नगरी प्रक्रिया अगाडि बढाउँदा माथि उल्लिखित विवादमा प्राधिकरणले अन्त्यमा निर्णय (Arbitral Award) कार्यान्वयन गर्दा तिर्नु परेको रकम र बाँकी विवादमा तिर्नु पर्ने रकमले प्राधिकरणमा आर्थिक संकट नल्याउला भनी भन्न सकिदैन। तसर्थ मध्यस्थताबाट विवाद समाधान हुंदा कानूनले तोकिदिएको ऐनको दफा ३० को प्रावधान बमोजिम न्याय पाइन्छ भनी विवादलाइ लम्बाइन खोज्दा अनावश्यक ठुलो ब्याज समेत तिर्नु पर्ने कारणले वित्तीय संकट नपर्ला भन्न सकिन्न। मध्यस्थबाट भएको निर्णय प्रचलित नेपाल कानून विपरीत भएको, कानून एवं सम्झौताको प्रतिकुल भएको निर्णयलाई क्षेत्राधिकार नाघेको (Excess of Jurisdiction) भएको र त्यस्तो निर्णय प्रचलित कानूनको समेत प्रतिकूल भई सार्वजनिक नीति विपरीत भएकोले बदर गर्न दाबी लिनु मात्र पर्याप्त हुंदैन। त्यस्तो दावी लिने पक्षले मध्यस्थ (Arbitral Tribunal) बाट भएको निर्णय के कुन आधारमा सार्वजनिक हित वा नीति प्रतिकूल भएको भन्ने स्पष्टसँग प्रमाणित समेत गर्न सक्नु पर्दछ। सो कुरा प्रमाणित गर्न सरल र सहज नभएकोले सो मार्गमा जानु भन्दा अगाडि अर्वाडको रकम, त्यसको व्याज लगायतको विश्लेषण गरी आपसी सहमति (Amicable Settlement) को विधिबाट केही वित्तीय भार कम गरी अगाडि बढ्नु उचित हुन्छ। दुई तहको फैसला भैसकेपछि पर्याप्त कारण बिना नेपाल सरकार/ संस्था /प्राधिकरण मध्यस्थको निर्णय कार्यान्वयन नगरी बदर गरी पाउँ भनी सम्मानित अदालतमा मुद्दा दर्ता गरी जानु सामान्य रूपमा पनि उचित हुने देखिदैन।

सन्दर्भ सामग्री

- नेपालको संविधान
- मध्यस्थता ऐन,२०५५
- सर्वोच्च अदालतबाट भएका फैसलाहरू
- उच्च अदालतबाट भएका फैसलाहरू
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ने.वि.प्रा.

१. पृष्ठभूमि खण्ड :

आधुनिक सभ्यताको विकाससँगै बिजुली मानव जीवनको अभिन्न आधार बनेको छ । आजको युगमा बिजुली बिना दैनिक जीवनको कल्पना गर्न सकिदैन । घर, कार्यालय, विद्यालय, अस्पताल, उद्योग, व्यापार, कृषि, यातायातदेखि सञ्चार र सूचना प्रविधिसम्म प्रत्येक क्षेत्रमा बिजुलीको प्रत्यक्ष भूमिका रहेको छ । बिजुलीलाई आधुनिक युगमा विद्युत भनेर चिनिन्छ । विद्युतले मानिसको जीवनलाई सहज, सुरक्षित, उत्पादनशील तथा गुणस्तरीय बनाएको छ । नेपाल प्राकृतिक जलस्रोतका दृष्टिले विश्वका धनी राष्ट्रहरूमध्ये एक हो । जलविद्युत् उत्पादनको विशाल सम्भावना भए तापनि विगतमा विद्युत् पहुँच र आपूर्तिमा धेरै चुनौतीहरू थिए । पछिल्ला वर्षहरूमा विद्युत उत्पादन, प्रसारण तथा वितरण प्रणालीमा उल्लेखनीय सुधार भई ९९ प्रतिशत भन्दा बढी नेपाली नागरिक विद्युत् सेवाको पहुँचमा पुगेका छन् । विद्युत् उत्पादन मात्र पर्याप्त हुँदैन, यसको सही उपयोग, संरक्षण र सुरक्षापूर्ण व्यवहारले मात्र यसको वास्तविक लाभ समाजले प्राप्त गर्न सक्छ । विद्युतको उपलब्धतासँगै यसको सुरक्षित, मितव्ययी र जिम्मेवार प्रयोग सम्बन्धी ज्ञान पनि समयको क्रमसँगै उत्तिकै आवश्यक भएको छ । विद्युत् केवल एउटा सेवा होइन, यो आर्थिक विकास, सामाजिक रूपान्तरण, वातावरणीय संरक्षण तथा राष्ट्रिय समृद्धिको आधार हो । त्यसैले हरेक नागरिकले दैनिक जीवनमा आवश्यक पर्ने आधारभूत विद्युत सम्बन्धी ज्ञान प्राप्त गर्नु आजको आवश्यकता मात्र होइन नागरिक जिम्मेवारी र कर्तव्य पनि हो ।

आजको अत्याधुनिक युगमा हाम्रो बिहानदेखि रातिसम्मको अधिकांश जीवन बिजुलीमै निर्भर छ । चाहे घरमा होस् वा कार्यालयमा होस् वा उद्योग धन्दाहरूमा होस् वा आवास गृहमा नै किन नहोस् झुपडी देखि दरवारसम्म बिजुली बत्ती जडान भएकै हुन्छ । बत्ती बाल्ने, खाना बनाउने, मोबाइल चार्ज गर्ने, कम्प्युटर चलाउने, हिटर चलाउने, पंखा, ए.सी., कुलर चलाउने, इन्टरनेट प्रयोग गर्ने, अस्पतालका उपकरण सञ्चालन गर्ने, उद्योगधन्दा चलाउने तथा कृषि क्षेत्रमा सिँचाइ गर्ने कार्य सम्म बिजुलीको प्रत्यक्ष प्रयोग हुन्छ । यसप्रकारको बिजुली केवल भौतिक सुविधा मात्र होइन, आजको जीवनको आधारभूत र अपरिहार्य आवश्यकता पनि हो । त्यसैले विद्युतका उपभोक्ता र सबै सरोकारवालाहरूमा यसको सुरक्षित, व्यवस्थित र किफायतीपूर्ण उपयोगको उचित र आधारभूत ज्ञान दिलाउन यो लेख केन्द्रित रहेको छ ।

२. मुख्य खण्ड : बिजुलीको ज्ञान

२.१ घरायसी प्रयोगको सन्दर्भमा बिजुलीको ज्ञान

Ignorance of Law is No Excuse भने जस्तै विद्युतीय सुरक्षाको दृष्टिले Ignorance of Electricity is No Excuse भन्ने उद्गार हिजो आज विकसित भएको छ । विद्युतको ज्ञान नभएर वा ज्ञान भएर पनि लापर्वाहीपूर्ण

ढंगले प्रयोग हुँदा आगलागी भई विशाल धनराशि नष्ट हुन सक्ने मात्र नभई मानिसको ज्यूज्यानै खतरामा पर्ने संभावना भएकोले दैनिक जीवनमा बिजुलीको प्रयोग गर्दा यसको आधारभूत ज्ञान हुनु अति आवश्यक छ ।

बिजुलीलाई हामी देख्न सक्दैनौं, तर यसको प्रभाव सहजै महसुस गर्न सक्दछौ । सुरक्षित रूपमा प्रयोग गरियो भने बिजुलीले जीवनलाई सहज, सरल र समृद्ध बनाउँछ; सावधानी अपनाइएन भने यसले दुर्घटना निम्त्याउन सक्छ । त्यसैले घरायसी जीवनमा बिजुलीको प्रयोग गर्दा निम्न कुरामा विशेष ध्यान दिनुपर्छ-

- भिजेको हातले स्विच वा विद्युतीय उपकरण नछुने,
- खुला वा क्षतिग्रस्त तार प्रयोग नगरी गुणस्तरीय तार प्रयोग गर्ने,
- गुणस्तरहीन प्लग, मल्टिप्लग तथा तारको प्रयोग नगर्ने,
- एउटै सकेटमा अत्यधिक उपकरण जडान नगर्ने,
- आकाशमा गड्याङ गुडुङ गर्दा वा बिजुली चम्कँदा विद्युतीय उपकरणहरू प्रयोग नगर्ने,
- घरमा उचित Earthing तथा Circuit Breaker जडान गर्ने,
- बालबालिकालाई खुला सकेट तथा तारबाट टाढा राख्ने वा अटोमेटिक बन्द हुने सकेट प्रयोग गर्ने,
- ट्रान्समिसन लाइन मुनि वा लाइनको निर्धारित मापदण्ड भित्र कुनै घर वा अन्य संरचना नबनाउने,
- घरभित्र विद्युत् मर्मत गर्दा मुख्य स्विच बन्द गर्ने,
- समस्या देखिएमा दक्ष प्राविधिकको सहायता लिने,
- विद्युतको चोरी कार्यमा अझ बढी दुर्घटना हुन सक्ने भएकोले यस्तो कार्य नगर्ने वा गर्न दुरुत्साहन नगर्ने, आदि ।

२.२ घरमा कसैलाई करेन्ट लागी सकेपछि अपनाउनु पर्ने सावधानीहरू :

- सबैभन्दा पहिले मुख्य विद्युत् आपूर्ति बन्द गर्ने,
- सुक्खा काठ, प्लास्टिक वा इन्सुलेटेड वस्तुको प्रयोग गरी लाइन छुट्याउने,
- घाइतेलाई तुरुन्त स्वास्थ्य संस्थामा पुऱ्याउने,
- आवश्यक परे प्राथमिक उपचार गर्ने,
- सम्बन्धित विद्युत कार्यालय वा आपतकालीन सेवामा जानकारी गराउने, आदि ।

२.३ मर्मत कार्यमा हुनुपर्ने बिजुलीको ज्ञान :

विद्युत् मर्मत कार्य प्राविधिक ज्ञान, अनुशासन, समन्वय र सुरक्षासँग प्रत्यक्ष रूपमा सम्बन्धित उच्च जोखिमयुक्त कार्य हो । सानो लापर्वाहीले गम्भीर दुर्घटना, मानवीय क्षति तथा विद्युत प्रणालीमा ठूलो अवरोध सिर्जना गर्न सक्छ । त्यसैले प्रत्येक कर्मचारीले मर्मत कार्य सुरु गर्नु अघि, मर्मत कार्यको क्रममा र कार्य सम्पन्न भएपछि निश्चित सुरक्षा मापदण्ड तथा समन्वय प्रक्रियाको पूर्ण रूपमा पालना गरी सावधानी अपनाउनु पर्दछ । अपनाउनुपर्ने उक्त साबधानीहरू यसप्रकार छन्:

२.३.१. मर्मत कार्य अघि अपनाउनु पर्ने सावधानीहरू :

- कार्यको प्रकृति, जोखिम तथा कार्ययोजना स्पष्ट रूपमा बुझ्ने,
- सम्बन्धित कार्यालयबाट आवश्यक स्वीकृति प्राप्त गर्ने,
- नियन्त्रण कक्षसँग समन्वय गरी विद्युत् आपूर्ति बन्द भएको सुनिश्चित गर्ने,
- Lockout-Tagout प्रणाली लागू गरी अनधिकृत रूपमा विद्युत् प्रवाह हुन नदिने,
- विद्युत् लाइन वा उपकरण वास्तवमै De–energized भएको उपयुक्त परीक्षण उपकरणबाट जाँच गर्ने,
- आवश्यक परे Earthing (Grounding) गरी Induced Voltage वा Back Feed को जोखिम हटाउने,
- व्यक्तिगत सुरक्षा सामग्री (PPE) जस्तै हेल्मेट, इन्सुलेटेड पंजा, सुरक्षा जुत्ता, सुरक्षा चस्मा, रिफ्लेक्टिभ ज्याकेट, सेफ्टी बेल्ट आदि अनिवार्य

रूपमा प्रयोग गर्ने,

- विद्युत क्षेत्रमा प्रयोग हुने औजारहरू (Insulated Tools) सुरक्षित र निर्धारित मापदण्ड अनुसारका छन् कि छैनन् भन्ने सुनिश्चित गर्ने,
- मौसमको अवस्था (वर्षा, हावाहुरी, चट्याङ आदि) अनुकूल छ कि छैन मूल्याङ्कन गरी कामको योजना बनाउने, आदि ।

२.३.२ मर्मत कार्यको क्रममा अपनाउनु पर्ने सावधानी

- एक्लै काम नगरी टोली (Team) मा कार्य गर्ने,
- विद्युत् मर्मतमा आवश्यक समन्वय गर्ने,
- Team Leader को निर्देशन अनिवार्य रुपमा पालना गर्ने,
- सबै कर्मचारीबीच स्पष्ट सञ्चार कायम राख्ने,
- Hand Signal वा Radio Communication को प्रयोग गर्ने,
- अनधिकृत व्यक्तिलाई कार्यस्थलमा प्रवेश गर्न नदिने,
- जोखिमयुक्त क्षेत्रलाई सुरक्षा टेप, कोन वा चेतावनी बोर्डद्वारा सुरक्षित गर्ने,
- पोल, ट्रान्सफर्मर वा उचाइमा काम गर्दा सेफ्टी बेल्ट तथा सेफ्टी उपकरण प्रयोग गर्ने,
- Live Line मा कार्य गर्नुपर्ने विशेष अवस्थामा सम्बन्धित मापदण्ड तथा विशेष तालिम प्राप्त कर्मचारीबाट मात्र कार्य गराउने,
- कामको क्रममा कुनै असामान्य अवस्था देखिएमा तुरुन्त कार्य रोक्ने र पुनः जोखिम मूल्याङ्कन गर्ने, आदि ।

२.३.३. मर्मत कार्यपछि अपनाउनुपर्ने सावधानी

- प्रयोग भएका सबै औजार तथा सामग्री हटाइएको सुनिश्चित गर्ने,
- सबै कर्मचारी सुरक्षित स्थानमा पुगेको यकिन गर्ने,
- अस्थायी Earthing हटाउने,
- नियन्त्रण कक्षसँग समन्वय गरेर मात्र विद्युत् आपूर्ति पुनः सञ्चालन (Energize) गर्ने,
- परीक्षण गरी उपकरण सामान्य अवस्थामा सञ्चालन भएको सुनिश्चित गर्ने,
- कार्य सम्पन्न भएको विवरण अभिलेखीकरण गर्ने, आदि ।

यसप्रकार विद्युत मर्मत कार्य सफल र सुरक्षित बनाउन प्रभावकारी संवाद, स्पष्ट सञ्चार र भरपूर समन्वय अत्यन्त आवश्यक हुन्छ । यसका लागि कार्यटोली भित्र प्रत्येक सदस्यको जिम्मेवारी स्पष्ट गर्ने र कार्य प्रारम्भ गर्नु अघि Safety Briefing गर्न पनि अत्यन्त आवश्यक छ ।

२.४ करेन्ट लागि हालेमा अपनाउनु पर्ने सावधानीहरू

- सबैभन्दा पहिले घर भित्रको मुख्य विद्युत् आपूर्ति बन्द गर्ने,
- घाईतेसँग प्रत्यक्ष सम्पर्क नगरी सुक्खा काठ, प्लास्टिक वा इन्सुलेटेड वस्तुको प्रयोग गरी लाइन छुट्याउने,
- घाइतेलाई आवश्यक प्राथमिक उपचार गरी आवश्यकता अनुसार तुरुन्त स्वास्थ्य संस्थामा पुऱ्याउने,
- घरभन्दा बाहिर वा खुला ठाउँमा विद्युतीय दुर्घटना भएमा सम्बन्धित विद्युत कार्यालय वा आपतकालीन सेवामा जानकारी गराउने,

२.४ विद्युतको किफायती उपयोग गर्न अपनाउनुपर्ने उपायहरू :

विद्युत् बचत गर्नु भनेको केवल बिल (महसुल) घटाउनु मात्र होइन, राष्ट्रिय स्रोतको संरक्षण गर्नु पनि हो । विद्युत् बचतका केही प्रभावकारी उपायहरू यसप्रकार छन्:

- LED बल्बको प्रयोग गर्ने,

- आवश्यक नभएको समयमा बत्ती तथा उपकरण बन्द गर्ने,
- ऊर्जा दक्ष (Energy Efficient) उपकरणहरू प्रयोग गर्ने,
- मोबाइल चार्जर, आइरन, हिटर लगायत अन्य उपकरण प्रयोग पछि प्लगबाट निकाल्ने,
- सकेसम्म प्राकृतिक प्रकाशको अधिकतम उपयोग गर्ने,
- एयर कन्डिसनर तथा गिजर आवश्यकता अनुसार मात्र सञ्चालन गर्ने,
- विद्युतीय उपकरणहरूको नियमित मर्मत सम्भार गर्ने, आदि ।

विद्युत खेर जानु पनि सम्पत्तिको नाश हो । एक युनिट विद्युत् बचत गर्नु भनेको एक युनिट विद्युत् उत्पादन गर्नु जत्तिकै हो । त्यसैले विद्युतको भरपूर तर किफायतीपूर्ण उपयोग गरी सवैले राष्ट्रिय सम्पत्तिको दिगो र प्रभावकारी उपयोग गर्न आवश्यक छ ।

३. निष्कर्ष:

विद्युतको सफलता केवल प्राविधिक दक्षतामा मात्र निर्भर हुँदैन, सुरक्षा अनुशासन, स्पष्ट सञ्चार, प्रभावकारी समन्वय र निर्धारित मापदण्डको पूर्ण पालनामा पनि उत्तिकै निर्भर हुन्छ । प्रत्येक कर्मचारीले "पहिले सुरक्षा, त्यसपछि कार्य" (Safety First, Work Next) भन्ने सिद्धान्तलाई आत्मसात् गरी व्यक्तिगत सुरक्षा सामग्रीको प्रयोग, Lockout-Tagout प्रक्रिया, नियन्त्रण कक्षसँगको समन्वय तथा टोलीगत कार्यसंस्कृतिको पालना गरेमा दुर्घटनाको जोखिम उल्लेखनीय रूपमा घटाउन सकिन्छ । त्यसैगरी सेवाग्राहीहरूले पनि विद्युतको सुरक्षित र नतिजामुखी उपयोगको ज्ञान राखी यसको संवेदनशीलता र सान्दर्भिकता अनुसार उपयोग गर्नु पर्दछ। सुरक्षित सेवाग्राही, सुरक्षित कर्मचारी र सुरक्षित प्रणाली नै विश्वसनीय र गुणस्तरीय विद्युत् व्यवस्थापनको आधार हो । आगामी दिनमा विद्युतको पहुँचसँगै विद्युत् साक्षरताको बिस्तार पनि समान रूपमा आवश्यक छ । यसरी हरेक नागरिकले "विद्युतको सुरक्षित प्रयोग गरौं, ऊर्जा बचत गरौं, राष्ट्रिय सम्पत्ति संरक्षण गरौं" भन्ने भावना आत्मसात् गर्न सकेमा मात्र उज्यालो, सुरक्षित, समुन्नत र समृद्ध नेपालको लक्ष्य हासिल गर्न कठिन हुने छैन ।

सन्दर्भ सामग्रीहरू :

१. विद्युत पत्रिकामा प्रकाशित विभिन्न लेख रचनाहरू ।

२. नेपाल विद्युत प्राधिकरणबाट सर्वसाधारणको जानकारीको लागि सम्प्रेषित विद्युत सम्बन्धी विभिन्न सूचनामूलक सन्देशहरू ।

३. युट्युव च्यानलहरूबाट विद्युत सम्बन्धी संप्रेषित विभिन्न सूचनाहरू ।

कर्मचारी दुर्घटनामा परी औषधि उपचार गराएको अवस्थामा वीमा दावीका लागि आवश्यक पर्ने कागजात

- **आवश्यक विवरण भरिएको वीमा दावी फाराम**
- **औषधि उपचारका सम्पूर्ण सक्कल कागजात तथा बिल**
- **कार्यालयले तयार पारेको दुर्घटना प्रतिवेदन (कार्यालयको कामको शिलशिलामा दुर्घटनामा परेको अवस्थामा मात्र)**
- **दुर्घटनाको प्रहरी प्रतिवेदन (कार्यालयको कामको सिलसिलामा दुर्घटनामा परेको अवस्थामा मात्र)**

सार्वजनिक संस्थानको उत्पत्ति, विकास र अभ्यास

रमेश कुमार पाण्डे
सहायक निर्देशक
ने.वि.प्रा.

विषय प्रवेश :

सर्वसाधारण जनतालाई आवश्यक पर्ने वस्तु तथा सेवा उत्पादन वा खरिद गरी बिक्रीवितरण गर्न सरकारी निकायको सट्टा सरकारको पूर्ण वा आंशिक स्वामित्व भई छुट्टै कानूनी अस्तित्वको रुपमा स्थापित संस्थाहरू सार्वजनिक संस्थान हुन् ।

सार्वजनिक संस्थानको उत्पत्ति तथा विकासको विश्व इतिहास :

विश्व परिदृष्यमा सार्वजनिक संस्थानको प्रारम्भ संरचनात्मक रुपमा कहिले र कसरी भयो भन्ने सम्बन्धमा स्पष्ट तथ्य भेटिंदैन । यद्यपि, राज्यको औपचारिक स्थापनासँगै राज्यद्वारा नियन्त्रित उद्योग तथा कलकारखाना मार्फत् वस्तु तथा सेवा उत्पादन र वितरणको थालनी भएको पाइन्छ । पश्चिमी र केही पूर्वी देशहरूमा लगभग १५० वर्षअघि नै सार्वजनिक संस्थानको विकास भएको मानिन्छ । प्रथम विश्वयुद्धको अन्त्य लगत्तै सन् १९३० को आर्थिक मन्दी पश्चात् विश्वमा चरम आर्थिक संकट सिर्जना भई बजार संयन्त्र प्रभावकारी रुपमा कार्य गर्न असफल भएपश्चात् अर्थव्यवस्थालाई योजनाबद्ध रुपमा अगाडि बढाउन, उक्त संकटबाट जनतालाई मुक्ति दिलाउन तथा आधारभूत आवश्यकताको सहज प्रत्याभूति गर्नका लागि राज्यले नै पहलकदमी लिनुपर्दछ भन्ने शासकीय धारणा विकास भई विश्वभर विभिन्न सार्वजनिक संस्थानहरू स्थापना गरिएको पाईन्छ । दोस्रो विश्वयुद्धपछि अर्थव्यवस्थाको पुनर्निर्माणको आवश्यकता र आर्थिक नीतिको आधारका रुपमा केन्सियन अर्थशास्त्रको प्रभुत्वले आधुनिक कल्याणकारी राज्यहरूको निर्माणमा राज्यको हस्तक्षेपकारी भूमिका भएको विकास मोडेलको चयनलाई प्रेरित गऱ्यो जसले राज्य स्वामित्वको महत्वलाई वृद्धि गऱ्यो । सन् १९१७ को क्रान्तिपछि रुसले नयाँ आर्थिक नीतिको अवलम्बन गरेको थियो जसमा कति परिमाणमा उत्पादन गर्ने तथा कहाँ कहाँ बिक्री गर्ने आदि सबै विषय राज्यले नै गर्ने, नीजीक्षेत्रको मनोमानी नियन्त्रण गर्ने, Heavy Tax लगाउने र सरकारले नै Business Production गर्ने नीति ल्याएको थियो । परिणामतः रसियाले आर्थिक वृद्धि प्राप्त गर्न सफल भयो । साथै उक्त समयमा आर्थिक क्रियाकलापमा राज्यको संलग्नता हुनुपर्ने र त्यसको लागि प्रभावकारी योजना बनाउनु उपयुक्त हुने महसुस गरियो परिणाम स्वरुप १९३० को आर्थिक मन्दीबाट पनि रसियालाई खासै ठूलो असर परेको थिएन ।

चीनमा सार्वजनिक संस्थानको पृष्ठभुमी :

चीन गणराज्य स्थापना (सन् १९४९) पछि समाजवादी अर्थतन्त्र स्थापना गर्न शिक्षा, स्वास्थ, कृषि, अनुसन्धान, संस्कृति आदि क्षेत्रमा राज्यको नेतृत्वमा सार्वजनिक संस्थाहरू स्थापना गरियो । Deng Xiaoping को आर्थिक सुधारपछि सरकारी दायित्व कम गर्ने लक्ष्यसहित सार्वजनिक संस्थानहरूमा सुधार सुरु भयो ।

धेरै संस्थानहरूलाई Semi Commercial, Semi Governmental स्वरुपमा रुपान्तरण गरियो। केही क्षेत्र जस्तै शिक्षा, अनुसन्धान, स्वास्थ्य लगायतमा सेवा शुल्क लगाउन अनुमति दिइयो तर मुख्य नियन्त्रण र निर्देशन राज्यकै हातमा रहेको थियो। विश्व बैंकद्वारा प्रकाशित अध्ययन प्रतिवेदन अनुसार सन् २०१७ मा चीनका सार्वजनिक संस्थानको GDP मा योगदान २७.५ प्रतिशत रहेको पाइन्छ।

भारतमा सार्वजनिक संस्थानको पृष्ठभूमि :

ब्रिटिस शासनकालमा सार्वजनिक संस्थानको आधार तयार हुन थाल्यो। सो समयमा प्रशासन सञ्चालनका लागि सरकारी विभागहरू (Civil Service) को स्थापना भयो भने रेल्वे, पोष्ट अफिस, सर्भे विभाग, वन सेवा, शिक्षा बोर्ड जस्ता संस्थानहरूको विकास भयो। यस कालमा भारतले आधुनिक ब्युरोक्रेसी र सार्वजनिक सेवा प्रणालीको ढाँचा तयार गऱ्यो। भारतमा सर्वप्रथम सन् १८५३ मा पहिलो रेलमार्ग सञ्चालनमा आयो। उक्त रेलमार्ग पहिले निजी कम्पनीहरूले स्थापना गरेको भए तापनि सन् १८५८ मा ब्रिटिस सरकारले रेलवेलाई सरकारी स्वामित्वमा लिएर सञ्चालन गऱ्यो।

जवारलाल नेहरूको समयमा विज्ञान, कृषि, शिक्षा, स्वास्थ्य जस्ता क्षेत्रमा राज्यले ठूलो लगानी गरेको पाइन्छ। जस्तै : सरकारी विभाग, सार्वजनिक क्षेत्र कर्पोरेसन, सार्वजनिक सेवा, कल्याण संस्थान आदि। स्वतन्त्र भारतको पहिलो सार्वजनिक संस्थानको रुपमा सन् १९५४ मा Hindustan Steel Ltd को स्थापना गरियो।

सन् १९९१ पछि भारतले LPG नीति (Liberalization, Privatization, Globalization) अपनायो। तत्पश्चात् सार्वजनिक संस्थानमा व्यावसायिकता र दक्षता बढाउने, घाटामा रहेका सार्वजनिक संस्थानहरू निजीकरण गर्दै लैजाने, विद्यालय, विश्वविद्यालय, अस्पताल, अनुसन्धान संस्थाहरूलाई स्वायत्त संस्था (Autonomous Body) मा रुपान्तरण गर्ने जस्ता केही महत्वपूर्ण कार्यहरू भए।

ISID को प्रतिवेदन अनुसार भारतको GDP मा भारतीय सार्वजनिक संस्थानको हिस्सा करिब एक चौथाइ अर्थात् २०-२५ प्रतिशत रहेको पाइन्छ।

अन्य देशहरूमा सार्वजनिक संस्थानको पृष्ठभूमि :

अमेरिकामा सन् १७७५ मा US Postal Service, सन् १८०० को समयमा Municipal Waterworks स्थापना भएको साथै Great Depression (1929-1939) पछि अमेरिकी सरकारले धेरै सार्वजनिक संस्थानहरू स्थापना गऱ्यो। जस्तै : Tennessee Valley Authority (TVA, 1933), Federal Deposit Insurance Corporation (FDIC, 1933), Rural Electrification Administration (REA, 1935) आदि।

बेलायतमा सुरुवाती समयमा सार्वजनिक संस्थानहरू राजकीय प्रशासन र धार्मिक संस्थाहरू मार्फत् सञ्चालन हुने गरेको पाइन्छ। १९ औं शताब्दीको मध्यतिर ब्रिटिस एयरलाइन्समा सरकारको शेयर संरचना वृद्धि गरी सार्वजनिक संस्थानकै रुपमा सञ्चालन गरिएको थियो। सन् १९८०-१९९० को दशकमा Privatization र New Public Management नीति अन्तर्गत केही सेवाहरू नीजी क्षेत्रमा हस्तान्तरण भए।

प्रारम्भिक **युरोपमा** सार्वजनिक संस्थान धार्मिक र सामन्तीय संरचनामा आधारित थिए। समकालीन युरोपमा लोकतान्त्रिक र डिजिटल सार्वजनिक संस्थान प्रमुख छन्। औधोगिकीकरणको समयमा फ्रान्स तथा जर्मनीमा हुलाक, रेल सेवा, टेलिग्राम लगायतका क्षेत्रमा सार्वजनिक संस्थानले कार्य गरेको पाइन्छ। त्यसबखत विश्वमै सार्वजनिक संस्थान स्थापनाले तीव्रता लिएको थियो।

नेपालमा सार्वजनिक संस्थानको इतिहास :

वि.सं. १९९० को समयमा नेपालमा नीजी क्षेत्र विकसित भइनसकेको, उत्पादन, वितरण र निर्माणमा नीजि क्षेत्र अगाडी आईनसकेकोले तत्कालीन अवस्थामा लगानी गर्ने क्षमता सरकारसँग मात्र थियो । आत्मनिर्भर, गतिशील र स्वाधीन अर्थतन्त्रको विकास गर्न, आयात प्रतिस्थापन तथा निर्यात पवर्द्धन गर्न, एकाधिकारको अन्त्य गर्न, रोजगारी सिर्जना गर्न, सामाजिक न्यायको पवर्द्धन गर्न, विकासका पूर्वाधार तयार गर्न, योजनाबद्ध विकासका प्रयासलाई सहयोग गर्न तथा नीजी क्षेत्रका लागि लगानी वातावरण निर्माण गर्ने उद्धेश्यले सर्वप्रथम वि.सं. १९९० को दशकमा सार्वजनिक संस्थानको स्थापना भएको पाइन्छ । वि.सं. १९९३ मा सर्वप्रथम विराटनगर जुट मिल, १९९४ मा नेपाल बैंक लि. सार्वजनिक संस्थानको रुपमा स्थापना भएपश्चात् नेपालमा धेरै सार्बजनिक संस्थानहरू स्थापना भएको पाइन्छ । नेपालमा सार्बजनिक संस्थानहरू विशेष ऐन, कम्पनी ऐन, विकास समिति ऐन, बैंक तथा वित्तीय संस्था सम्बन्धी ऐन अन्तर्गत स्थापित भएका छन् ।

नेपालमा सार्वजनिक संस्थानको भूमिका:

१) **जनहितकारी/लोककल्याणकारी सेवाहरू :** निजी क्षेत्र मुनाफाकेन्द्रित हुने भएकोले सार्वजनिक संस्थानले आफ्ना वस्तु तथा सेवा मार्फत् लोककल्याणकारी कार्यमा ध्यान दिएका छन् ।

२) **आर्थिक विकास :** उद्योग, व्यापार र पूर्वाधार विकास मार्फत सहयोग ।

३) **रोजगारी सिर्जना :** मानव संसाधनको प्राप्ति, विकास, उपयोग तथा संभार । ४५ संस्थानमा कुल ३३,६५६ दरबन्दी रहेको ।

४) **क्षेत्रीय सन्तुलित विकास :** राज्यको प्राथामिकता बमोजिम सेवा बिस्तार ।

५) **प्राकृतिक स्रोतको संरक्षण र उपयोग :** खानी तथा खनिज पदार्थ प्रयोग तथा संरक्षण ।

६) **निजी क्षेत्रको एकाधिकार नियन्त्रण :** सन्तुलित बजार संयन्त्रको विकास ।

७) **अत्यावश्यक सेवाको सुनिश्चितता :** यातायात, विद्युत, खानेपानी र सञ्चार सम्बन्धी सेवाहरू ।

८) **सामाजिक न्याय :** वर्गीय, क्षेत्रीय, अल्पसंख्यक र अन्य समुदायको हित अभिवृद्धि गर्नुका साथै सामाजिक उत्तरदायित्व सम्बन्धी कार्य गरेका छन् ।

नेपालमा सार्वजनिक संस्थानहरूको स्थापना विराटनगर जुटमिलबाट प्रारम्भ भएको थियो । हाल विभिन्न ६ समूह (औधोगिक, व्यापारिक, सेवा, सामाजिक, जनउपयोगी र वित्तीय) मा रहेका ४५ वटा सार्वजनिक संस्थानहरूमध्ये जनउपयोगी (नेपाल विद्युत प्राधिकरण, नेपाल खानेपानी संस्थान, नेपाल दूरसञ्चार कं.लि. लगायत) र सेवा क्षेत्र (नेपाल वायुसेवा निगम, नेपाल नागरिक उड्डयन प्राधिकरण लगायत) मा रहेका संस्थानहरूको भुमिका नागरिकको दैनिक आधारभूत आवश्यकतासँग जोडिएको छ । वि.स २०८२ अन्त्यसम्म नेपाल विद्युत प्राधिकरणको सेवा ९९ प्रतिशत, आधारभूत खानेपानीको पहुँच ९७ प्रतिशत, मोबाईल टेलिफोन ग्राहक घनत्व १०३.२ प्रतिशत र ४ जी मोबाईल सेवाको पहुँच ८९.६ प्रतिशत नागरिकमा पुगेको देखिन्छ । यसरी विद्युत, खानेपानी, टेलिफोन जस्ता आधारभूत आवश्यकताका क्षेत्रमा जनउपयोगी क्षेत्रका सार्वजनिक संस्थानहरूले पुऱ्याएको सेवा साँच्चिकै प्रशँसनीय देखिन्छ ।

विद्यमान अवस्था विश्लेषण :

विश्वमा सार्वजनिक संस्थानको अवस्था विश्लेषण

विश्व अर्थतन्त्रको ठूलो हिस्सा ओगटेका विश्वका सार्वजनिक संस्थानहरूको कुल सम्पत्ति सन् २०२३ को अन्त्यसम्ममा अनुमानित ५३.३ ट्रिलियन अमेरिकी डलर थियो । उक्त रकम सोही अवधिको विश्वको कुल ग्राहस्थ उत्पादन (GDP) १०६.१७ ट्रिलियन अमेरिकी डलरको आधाभन्दा बढी हो । सोही वर्ष विश्वभरका

सार्वजनिक संस्थानको कुल आय १२ ट्रिलियन अमेरिकी डलर थियो। विश्वमा आयको आधारमा रहेका ५०० वटा ठूला कम्पनीमध्ये १२६ वटा कम्पनी सार्वजनिक संस्थान रहेका छन्। विश्वबैंकले सन् २०२३ मा ९१ देशका करिब ७६ हजार कम्पनीहरूमा गरेको एक अध्ययनले १० प्रतिशत भन्दा बढी राज्यको स्वामित्व रहेका कम्पनीहरूको व्यापारबाट प्राप्त आयले औसतमा ती देशहरूको GDP मा १७ प्रतिशत योगदान दिएको देखाएको छ। यसरी हेर्दा सार्वजनिक संस्थानको विश्व अर्थतन्त्रमै अहम् भूमिका रहेको देखिन्छ।

नेपालमा सार्वजनिक संस्थानको अवस्था विश्लेषण

हाल नेपालमा विभिन्न औधोगिक, व्यापारिक, सेवा, सामाजिक, जनउपयोगी र वित्तीय क्षेत्रमा गरी ४५ वटा सार्वजनिक संस्थानहरू अस्तित्वमा रहेका छन्। जसमध्ये २० वटा पूर्ण सरकारी स्वामितमा र २५ वटामा सरकारको आंशिक स्वामित्व रहेको छ। कम्पनी ऐन अनुसार स्थापना भएका ३४, संस्थान विशेष ऐन अनुसार ८, सञ्चार संस्थान ऐन अनुसार १, सहकारी ऐन अनुसार १ र संस्थान ऐन २०२१ अनुसार १ वटा संस्थान रहेका छन्। आ.व. २०८१-०८२ सम्म संस्थानको कुल सम्पत्ति रु ३२ खर्ब ६ अर्ब ९१ करोड रहेको छ। हाल नाफामा रहेका सार्वजनिक संस्थान २७, नोक्सानीमा रहेका १६ र कारोबार नभएका २ वटा रहेका छन्। संस्थानमा सरकारको कुल लगानी ७ खर्ब ९८ अर्ब ५६ करोड रहेको छ जसमध्ये शेयर लगानी ३ खर्ब ७० अर्ब २५ करोड र ऋण लगानी ४ खर्ब २८ अर्ब ३१ करोड रहेको छ। आ.व. २०८१-०८२ मा खुद नाफा ४५ अर्ब ८ करोड ४९ लाख रहेको छ। आ.व. २०८१/८२ मा संस्थानहरूको कुल प्रशासनिक खर्च (कर्मचारी खर्च समेत) रु ६१ अर्ब ५ करोड देखिन्छ। उक्त रकमको आकार संस्थानको खुद नाफाभन्दा सञ्चालन खर्च बढी हो। प्रत्येक वर्षको सार्वजनिक संस्थानको आर्थिक उपार्जनलाई तुलना गर्दा लगानीको अनुपातमा मुनाफाको प्रतिशत नगण्य देखिएको कारण सरकार सार्वजनिक संस्थानलाई लगानी गर्ने वा नगर्ने विषयमा सोच्न बाध्य बन्न पुगेको देखिन्छ। अर्कोतर्फ आ.व. २०८१/०८२ सम्म संस्थानमा कुल ३८,२८५ स्वीकृत दरबन्दी रहेकोमा कार्यरत जनशक्ति ३०,३५२ रहेकोले पनि संस्थानले रोजगारीका साथै प्रतिभा व्यवस्थापनको पाटोमा पनि राम्रै भूमिका निर्वाह गरेको देखिन्छ। ४५ वटा सार्वजनिक संस्थानमध्ये Nepal Stock Exchange मा सूचीकृत भई कारोबार गरेका ७ वटा संस्थानको बजार पूँजीकरण नेपालको शेयर बजारको जम्मा Market Capitalization को १५.०८ प्रतिशत रहेको छ।

नेपालमा सार्वजनिक संस्थानका समस्याहरू :

विविध उद्देश्य, प्रतिस्पर्धात्मक क्षमताको अभाव, चरम राजनीतिक हस्तक्षेप, व्यावसायिक क्षमताको अभाव, कमजोर व्यवस्थापन र अस्वस्थ ट्रेड युनियन गतिविधि, व्यवसायिक सञ्चालन र सामाजिक उत्तरदायित्वबीच सन्तुलन कायम गर्न नसक्नु, मूल्य निर्धारण लगायतका विषयमा परनिर्भरता, योग्यता प्रणालीमा आधारित नेतृत्व चयन हुन नसक्नु, फितलो जवाफदेहिता तथा अनुगमन प्रणाली, परम्परागत कार्यशैली तथा उच्च कर्मचारी Turnover, Retention Policy को अभाव, Market Intervention Policy को अभाव, Alternative Backup Plan को अभाव, सबल जनशक्ति योजनाको अभाव, खस्किँदो आर्थिक अवस्था, व्यावसायिक र व्यवस्थापकीय क्षमतामा ह्रास, उपलब्ध सम्पत्ति र क्षमताको प्रभावकारी उपयोगको अभाव, सार्वजनिक संस्थान सुधार कार्यदलका प्रतिवेदन कार्यान्वयनको उदासीनता, संस्थागत सुशासन पक्ष कमजोर, सञ्चालन खर्चमा वृद्धि, कर्मचारीहरूमा व्यवासायिकता वृद्धि गर्न नसकिनु आदि रहेका छन्।

सार्वजनिक संस्थानको सुधार र सबलीकरणका उपायहरू :

१) **योग्यतामा आधारित नियुक्ति :** संचालक समिति, कार्यकारी निर्देशक वा महाप्रबन्धक नियुक्ति गर्दा

खुला प्रतिस्पर्धाबाट गर्नुपर्ने । साथै निश्चित कार्यसम्पादन लक्ष (KPI) सहित करार गर्नुपर्ने ।

२) **सुशासन प्रवर्द्धन (Good Governance)** : पारदर्शी निर्णय प्रक्रिया, जवाफदेहिता र पारदर्शिता प्रवर्द्धन, आन्तरिक नियन्त्रण र लेखापरीक्षणलाई प्रभावकारी बनाउने । भ्रष्टाचार र अनियमितताप्रति शून्य सहनशीलता अपनाउने ।

३) **कार्यसम्पादनमा आधारित मूल्याङ्कन** : KPI निर्धारण र सो आधारमा मूल्याङ्कन ।

४) **वित्तीय सुधार** : अनावश्यक खर्च कटौती, प्रभावकारी ऋण व्यवस्थापन, वित्तीय पुनसंरचना ।

५) **प्रभावकारी मानव संसाधन व्यवस्थापन** : Right Sizing, उत्प्रेरणा वृद्धि, उचित दण्ड पुरस्कार प्रणाली, क्षमता विकास र उपयुक्त तालिम प्रदान गर्ने ।

६) **प्रविधिको प्रयोग वृद्धि गर्ने** : Paperless Office, Digital Service, e-Payment, MIS आदि लागू गर्ने ।

७) **अन्य सुधार** : विगतका सार्वजनिक संस्थान सुधार कार्यदलका प्रतिवेदनहरूका उपयुक्त प्रावधानहरू कार्यान्वयन गर्ने, खरिद प्रणाली प्रभावकारी बनाउने, सेवा केन्द्रित प्रशासन निर्माण गर्ने, गुनासोको उचित सम्बोधन गर्ने, समयसापेक्ष गुणस्तरीय सेवाप्रवाह व्यवस्थापन, सेवा बजारीकरणमा जोड, गुणस्तरीय र नागरिकमैत्री सेवा प्रवाह गर्ने आदि ।

आर्थिक उदारीकरण र निजीकरण

विश्वमा देखिएको निजीकरणको प्रभावस्वरुप नेपालमा पनि क्रमशः धेरै सार्वजनिक संस्थानहरूलाई निजीकरण गरिएको पाइन्छ । नेपालमा छैटौं योजनामा नेपाल ढलोट उद्योग र चिउरी घिउ उद्योगको खारेजी पश्चात् अघोषित रुपमा निजीकरणको सुरुवात भएको थियो । निजीकरणको मूल तात्पर्य Less Government is best Government थियो अर्थात् निजी क्षेत्रको संलग्नतामा सबल, सक्षम र व्यावसायिक संस्था निर्माण गरी राज्यको आर्थिक दायित्वमा कमी गर्दै रोजगारी सृजनामा जोड दिनु थियो तर विडम्बनास्वरुप आर्थिक वृद्धि गर्न नसक्दा सरकारको संरक्षण र लगानीमा संचालित सार्वजनिक संस्थान आर्थिक उदारीकरण पछि प्रतिस्पर्धात्मक वातावरणमा व्यावसायिक कुशलता अनुरुप सञ्चालनमा आउन र निजीक्षेत्रसँग प्रतिस्पर्धा गर्न नसक्दा क्रमशः कमजोर बन्दै गए । फलस्वरुप राज्यले संस्थानहरू क्रमशः निजीकरण गर्दै गयो । नेपालले आर्थिक उदारीकरणबाट सिर्जित निजीकरणको अभ्यासलाई अनुसरण गरेतापनि उक्त प्रयासले न त सार्वजनिक संस्थानको व्यवसायिकता प्रवर्द्धन गर्न सक्यो न त निजीक्षेत्रको विकास र सवलीकरण । यसरी सेवा प्रवाहको माध्यम बनेका सार्वजनिक संस्थानहरू उल्टै धराशाही हुन पुगेको देखिन्छ । पूर्व तयारीबिना विश्वका नवोदित सिद्धान्तलाई सिको गर्न खोज्दा सार्वजनिक संस्थान असफलताको दुष्चक्रमा परेका देखिन्छन् ।

विश्लेषण तथा निचोड

नागरिकको संविधानप्रदत्त मौलिक हक, राज्यका निर्देशक सिद्धान्त र नीति, आवधिक योजना तथा सरकारका वार्षिक नीति तथा कार्यक्रमको कार्यान्वयन गर्न तथा विपद्को समयमा अत्यावश्यक वस्तु तथा सेवाको नियमित र सुलभ आपूर्ति गरी जनताको अधिकारको रक्षाका लागि सार्वजनिक संस्थानको सान्दर्भिकता अझै सशक्त बनेको छ । कोभिड १९ को समयमा निजीक्षेत्रले व्यवसाय तथा आफ्ना अत्यावश्यक सेवाहरू बन्द गरी सामाजिक दायित्वबाट विमुख भएको समयमा यिनै सार्वजनिक संस्थानहरू अहोरात्र सार्वजनिक सेवा प्रवाहमा खटिएको ज्वलन्त उदाहरण स्पष्ट छ । नेपालको संविधानमा स्पष्ट रुपमा समाजवादउन्मुख अर्थतन्त्रमा जोड दिई लोककल्याणकारी राज्यको परिकल्पना गरिएको छ भने अर्कोतर्फ नेपालमा निजीकरण प्रयास पनि मूलतः असफल देखिएको कारणले सार्वजनिक संस्थानको सुदृढीकरणको विकल्प नभएको प्रस्ट देखिन्छ ।

सरकार र सार्वजनिक निकायहरूबाटै विश्वव्यापीकरण र उदारीकरणको अभ्यास भएको विश्व परिप्रेक्ष्यमा सार्वजनिक संस्थान नराख्दा हुने, संस्थानहरू सेतो हात्ती भए, राज्यको लगानी जोखिममा पऱ्यो, राज्यको लागि दायित्व मात्र भए भन्ने जस्ता केही अभिव्यक्ति समय समयमा आएका पनि देखिन्छन् । नाफाको इन्डिकेटरको आधारमा मात्र संस्थानको मूल्याङ्कन गरिनु र उसको कार्यप्रकृति र सेवालाई नजरअन्दाज गरी निजीकरणको मार्गमा जबर्जस्ती धकेलिँदै गर्दा सार्वजनिक संस्थानको भविष्यमाथि नै प्रश्न उठेको छ ।

सार्वजनिक सस्थानको मुनाफा वृद्धि हुन्जेल आवश्यक ठान्ने र राज्यको सहयोग आवश्यक पर्ने बेलामा सार्वजनिक संस्थानको भविष्य अन्योलमा पर्ने देखिन्छ । कुनै सार्वजनिक संस्थानहरू सुरक्षाका दृष्टिले समेत राज्यले नै संचालन नगरी नहुने अबस्थामा छन् त कुनै राष्ट्रको गौरवसँग जोडिएका छन् जस्तैः नेपाल विद्युत प्राधिकरण, नेपाल टेलिकम, नेपाल वायुसेवा निगम, नेपाल आयल निगम आदि । राज्यको प्रमुख दायित्व नै नागरिकको संरक्षण गर्नु हो । त्यसैले नागरिकको आधारभूत आवश्यकतासँग सम्बन्धित सेवामा निजीक्षेत्र मात्र हाबी हुन नदिई सरकारको उपस्थिति हुनु अत्यन्त आवश्यक छ । कृषि उत्पादनलाई बजारसम्म पुऱ्याउन सकिएको छैन, कृषि उत्पादनको उचित मूल्य छैन, कोल्ड स्टोरहरूको अभाव छ, मल, बिउबिजन लगायतका कृषि सामग्रीको अभाव पूर्ति गर्न सकिएको छैन । यस्तै अनेक समस्याको समाधानको लागि, विविध कार्य प्रकृतिका सार्वजनिक संस्थानहरू स्थापना तथा निरन्तरता अपरिहार्य छ । सार्वजनिक संस्थानको आवश्यकता र महत्वलाई बिर्सेर आर्थिक रुपमा घाटा नाफाको दृष्टिले मात्र हेरिनु हुँदैन । राज्य नियामक मात्र नभएर सेवा प्रदायक पनि भएकोले आफ्नो क्षेत्राधिकारलाई संकुचन गर्दा राज्यको लोककल्याणकारी नीति असफल हुनेतर्फ पनि संवेदनशील हुनु जरुरी छ । विद्यमान समयमा राज्य तथा सरकारको नागरिकप्रतिको सार्वजनिक उत्तरदायित्व र जवाफदेहितालाई अर्को प्रणाली वा पद्धतिबाट न्यूनीकरण गर्नसक्ने संभावना नरहेको साथै राज्यले लोककल्याणकारी नीतिलाई सफल बनाउन सबैक्षेत्रमा सरकारको उपस्थिति पर्याप्त नहुँदासम्म सार्वजनिक संस्थानको अपरिहार्यता भईरहने हुँदा विद्यमान सार्वजनिक संस्थानहरूको सबलीकरण नै आजको आवश्यकता हो भन्नेमा दुईमत नहोला ।

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सार्वजनिक सेवाका आधारभूत मूल्यहरू र नेपाल विद्युत प्राधिकरण

सन्तोष गौतम
लेखा अधिकृत
ने.वि.प्रा.

विषय प्रवेश :

कुनै निश्चित भूभाग वा सिमाना भित्र विभिन्न जातजाति, समूदाय, वर्गको स्वतन्त्रता र सार्वभौमिकताको संरक्षण गर्दै त्यस भूगोलमा बसोबास गर्ने नागरिकको हित संरक्षण एवं कल्याणकारी उद्देश्यले संरक्षित बृहत् संस्था नै राज्य हो। राज्यका मामिलाहरूको व्यवस्थापनका निमित्त राजनीतिक, आर्थिक र प्रशासनिक सत्ताको प्रयोग शासन हो। यो जटिल संयन्त्र, प्रक्रिया, सम्बन्ध र संस्थाहरूको एकीकृत स्वरुप हो। यस भित्र नियमन गर्ने, व्यवस्थापन गर्ने, जनपरिचालन गर्ने एवं सेवा प्रवाह गर्ने जस्ता महत्वपूर्ण पक्षहरू सन्निहित हुन्छन्। सार्वजनिक सेवा कुनै पनि राज्यको प्रशासनिक संयन्त्रको आधार स्तम्भ हो। यसले नागरिक र राज्य बिचको सम्बन्धलाई मूर्त रुप दिन्छ र राज्यले लिएका नीति तथा कार्यक्रमहरूलाई व्यवहारमा रुपान्तरण गर्ने माध्यमको कार्य गर्दछ। नेपाल जस्तो संघीय लोकतान्त्रिक गणतन्त्रात्मक मुलुकमा जहाँ राज्य शक्ति संघ, प्रदेश र स्थानीय तह गरी तिन तहमा विभाजन गरिएको छ , सार्वजनिक सेवा प्रदायकहरू चाहे निजामती कर्मचारी या सुरक्षा निकाय, प्रदेश, स्थानीय तह या सार्वजनिक संस्थान क्षेत्रका कर्मचारी नै किन नहोऊन्, ती सवैको आचरण, निर्णय र व्यवहार निश्चित आधारभूत मूल्यहरूमा आधारित हुनुपर्दछ ।ती मूल्यहरूले नै राज्य भित्रको सार्वजनिक सेवालाई कानूनसम्मत,नैतिक, पारदर्शी,प्रभावकारी र सेवाग्राहीमुखी बनाउँदछ।

सार्वजनिक सेवाको अवधारणात्मक पक्ष

सार्वजनिक सेवाका पछिल्ला अवधारणा खासगरी Empowering Rather Than Servicing जस्ता मर्ममा आधारित छन्। सार्वजनिक सेवाका नवीनतम अवधारणा विशेषगरी नागरिकलाई केन्द्रमा राखी सेवा प्रवाह हुनुपर्छ भन्ने मान्यतामा अडिग छन्। यस्ता अवधारणालाई खासगरी दुईवटा आयामवाट हेर्न सकिन्छ। पहिलो वितरणात्मक अवधारणा जहाँ राज्य वा सरकारले जनताको माग वा आवश्यकताका आधारमा प्रदान गर्ने सेवाहरू पर्दछन्, यी नियमित कार्य हुन् ,आधारभूत रुपमा यस्ता सेवा प्रदान गर्न सरकारले विभिन्न संयन्त्र,योजना,कार्यक्रम परिचालन गर्दछ, जस्तो विद्युत,स्वास्थ्य सेवा, शिक्षा खानेपानी आदि। दोस्रो पुनर्वितरणात्मक अवधारणा जस अन्तर्गत राज्य भित्रका विभिन्न पिछडा वर्ग,समूदाय तथा क्षेत्र र वर्गका लागि प्राथमिकताका आधारमा विशेष व्यवस्था गरिएको हुन्छ। जस्तैः प्रौढ शिक्षा, अशक्त भत्ता आदि। यसरी राज्यले प्रदान गर्ने परम्परागत सेवा,कल्याणकारी सेवा, प्रवर्धनात्मक सेवा, मनोरञ्जनात्मक सेवा, नियमन सेवा, पूर्वाधार विकास सेवा तथा आकस्मिक सेवा बितरणका विभिन्न अवधारणाहरू उपयोगमा छन्।

सार्वजनिक सेवाका आधारभूत मूल्यहरू

अनुकरणयोग्य एवं असल आचरण र निष्ठापूर्ण प्रशासनिक संयन्त्रले मात्रै निष्पक्ष,पारदर्शी एवं प्रभावकारी सेवा प्रवाह सुनिश्चित गर्दै पूर्व निर्धारित राज्यका उद्देश्य हासिल गर्न र लोकतान्त्रिक पद्धतिलाई सघन तरिकाले संस्थागत गर्न सक्छ।

विधिको शासन,आर्थिक अनुशासन,सार्वजनिक स्रोतको महत्तम उपयोग र बृहत्तर सार्वजनिक हित प्रवर्धनका लागि सार्वजनिक सेवा प्रवाहमा सच्चरित्रता,नैतिकता,समर्पण,समानुभूति,दया करुणा आदि मूल्यहरूको उपयोग अपरिहार्य छ ।

सदाचार (Integrity)

सार्वजनिक हितप्रतिको प्रतिवद्धताबाट पूर्ण निर्देशित हुनु नै सार्वजनिक सेवाको सच्चरित्रता, निष्ठा वा सदाचारिता हो । सदाचार भित्र आफ्ना कर्तव्यहरू र दायित्वलाई पूर्ण रुपमा जिम्मेवार भई पालना गर्ने,पेशागत आचरण तथा व्यावसायिक व्यवहारको निरन्तर प्रदर्शन गर्ने,सार्वजनिक कोषको परिचालन मितव्ययी तवरले गर्ने,सार्वजनिक सम्पत्तिको अत्युत्तम उपयोगमा जोड दिने,सार्वजनिक सम्पत्तिको सदुपयोगमा जोड दिने ,स्वच्छ,निष्पक्ष,छरितो र प्रभावकारी रुपमा सार्वजनिक मामिलाको व्यवस्थापनमा विशेष ध्यान दिने विषयहरू पर्दछन् । खासगरी व्यक्तिगत वा अन्य लाभ वा कुनै समूहको स्वार्थवाट प्रभावित नभई सार्वजनिक सेवा र हितप्रतिको निष्ठावान् सोच र अभ्यास नै सार्वजनिक सेवाको सदाचारिता हो ।

निष्पक्षता (Impartiality)

कुनै पनि सार्वजनिक प्रकृतिका निर्णय गर्दा आग्रह र पुर्वाग्रहका आधारमा नभई वस्तुगत मानकका आधारमा गरिन्छ भने त्यो निष्पक्षता हो । खासगरी सार्वजनिक सेवामा निष्पक्षताका दुईवटा तह हुने गर्दछन्, पहिलो तह राजनीतिक निष्पक्षता हो । यस अन्तर्गत सार्वजनिक सेवा वितरणमा कार्य गर्ने कर्मचारीले राजनीतिक आस्था वा विचारबाट प्रभावित नभई सरकारका नीति तथा कार्यक्रममा निष्पक्ष ढंगले संलग्न हुनुपर्ने ,सत्ता पक्षको मात्र नभई प्रतिपक्षको विश्वास जित्ने गरी कार्य गर्नुपर्ने राष्ट्रिय हित सम्बन्धी नीति कार्यक्रम प्रति सधैं सकारात्मक रहनुपर्ने आदि विषयहरू पर्दछन् भने दोस्रो तह सार्वजनिक निष्पक्षता अन्तर्गत सार्वजनिक सेवा अन्तर्गत रहने कर्मचारीले आफ्नो पदीय जिम्मेवारी निर्वाह गर्दा स्वच्छ,न्यायपूर्ण एवं समताका आधारमा गर्ने,सार्वजनिक निकायका नियमित तथा अल्पकालीन, दीर्घकालीन रुपमा सम्पन्न गर्नुपर्ने कार्य गर्दा कुनै व्यक्ति वा समूहको रुचिबाट प्रभावित नहुने,सेवा प्रवाहमा कुनै प्रकारका विभेद हुन नदिने,संविधान र राज्यका नीति प्रति बफादार रहने,साथै राजनीतिले निर्णय गर्छ , त्यसको कार्यान्वयन प्रशासनले गर्छ भन्ने मूल मन्त्रलाई बिर्सन नहुने आदि विषयहरू सार्वजनिक निष्पक्षता भित्र पर्दछन् ।

समर्पण (Dedication)

लक्ष्य तथा उद्देश्य प्राप्तिका सन्दर्भमा जुन काम व्यक्तिका लागि महत्वपुर्ण लाग्छ ,त्यस्तो काम वा उद्देश्य परिपूर्तिका लागि ऊ शारीरिक र मानसिक रुपमा पूर्ण रुपमा तयार भई कडा मेहनत र अनवरत प्रयास गर्नुलाई समर्पण भनिन्छ । कामबाट प्राप्त हुने सुविधा वा लाभलाई सामान्य रुपमा लिदै काम प्रति सम्पूर्ण रुपले उत्प्रेरित रहने गुण समर्पणमा रहन्छ । उच्च मनोबलका साथ आवश्यक र महत्वपूर्ण ठानिएको लक्ष्य हासिल गर्नका लागि हृदय देखि नै कामलाई मन पराउनु र त्यस्तो काममा दत्तचित्त भइरहनु समर्पण हो ।

सहिष्णुता (Tolerance)

आफूले अँगालेको मान्यता, विश्वास ,विचार धारणा तथा क्षमता भन्दा भिन्न प्रकृतिका व्यक्ति वा समूहलाई स्वीकार गर्न सक्ने मानवीय गुण नै सहिष्णुता हो । सार्वजनिक सेवा वितरणका क्रममा उक्त जिम्मेवारीमा रहने राष्ट्रसेवकले राज्यभित्र निहित भिन्न भूगोल,विचार,संस्कृति र विश्वास भएका नागरिकसँग अन्तरक्रिया गर्नुपर्ने हुन्छ । त्यसबखत सहिष्णुता मार्फत राष्ट्रिय एकता प्रवर्धनमा योगदान पुग्छ ।

समानुभूति (Empathy)

अरुको बुझाइ भावना,विचार उसकै दृष्टिबाट पहिचान गर्ने र बुझ्ने क्षमता समानुभूति हो ।खास गरी यो मूल्य अन्तर्गत सार्वजनिक सेवाको कर्मचारीले आफूलाई सेवाग्राहीको स्थानमा राखेर हेर्ने प्रयास गर्ने र समस्याको जडसम्म पुगेर समाधानको प्रयास गर्नुपर्छ । समग्रमा यो यस्तो मूल्य प्रणाली हो जसले अरुको स्थानमा आफूलाई राखी अरुको भावना,अनुभूति र अवस्थाको पहिचान र विश्लेषण गर्छ ।

करुणा (Compassion)

अरुको पीडा,असहजता वा दुःखको बारेमा अन्तर्यमा पुग्ने र त्यस्तो दुःख पीडालाई कम गर्न सक्दो प्रयास गर्ने गुणलाई दया या करुणा भनिन्छ। सार्वजनिक क्षेत्रका कर्मचारीहरूमा समानुभूति र करुणाका गुण भएमा राज्य भित्रका कमजोर र पछि परेका तथा पारिएका वर्ग र समुदायको संरक्षण, उत्थान र विकास गर्न संवैधानिक ,कानूनी तथा नीतिगत उद्देश्य तर्फ सार्वजनिक गतिविधिहरू अघि बढाउन सहज हुन्छ। सार्वजनिक सेवा प्रवाहमा सच्चरित्रता,नैतिकता,समर्पण,समानुभूति,दया करुणा आदि मूल्यहरूका अलावा पनि दक्षता र सेवा सहजीकरण, सत्यनिष्ठा, जवाफदेहिता,पारदर्शिता जस्ता अन्य विविध मूल्यहरू हुन्छन् ।

नेपाल विद्युत प्राधिकरणमा सार्वजनिक सेवाका आधारभूत मूल्यहरूको उपयोग नहुँदा पर्ने असर

नेपाल विद्युत प्राधिकरण व्यावसायिक तथा जनउपयोगी सार्वजनिक संस्था हो। यस संस्थाको व्यावसायिकता प्रवर्धन गर्न र सुशासन कायम गर्नका लागि सार्वजनिक सेवाका विविध मूल्यहरू फलदायी हुन सक्छन् , आधारभूत मूल्यहरूलाई उपेक्षा गर्दा विभिन्न प्रकारका जोखिम तथा असरहरू देखिन सक्छन्। कर्मचारीको सदाचारको अभावमा विद्युत_खपत अंकमा गडबड गर्ने, अवैध जडान, रिडर र ग्राहकको मिलेमतो बढ्दा सिस्टम लस उच्च हुने खतरा रहन्छ, जसले गर्दा प्राधिकरणको वित्तीय अवस्था कमजोर पार्न सक्छ। समयमा काम नहुँदा संस्था प्रतिको विश्वास कम हुन सक्छ ,लगानीकर्ता र दातृनिकायसँगको सम्बन्ध बिग्रन सक्छ। यसैगरी सार्वजनिक सेवामा निष्पक्षताको अभाव हुँदा प्राधिकरणबाट सेवा प्राप्त गर्दा पहुँच भएकोले मात्रै छिटो सेवा प्राप्त गर्न सक्ने अवस्था आउन सक्छ। कर्मचारीमा समर्पणको अभाव हुँदा आपतकालिन समयकमा जवाफदेहिता कमजोर हुन सक्छ। जस्तैः भूकम्प ,बाढी, पहिरो तथा डढेलो पछि विद्युत लाइन मर्मतमा ढिलाइ हुन सक्छ। करुणाको अभावमा जेष्ठ नागरिक,अपांगता भएका विपन्न परिवारसँग कठोर नीति अपनाउदा संस्था प्रतिको आलोचना बढ्दै जान्छ।

नेपाल विद्युत प्राधिकरणमा आधारभूत मूल्यहरूको उपयोग गर्ने तरिका र क्षेत्र

सार्वजनिक सेवाका आधारभूत मूल्यहरू संस्थागत संरचना भन्दा बढी व्यक्तिगत आचरण र संगठनात्मक संस्कृतिसँग बढी सम्बन्धित छन् ,नेपाल विद्युत प्राधिकरणमा आधारभूत मूल्यहरूको उपयोग गर्ने तरिका र क्षेत्र यस प्रकार छन् :

- निष्पक्षता कायम गर्न नयाँ लाईन जडान, क्षमता बढाउने, ट्रान्सफर्मर राख्ने, ट्रिपिङ/मर्मत प्राथमिकीकरणमा राजनीतिक वा व्यक्तिगत प्रभाव नपर्ने प्रस्ट मानक र क्रम (Queue Based,Digitial Token System) निर्धारण गर्न सकिन्छ। गुनासो तथा उजुरी व्यवस्थापनलाई प्रभावकारी बनाउन डिजिटल ट्र्याकिङ प्रणाली लागू गर्न सकिन्छ।
- कामप्रति समर्पण भाव बढाउन कार्यसम्पादनमा आधारित पुरस्कार प्रणालीलाई विशेषतः भवितव्य र आपतकालीन अवस्थामा कार्य गर्ने कर्मचारी र बक्यौता असुली, चोरी नियन्त्रणको योगदानमा आधारित वनाउन सकिन्छ। साथै वृत्तिबिकासको स्पष्ट मार्ग (career Progression Path) निर्धारण गर्ने जसले दीर्घकालीन रुपमा संस्थाप्रतिको लगाव बढाउँछ।
- समानुभूति पनि एक महत्वपूर्ण मूल्य हो, सेवाग्राहीका काम र समस्या प्रतिको वुझाइ भावना, विचार उसकै दृष्टिवाट पहिचान गर्ने र वुझ्न सक्ने क्षमता भएका कर्मचारीलाई एकल सेवा केन्द्रमा परिचालन गर्न सकिन्छ।
- संवेदनशील उपभोक्ता नीति मार्फत सुत्केरी, किरिया, ज्येष्ठ नागरिक, बेसहारा बालबालिका, अपांग, असाध्य रोग लागेका अक्सिजन चाहिने विरामी भएका घरमा लाइन नकाट्ने, महसुल बुझाउन किस्ताबन्दी सुविधा दिने साथै असन्तुष्ट ग्राहकसँग व्यवहार गर्ने सीप विकास तालिम मार्फत कर्मचारीलाई सशक्त पार्ने आदि सहनशीलता तथा करुणाभावका उपाय मार्फत सार्वजनिक सेवाका आधारभूत मूल्य कायम गर्न सकिन्छ।

- यी मूल्य र मान्यतालाई संस्थागत वनाउन नागरिक बडापत्रमा सेवाको मापदण्ड संगसंगै आचरणको मापदण्ड पनि लागू गर्ने,भर्ना प्रक्रियामा विशेषत ग्राहकसँग प्रत्यक्ष सम्पर्क हुने पदमा Behavioral/Emotional Intelligence मूल्यांकन समावेश गर्ने, वार्षिक कार्य सम्पादनमा <u>उपभोक्ता सन्तुष्टि स्कोर</u> लागू गरी अंक प्रदान गर्ने व्यवस्था मिलाउने र एकपटकको अभिमुखीकरणमा मात्र नभई निरन्तर रिफ्रेसरका रुपमा नियमित नैतिक.मूल्यमा आधारित तालिमको व्यवस्था गर्न सकिन्छ।

सार्वजनिक सेवाका आधारभूत मूल्य उपयोगका संवैधानिक तथा कानूनी आधार

नेपालको संविधान २०७२ले सार्वजनिक सेवाका आधारभूत मूल्यहरूलाई विभिन्न धाराहरू मार्फत संस्थागत गरेको छ। धारा १८ ले समानताको हक सुनिश्चित गरेको छ भने धारा २७ ले सूचनाको हक प्रदान गर्दछ , पारदर्शिता र जवाफदेहितालाई संवैधानिक जग प्रदान गरेको छ। धारा २४२ मार्फत लोकसेवा आयोगलाई निजामती सेवाको भर्नामा स्वतन्त्र र निष्पक्ष संस्थाका रुपमा स्थापित गरेको छ। जसको उद्देश्य नै तटस्थता र योग्यता प्रणालीलाई सुनिश्चित गर्नु हो। निजामती सेवा ऐन, २०४९ ले कर्मचारीको अनुशासन, आचरण र सेवा शर्त सम्बन्धी विस्तृत व्यवस्था गरेको छ। त्यसैगरी सुशासन (व्यवस्थापन तथा संचालन) ऐन, २०६४ ले सुशासनका आधारभूत सिद्धान्तहरू ,जवाफदेहिता पारदर्शिता जनसहभागिता,कानूनी शासनलाई प्रशासनिक अभ्यासमा उतार्ने खाका दिएको छ। संघीयता कार्यान्वयनसँगै स्थानीय सरकार संचालन ऐन, २०७४ ले स्थानीय तहमा यी मूल्यहरूको पालना सम्बन्धी जिम्मेवारी तोकेको छ साथै सरकारको अधिकांश स्वामित्व र नियन्त्रण रहेका नेपाल विद्युत प्राधिकरण लगायत प्रायजसो निकायहरूका ऐन, विनियम तथा आचारसंहितामा समेत सार्वजनिक सेवाका आधारभूत मूल्यहरूको उपयोगको अभ्यास पाइन्छ।

उपसंहार

संस्थाको दिगो व्यावसायिक उपलब्धिका आधारशीला सार्वजनिक सेवाका आधारभूत मुल्यहरू नै हुन् ,तर सैद्धान्तिक र कानूनी प्रबन्ध बलियो भएपनि व्यवहारमा नेपालको सार्वजनिक सेवाले धेरै चुनौतीहरूको सामना गरिरहेको छ। राजनीतिकरणको समस्या गहिरो देखिएकै छ,कर्मचारी व्यवस्थापन,योग्यताप्रणाली, तटस्थता ,नैतिकता ,सदाचार माथि प्रश्न उठेकै छन्। भ्रष्टचार र अनियमितताका समाचारहरू निरन्तर सुनिएकै छन् जसले सार्वजनिक सेवा प्रतिको जनविश्वासलाई कमजोर बनाईरहेका छन् यद्यपि यी चुनौतीको डटेर सामना गर्दै व्यापक सुधार मार्फत अवसरमा परिणत गर्न राज्यमा विकसित पछिल्ला राजनीतिक परिवर्तनले ल्याएको स्थायित्वले सघाउ पुग्ने अपेक्षा गर्न सकिन्छ। नागरिक समाज, सञ्चार माध्यम, इमानदार सामाजिक अभियन्ता,स्थानीय समूदायको समेत सक्रिय सहभागिता मार्फत सामाजिक जवाफदेहिताको संस्कृति विकास गर्नु उत्तिकै महत्वपूर्ण देखिन्छ। किनकि नीतिगत व्यवस्थाले मात्रै दिगो परिवर्तन ल्याउन सकिदैन, यसका लागि संस्कार र व्यवहारमा पनि आमूल परिवर्तन आवश्यक छ।

सन्दर्भ सामग्री

नेपालको संविधान, कानून किताब व्यवस्था समिति, सिंहदरबार काठमाडौं।

सार्वजनिक प्रशासनमा आचरण, व्यावसायिकता र जवाफदेहिता, तारानाथ अधिकारी।

शासन प्रणाली, श्रीकृष्ण श्रेष्ठ, पैरवी प्रकाशन काठमाडौं।

सबल अर्थतन्त्र निर्माणमा विकसित सूचना प्रविधिको भूमिका

यादव नेपाल
सहायक कम्प्युटर अधिकृत
ने.वि.प्रा.

एक्काइसौं शताब्दीलाई सूचना र ज्ञानको युगको रुपमा चिनिन्छ। मानव सभ्यताको विकासक्रममा वाष्प इन्जिनको अविष्कारदेखि विद्युतको प्रयोग हुँदै आज विश्व एउटा यस्तो स्वर्णिम युगमा आइपुगेको छ , जहाँ सूचना र सञ्चार प्रविधि (ICT) केवल विलासिता र आधुनिकताको प्रतीक मात्र नभई कुनै पनि राष्ट्रको अस्तित्व, सामर्थ्य र समृद्धिको मापनको रुपमा स्थापित भइसकेको छ। देशका प्राकृतिक श्रोतको आफ्नो महत्व छ तर समृद्धिमा प्रभाव पार्ने तत्वहरूमा विकसित सूचना प्रविधिको प्रयोग एउटा महत्वपूर्ण तत्व हुन आएको छ। विकसित सूचना प्रविधिको प्रयोगले विश्व अर्थतन्त्रको संरचना, उत्पादन प्रणाली, व्यापारिक प्रक्रिया, सामाजिक सेवा, वित्तीय कारोवार तथा मानव जीवन शैलीमा आमूल परिवर्तन ल्याउन सफल भएको छ। नेपाल जस्तो भू-परिवेष्ठित र कठिन भौगोलिक धरातल भएको मुलुकले भौतिक रुपमा समुन्द्रसँग पहुँच नभए पनि डिजिटल संसारको समुन्द्र मार्फत आफूलाई विश्व बजारको अग्रपंक्तिमा उभ्याउने अभूतपूर्व अवसर प्राप्त भएको छ।

कुनैपनि देशको सबल अर्थतन्त्र भनेको त्यो अवस्था हो जहाँ आर्थिक गतिविधिहरू मजबुत, सन्तुलित र दिगो हुन्छन्, नागरिकको जीवनस्तर उच्च र देश आत्मनिर्भरता तर्फ उन्मुख हुन्छ। सबल अर्थतन्त्रका लक्षणहरूमा उच्च र स्थिर आर्थिक वृद्धिदर, धेरै रोजगारीका अवसरहरू, निर्यातमुखी व्यापार, उच्च उत्पादन क्षमता, मूल्य स्थिरता, मजबुत भौतिक पूर्वाधार, पर्याप्त विदेशी मुद्रा सञ्चिती, गुणस्तरीय शिक्षा-स्वास्थ्य, न्यून वैदेशिक ऋण, राजनैतिक स्थिरता, लगानी मैत्री वातावरण, न्यून गरिबी दर आदि मुख्य मुख्य सूचक हुन्।

विकसित सूचना प्रणाली भन्नाले यस समयसम्म आइपुग्दा कृत्रिम बुद्धिमत्ता (AI), क्लाउड कम्प्युटिङ, बिग डेटा, इन्टरनेट अफ थिङ्स (IOT), ब्लक चेन, 5G प्रविधि, डिजिटल भुक्तानी प्रणाली , साइबर सेक्युरिटी, स्मार्ट ग्रीड जस्ता आधुनिक प्रविधिहरूलाई जनाउँछ र यी प्रविधिको प्रयोगले उद्योग, व्यापार, बैंकिङ, ऊर्जा कृषि, शिक्षा, स्वास्थ्य, पर्यटन लगायतका क्षेत्रमा डिजिटल रुपान्तरण मार्फत उत्पादकत्व, वृद्धि गरी प्रतिस्पर्धी बनाउने एवम् सार्वजनिक सेवालाई दक्ष, प्रभावकारी, पारदर्शी, बनाउन सकिन्छ। यहाँ विकसित सूचना प्रणालीका केही विषयको छोटो परिभाषा दिने प्रयास गरिएको छ।

कृत्रिम बुद्धिमत्ता (AI) कृत्रिम बुद्धिमत्ता (AI) भनेको कम्प्युटर विज्ञानको त्यो क्षेत्र हो, जसले मेसिन वा सफ्टवेयरलाई मानव मस्तिष्कले जस्तै सोच्न, सिक्न, तर्क गर्न र निर्णय लिन सक्ने क्षमता प्रदान गर्छ।

बिग डेटा भन्नाले अत्यन्तै विशाल परिमाण, तीव्र गति र विविध स्वरूपमा संकलन हुने डिजिटल तथ्याङ्को समूहलाई बुझिन्छ। यसलाई परम्परागत डाटाबेस

सफ्टवेयरले प्रशोधन गर्न कठिन हुन्छ। इन्टरनेट, सामाजिक सञ्जाल, अनलाइन कारोबार र सेन्सरहरूबाट प्राप्त हुने यस्ता तथ्याङ्कहरूलाई आधुनिक प्रविधि (AI & Machine Learning) को प्रयोग गरेर विश्लेषण गरिन्छ। यसका मुख्य विशेषताहरूलाई परिमाण (Volume), गति (Velocity) र विविधता (Variety) का रूपमा चिनिन्छ।

यसको भूमिका:

१. सही निर्णय प्रक्रिया : तथ्यपरक तथ्याङ्कको विश्लेषणबाट सरकार र निजी क्षेत्रले जोखिम कम गर्दै बढी प्रतिफल दिने योजनाहरू बनाउन सक्छन्।

२. उत्पादकत्वमा वृद्धि : उद्योग र कृषिमा स्रोतहरूको सही परिचालन र मेसिनहरूको कार्यक्षमता बढाएर लागत घटाउन र उत्पादन बढाउन मद्दत गर्छ।

३. व्यापार बिस्तार : ग्राहकको रुचि र बजारको माग बुझेर व्यवसायीहरूले आफ्ना सेवामा सुधार ल्याई प्रतिस्पर्धात्मक क्षमता बढाउन सक्छन्।

४. वित्तीय पारदर्शिता : बैंकिङ क्षेत्रमा हुने ठगी नियन्त्रण गर्न र सुरक्षित डिजिटल अर्थतन्त्र निर्माण गर्न यसले सहयोग गर्छ।

५. रोजगारी सिर्जना : डेटा साइन्स र एनालिटिक्सको क्षेत्रमा नयाँ र उच्च पारिश्रमिक भएका रोजगारीका अवसरहरू सिर्जना हुन्छन्।

क्लाउड कम्प्युटिङ : क्लाउड कम्प्युटिङ (Cloud Computing) भनेको इन्टरनेटको माध्यमबाट कम्प्युटरका विभिन्न सेवाहरू–जस्तै डाटा भण्डारण (Storage), सर्भर, डाटाबेस, नेटवर्किङ र सफ्टवेयरहरू– माग अनुसार प्रयोग गर्ने प्रविधि हो।

इन्टरनेट अफ थिङ्स (IOT) : इन्टरनेट अफ थिङ्स (IOT) भन्नाले भौतिक वस्तुहरू (जस्तैः घरेलु उपकरण, गाडी, सेन्सर, वा घडी) लाई इन्टरनेटसँग जोड्ने प्रविधि हो।

यस प्रविधिमा वस्तुहरू भित्र सेन्सर र सफ्टवेयर जडान गरिएको हुन्छ, जसले गर्दा ती वस्तुहरूले एक-अर्कासँग डाटा आदानप्रदान गर्न र निर्देशन अनुसार कार्य गर्न सक्छन्। उदाहरणका लागि तपाईंले आफ्नो मोबाइलबाटै घरको बत्ती निभाउनु, एअर कन्डिसनर चलाउनु वा स्मार्ट घडीले तपाईंको स्वास्थ्य निगरानी गर्नु (IOT) कै नमुना हुन्।

ब्लकचेन (Blockchain) : एक आधुनिक डिजिटल खाता वा प्रणाली हो, जहाँ तथ्याङ्कहरू (Data) साना-साना ब्लकहरूमा सुरक्षित राखिन्छन्। यी ब्लकहरू एकअर्कासँग साङ्लो जस्तै जोडिएका हुन्छन्, त्यसैले यसलाई 'ब्लकचेन' भनिएको हो।

यसको मुख्य विशेषता भनेको विकेन्द्रीकृत (Decentralized) हुनु हो, अर्थात् यसलाई कुनै एक व्यक्ति, कम्पनी वा बैंकले मात्र नियन्त्रण गर्न सक्दैन। ब्लकचेनमा एकपटक रेकर्ड गरिएको जानकारीलाई कसैले पनि सजिलै परिवर्तन गर्न वा मेटाउन सक्दैन, जसले गर्दा यो अत्यन्तै सुरक्षित र पारदर्शी मानिन्छ। यसको प्रयोग मुख्यतया बिटक्वाइन जस्ता डिजिटल मुद्रा, स्मार्ट कन्ट्र्याक्ट र सुरक्षित डेटा व्यवस्थापनमा गरिन्छ।

मेसिन लर्निङ : (Machine Learning) कृत्रिम बौद्धिकता (Artificial Intelligence) को एउटा यस्तो शाखा हो, जसले कम्प्युटरलाई विशेष प्रोग्रामिङ बिना नै डेटाबाट सिक्न र अनुभवबाट सुधार गर्न सक्षम बनाउँछ। यस प्रविधिमा कम्प्युटरले उपलब्ध तथ्याङ्कहरू विश्लेषण गरेर निश्चित ढाँचा (Pattern) पत्ता लगाउँछ र त्यसकै आधारमा निर्णय वा भविष्यवाणी गर्छ।

सूचना प्रविधि र अर्थतन्त्रको सम्बन्ध

कुनैपनि देशको उत्पादन प्रणाली, बजार प्रणाली र सेवा प्रणाली सूचना प्रविधिबाट नियन्त्रित र सुदृढ हुन थालेका छन् । सूचना प्रविधिले अर्थतन्त्रलाई तीन तरिकाले सुदृढ बनाउँछ । पहिलो काम गर्ने गति बढ्छ, दोस्रो लागत घट्छ र तेस्रो गुणस्तर र पारदर्शिता बढ्छ । यी तिनैवटा कारणले उत्पादन र सेवा दुवै प्रतिस्पर्धी बन्छन् ।

नेपाल जस्तो अतिकम विकसित मुलुकको लागि विकसित सूचना प्रविधि केवल आधुनिक सुविधा र मनोरञ्जनको साधन मात्र नबनेर आर्थिक रुपान्तरणको आधार बन्दै जानुपर्छ र व्यावहारिक रुपमा यस दिशातर्फ लम्कन पनि लागेको छ । (ICT) लाई सेवा, रोजगारी , निर्यात र सुशासनको साधनको रुपमा उपयोग गर्न सकेमा नेपालमा समृद्धिको नयाँ बाटो खुल्न सक्छ ।

नेपालको अर्थतन्त्र लामो समयदेखि कृषि, रेमिट्यान्स, पर्यटन र सीमित औद्योगिक गतिविधिमा निर्भर रहँदै आएको छ । यी क्षेत्रहरू महत्वपूर्ण भए पनि पर्याप्त रोजगारी सिर्जना गर्न, दिगो आर्थिक वृद्धि सुनिश्चित गर्न एक्लै पर्याप्त छैनन् । यस्तो अवस्थामा (ICT) को विकसित प्रविधिको प्रयोगले सफ्टवेयर विकास , डेटा विश्लेषण, साइबर सुरक्षा, अनलाइन शिक्षा, टेलिमेडिसन, डिजिटल प्रशासन र आउट सोर्सिङ जस्ता क्षेत्रमा नेपालले तुलनात्मक रुपमा लाभ लिन सक्छ ।

डिजिटल नेपाल फ्रेमवर्क २०१९ मा पनि नेपाल सरकारले मुलुकको आर्थिक समृद्धि र सुशासनका लागि सूचना र सञ्चार प्रविधिको अधिकतम प्रयोग गरी नेपाललाई 'डिजिटल अर्थतन्त्र' तर्फ लैजानु र नागरिकको जीवनस्तर सुधार गर्नु भनेको छ र यसको लागि चाहिने पूर्वाधार हरूको विकास गरी राम्रोसँग कार्यान्वयनमा ल्याइएमा देशको आर्थिक अवस्थामा राम्रो टेवा पुर्‍याउने देखिन्छ ।

नेपालको १६औं पञ्चवर्षीय योजना (२०८१/८२-२०८५/०८६) अनुसार सूचना तथा सञ्चार प्रविधि (ICT) लाई डिजिटल रूपान्तरण, सुशासन, उत्पादनशीलता वृद्धि र ज्ञानमा आधारित अर्थतन्त्र निर्माणको प्रमुख आधारका रूपमा लिइएको छ । योजनाले डिजिटल पूर्वाधार बिस्तार, उच्चगतिको इन्टरनेट पहुँच, सरकारी सेवाको पूर्ण डिजिटलीकरण, साइबर सुरक्षा सुदृढीकरण, डाटा सेन्टर तथा क्लाउड सेवाको विकास, कृत्रिम बुद्धिमत्ता (AI) लगायत नवप्रवर्तनको विकास तथा बिस्तार , डिजिटल सीप विकास, ICT उद्योग तथा स्टार्टअपको प्रोत्साहन, र नागरिकमैत्री इ-सेवा बिस्तारमा जोड दिएको छ । यी माध्यमबाट सेवा प्रवाह प्रभावकारी, पारदर्शी, समावेशी र प्रतिस्पर्धी डिजिटल अर्थतन्त्र निर्माण गर्ने लक्ष्य राखिएको छ ।

क्षेत्रगत रुपमा

(ICT) को प्रभावकारी प्रयोगले कसरी अर्थतन्त्र सबल बनाउँछ त ? यसको लागि पहिलो क्षेत्रको रुपमा उत्पादकत्व वृद्धिलाई लिन सकिन्छ । उद्योग , कृषि र सेवाका क्षेत्रमा डिजिटल उपकरण र प्रणाली प्रयोग गर्दा समय, लागत र त्रुटि घट्छ । जस्तै उद्योगमा स्वचालित प्रणालीले वस्तु उत्पादन छिटो र गुणस्तरिय बनाउँछ । डिजीटल डेटा, सफ्टवेयर अटोमेसनको मदतले औद्योगिक र प्रशासनिक कामहरू छिटो र विना त्रुटि सम्पन्न हुन्छन् । कृषि क्षेत्रमा मौसम जानकारी, रोग पहिचान, बजार मूल्यको हरपल जानकारी र स्मार्ट सिँचाइले कृषकको आय बढाउँछ ।

रोजगारी सिर्जना : विकसित सूचना प्रविधिको सबैभन्दा ठूलो लाभ रोजगारी सिर्जना हो । सफ्टवेयर विकास, वेब डिजाइन, ग्राफिक्स डिजाइन, डिजिटल मार्केटिङ, डेटा एनालिटिक्स, साइबर सुरक्षा , क्लाउड सेवा , नेटवर्क व्यवस्थापन र इ-कमर्स जस्ता क्षेत्रमा नयाँ रोजगारका अवसर सिर्जना हुन्छन् । नेपालमा ठूलो संख्यामा युवाशक्ति छ । उनीहरूलाई प्रविधिको विशेष तालिम, सीप दिइयो भने स्वदेशमै रोजगारी सिर्जना गर्न सकिन्छ ।

निर्यात बढाउने क्षमता : अतिकम विकसित राष्ट्रले वस्तु निर्यातमा प्रतिस्पर्धा गर्न नसके पनि सेवा निर्यातमा ठूलो फड्को मारेका छन्। नेपालले पनि सफ्टवेयर, डिजिटल सेवा, Customer सपोर्ट आदि मार्फत विदेशी मुद्रा आर्जन गर्न सक्छ।

व्यापार र बजार विस्तार : सूचना प्रविधिले व्यापारलाई स्थानीय सीमाबाट बाहिर निकालेर अन्तर्राष्ट्रिय बजारमा पुर्‍याउँछन्। इ-कमर्स, अनलाइन मार्केट, डिजिटल भुक्तानी, र सामाजिक सञ्जाल मार्फत साना व्यापारीले पनि आफ्ना वस्तु र सेवा बिक्री गर्न सक्छन्। (ICT) को प्रयोगबाट बजार पहुँच बढ्छ , ग्राहक संख्या विस्तार हुन्छ तथा व्यापार लागत घटाउँछ। पहिले पहिले ठूलो पूँजी भएका कम्पनी मात्र ठूलो बजारमा पुग्थे तर आज एउटा सानो उद्यमीले पनि मोबाइल र इन्टरनेट प्रयोग गरेर देशभर व्यापार गर्न सक्छ।

सरकारी सेवा र सुशासन : सबल अर्थतन्त्रका लागि सुशासन अनिवार्य हुन्छ र सुशासनका लागि सूचना प्रविधि अपरिहार्य हुन्छ। अतिकम विकसित मूलुकमा भ्रष्टाचार, ढिलासुस्ती, र कागजी प्रकियाले विकासलाई कमजोर बनाउँछ। इ-गभर्नेन्स, डिजिटल कर प्रणाली , अनलाइन सेवा पोर्टल , विद्युतीय दर्ता , डिजिटल नागरिक पहिचान र पारदर्शी रेकर्ड प्रणालीले प्रशासनलाई छरितो र जिम्मेवार बनाउँछ। जब सेवा डिजिटल हुन्छ, बिचौलियाको भूमिका घट्छ , पारदर्शिता बढ्छ र राज्यको राजश्व चुहावट कम हुन्छ। यसले सरकारको वित्तीय क्षमतालाई बढाउँछ र विकास खर्चलाई प्रभावकारी बनाउँछ।

वित्तीय समावेशिता : मोवाइल बैंकिङ , डिजिटल वालेट, QR भुक्तानी, अनलाइन ट्रान्सफर र फिनटेक सेवाले दुर्गम बस्तीका मानिसहरूलाई पनि औपचारिक वित्तीय प्रणालीमा जोड्छ। बैंक शाखा नभएका स्थानमा पनि मोबाइलबाट पैसा पठाउन, बचत गर्न, सानो ऋण उपयोग गर्न सकिन्छ। यसले साना उद्यम, महिला उद्यमशीलता , कृषि , व्यापार र ग्रामीण बजार विस्तारलाई सहयोग गर्छ। वित्तीय समावेशिता बढ्नु भनेको अर्थतन्त्रको आकार फराकिलो हुनु हो।

(ICT) ले ग्रामीण अर्थतन्त्रलाई शहर सँग जोड्छ। नेपालमा भौगोलिक विकटता र यातायातका समस्या विकासका ठूला अवरोध हुन्। (ICT) को प्रयोगले किसान , उद्यमी र उपभोक्ता प्रत्यक्ष रुपमा जोडिन सक्छन्। किसानले बजार मूल्य हेरेर उत्पादन बेच्न सक्छ , सहकारीले डिजिटल लेखाजोखा राख्न सक्छ। यसले ग्रामीण अर्थतन्त्रलाई औपचारिक, पारदर्शी र लाभदायक बनाउँछ।

शिक्षा र मानव श्रोत विकास : अर्थतन्त्र निर्माणमा दक्ष जनशक्ति सबैभन्दा महत्वपूर्ण कुरा हो। अनलाइन कक्षा , डिजिटल पुस्तकालय, भर्चुअल प्रशिक्षण, इ-लर्निङ प्लेटफर्म र प्राविधिक एवं सिपमूलक कार्यक्रमले ठूलो जनसंख्यालाई तुलनात्मक रुपमा सस्तो तर प्रभावकारी शिक्षा दिन सक्छ। नेपालमा शहरी र ग्रामीण विद्यालय, विश्वविद्यालय एवं गाउँ शहर बीचको शैक्षिक खाडल यसले घटाउन सक्छ। जब विद्यार्थीले उच्च स्तरको शिक्षा र अनलाइन मार्फत सीपमूलक तालिम पाउँछन् उनीहरू स्वदशमै उद्यम रोजगारीतर्फ आकर्षित हुन्छन्।

स्वास्थ्य क्षेत्र : स्वस्थ नागरिक नै उत्पादनशील नागरिक हुन्छ। सूचना प्रविधिले स्वास्थ्य सेवा सुधारेर अर्थतन्त्रमा अप्रत्यक्ष तर ठूलो योगदान दिन्छ। अनलाइन अपोइन्टमेन्ट, डिजिटल स्वास्थ्य रेकर्ड , टेलिमेडिसन, रोग निगरानी प्रणाली र स्वास्थ्य सूचना व्यवस्थापनले सेवा प्रभावकारी बनाउँछ। स्वस्थ श्रमिक बढी उत्पादनशील हुन्छ र बढी समय काममा समर्पित हुन सक्छ। यसबाट परिवारको आर्थिक अवस्था पनि सुधार हुँदै जान्छ।

पर्यटन क्षेत्र : नेपालको अर्थतन्त्रमा पर्यटनको ठूलो संभावना छ। सूचना प्रविधिले पर्यटन प्रवर्धन गर्न महत्वपूर्ण भूमिका खेल्छ। वेवसाइट, सामाजिक

सञ्जाल, अनलाइन बुकिङ , डिजिटल नक्सा र भर्चुअल प्रचार-प्रसार मार्फत नेपालका गन्तब्यहरू विश्वव्यापी रुपमा चिनाउन सकिन्छ । पर्यटकले होटल, यातायात र गाइड सेवा अनलाइन बुकिङ गर्न सक्छन् । यसले सेवा सहज बनाउँछ र विदेशी मुद्रा आर्जन एवं पर्यटन क्षेत्रमा रोजगारीका अवसर बढाउँछ ।

नवप्रवर्तन र उद्यमशीलता : विकसित सूचना प्रविधिले नव प्रवर्तनलाई प्रोत्साहन गर्छ । एप विकास, सफ्टवेयर निर्माण , अनलाइन सेवा र प्रविधिमा आधारित व्यवसाय मार्फत युवाले आफ्नै उद्यम सुरु गर्न सक्छन् । नवप्रवर्तक संस्कृतिले पारम्पारिक रोजगारीको विकल्प मात्र होइन, नयाँ आर्थिक गतिशीलता पनि ल्याउँछन् । सरकार, निजी क्षेत्र र शैक्षिक संस्थाले सहकार्य गऱ्यो भने नव प्रवर्तन मैत्री वातावरण निर्माण हुन सक्छ र यसले बाह्य निर्भरता घटाउँछ ।

डेटामा आधारित नीति निर्माण : परम्परागत विकास योजनामा अनुमान धेरै र तथ्य कम रहने समस्या हुन्छ तर डिजिटल रेकर्ड , नागरिक डेटा , बजार प्रवृति , कृषि तथ्याङ्क आदि सूचना र आर्थिक सूचकका आधारमा निर्णय गर्दा नीति अझ सही हुन्छ । अर्थतन्त्रको योजना सही बन्यो भने श्रोतको दुरुपयोग घट्छ र विकासको प्रभाव बढ्छ । आधुनिक अर्थतन्त्रमा निर्णय अनुमान होइन, तथ्य र डेटामा आधारित हुनुपर्छ । सूचना प्रविधिले ठूलो मात्रामा डेटा संकलन, विश्लेषण र प्रयोग गर्न सम्भव बनाएको छ । यस्ता विश्लेषण सही हुने हुँदा उत्पादन, लगानी र नाफा दुवै बढ्न सक्छ । त्यसैले डेटालाई अर्थतन्त्रको नयाँ सम्पत्तिको रुपमा लिन सकिन्छ ।

नेपाल विद्युत प्राधिकरणमा विकसित सूचना प्रविधि एवं आर्थिक सम्बन्ध

विकसित सूचना प्रविधि आजको आर्थिक विकासको प्रमुख आधार हो । नेपाल विद्युत् प्राधिकरणले पछिल्ला वर्षहरूमा डिजिटल प्रविधिको प्रयोग बढाउँदै संस्थाको आर्थिक अवस्था सुधार गर्न उल्लेखनीय सफलता हासिल गरेको छ। अनलाइन महसुल भुक्तानी, मोबाइल एप, स्मार्ट मिटर, SCADA प्रणाली तथा डिजिटल ग्राहक सेवा जस्ता प्रविधिले सञ्चालन खर्च घटाउने, राजस्व बढाउने र सेवा प्रवाहलाई प्रभावकारी बनाउने काम गरेका छन् ।

नेपालको सन्दर्भमा पहिले महसुल संकलनमा ढिलाइ, विद्युत् चोरी, कागजी प्रक्रिया र सेवा ढिलाइका कारण प्राधिकरणले ठूलो आर्थिक नोक्सानी व्यहोर्नुपर्थ्यो। अहिले डिजिटल बिलिङ, बैंक तथा डिजिटल वालेटमार्फत भुक्तानी प्रणाली विस्तार भएपछि महसुल संकलन छिटो भएको छ । यससँगै स्मार्ट मिटरको प्रयोगले विद्युत् चोरी नियन्त्रण, लाइन लस घटाउने तथा वास्तविक विद्युत् खपत मापन गर्न सहयोग पुऱ्याएको छ । यसले प्राधिकरणको आम्दानी वृद्धि गरी आर्थिक अवस्था बलियो बनाएको छ ।

भविष्यमा विकसित सूचना प्रविधिको प्रयोग अझ व्यापक बनाउन सकिए यसको आर्थिक लाभ अझ धेरै हुनेछ । कृत्रिम बुद्धिमत्ता (AI) मार्फत विद्युत् मागको पूर्वानुमान, Internet of Things (IoT) द्वारा उपकरणको वास्तविक समय निगरानी तथा Big Data Analytics प्रयोग गरी योजना निर्माण गर्न सकिन्छ । यसले मर्मत खर्च घटाउने, विद्युत् आपूर्ति भरपर्दो बनाउने तथा ऊर्जा व्यवस्थापनलाई वैज्ञानिक बनाउनेछ । साथै, स्मार्ट ग्रिडको विकासले जलविद्युत् उत्पादन, उद्योग तथा विद्युतीय सवारीको बढ्दो मागलाई प्रभावकारी रूपमा व्यवस्थापन गर्न मद्दत गर्नेछ ।

यसरी विकसित सूचना प्रविधिले नेपाल विद्युत् प्राधिकरणको पारदर्शिता, कार्यक्षमता, राजस्व वृद्धि र सेवा गुणस्तरमा उल्लेखनीय सुधार ल्याएको छ । आगामी दिनमा आधुनिक सूचना प्रविधिको अधिकतम उपयोग

गर्न सके प्राधिकरण आर्थिक रूपमा अझ सबल बन्ने मात्र होइन, औद्योगिकीकरण, ऊर्जा निर्यात, रोजगारी सिर्जना तथा राष्ट्रिय आर्थिक समृद्धिमा समेत महत्वपूर्ण योगदान पुऱ्याउनेछ ।

नेपालमा विकसित सूचना प्रविधिको प्रयोगमा देखिएका प्रमुख समस्याहरू :

- डिजिटल पूर्वाधारको अपर्याप्तता
  - ✓ ग्रामीण क्षेत्रमा उच्च गतिको इन्टरनेट र भरपर्दो सञ्चार सेवा अझै पर्याप्त छैन ।
  - ✓ दुर्गम क्षेत्रमा विद्युत र नेटवर्कको अस्थिरताले डिजिटल सेवाको प्रभावकारिता घटाउन सक्छ ।
- दक्ष जनशक्तिको अभाव
  - ✓ AI, Cyber Security, Data Science, Blockchain, Cloud Computing लगायतका क्षेत्रमा दक्ष जनशक्तिको अभाव छ ।
  - ✓ भएका दक्ष आइटी जनशक्ति पनि राम्रो अवसरको खोजीमा विदेश पलायन हुने क्रम उच्च छ (Brain Drain)
- उच्च प्रारम्भिक लगानी
  - ✓ डेटा सेन्टर, क्लाउड, स्मार्ट प्रणाली, स्मार्ट मिटर, तथा आधुनिक सफ्टवेयर विकासमा ठूलो लगानी आवश्यक हुन्छ ।
  - ✓ सीमित बजेटका कारण धेरै परियोजनाहरू समयमै कार्यान्वयन हुन सक्दैनन् ।
- साइबर सुरक्षा जोखिम
  - ✓ सरकारी तथा सार्वजनिक संस्थाहरूमा साइबर आक्रमणको जोखिम बढ्दो छ ।
  - ✓ पर्याप्त सुरक्षा प्रणाली, नियमित सुरक्षा परीक्षण र दक्ष साइबर सुरक्षा विज्ञको कमी छ ।
- नीति तथा कानूनको प्रभावकारी कार्यान्वयनमा कमजोरी
  - ✓ डिजिटल रूपान्तरणसम्बन्धी केही नीति नियमहरू बने पनि कार्यान्वयन प्रभावकारी रुपमा हुन सकेको छैन ।
- विभिन्न सरकारी निकायबीच सहकार्यको सवालमा समन्वयको कमी देखिन्छ ।
- डिजिटल साक्षरताको कमी
  - ✓ ग्रामीण तथा ज्येष्ठ नागरिकमा डिजिटल सेवाको प्रयोग गर्ने क्षमता अझै सीमित छ ।
  - ✓ डिजिटल प्रविधिप्रति विश्वास र जागरूकता पनि पर्याप्त छैन ।
- डेटा व्यवस्थापन र एकीकृत प्रणालीको अभाव
  - ✓ सरकारी निकायहरूको डेटा छुट्टाछुट्टै प्रणालीमा रहेको छ ।
  - ✓ Data Sharing र Interoperability विभिन्न (ICT) प्रणालीहरूबीच बिना अवरोध सूचना साटासाट र संयुक्त रूपमा काम गर्ने क्षमता) नभएकाले निर्णय प्रक्रिया प्रभावकारी बन्न सकेको छैन ।
- आयतित प्रविधिमा अत्यधिक निर्भरता रहेको छ ।
- अधिकांश हार्डवेयर, सफ्टवेयर तथा प्रविधि विदेशबाट आयात गर्नुपर्छ ।
- यसले विदेशी मुद्रा बाहिरिने र दीर्घकालीन रूपमा आत्मनिर्भरता कमजोर हुने समस्या सिर्जना गर्छ।
- परिवर्तनप्रति प्रतिरोध
  - ✓ केही कर्मचारी र संस्थागत संस्कृतिले नयाँ प्रविधि अपनाउन ढिलाइ गर्ने हुन सक्छ ।
  - ✓ परम्परागत कार्यशैली परिवर्तन गर्न समय लाग्ने गर्दछ ।
- अनुसन्धान तथा नवप्रवर्तनमा कम लगानी
  - ✓ विश्वविद्यालय, उद्योग र सरकारबीच अनुसन्धान तथा नवप्रवर्तनमा पर्याप्त सहकार्य छैन ।
  - ✓ स्वदेशमै नयाँ प्रविधि विकास गर्ने वातावरण कमजोर छ ।

- विद्युत् तथा सूचना प्रविधिको असमान पहुँच
    - ✓ दुर्गम क्षेत्रमा गुणस्तरीय विद्युत् र इन्टरनेट सेवा अझै चुनौतीपूर्ण छ ।
    - ✓ यसले डिजिटल अर्थतन्त्रको लाभ सबै नागरिकसम्म समान रूपमा पुग्न सकेको छैन ।
- डिजिटल सुशासनमा पारदर्शिता र उत्तरदायित्वको चुनौती
    - ✓ ई-गभर्नेन्स प्रणाली पूर्ण रूपमा एकीकृत नहुँदा सेवा प्रवाहमा दोहोरोपन, ढिलाइ र भ्रष्टाचारको सम्भावना रहन्छ ।

समाधानका उपायहरू :

- ➢ देशभर उच्च गतिको इन्टरनेट, फाइबर नेटवर्क, 5G तथा भरपर्दो विद्युत् पूर्वाधार विस्तारमा सरकारी तथा निजी क्षेत्रको संयुक्त लगानी बढाउने ।
- ➢ विद्यालयदेखि विश्वविद्यालयसम्म AI, Data Science, Cyber Security, Cloud Computing जस्ता विषय समावेश गर्ने तथा सरकारी कर्मचारीलाई नियमित ICT तालिम दिने ।
- ➢ प्रतिस्पर्धी तलब, अनुसन्धान अनुदान, स्टार्टअप प्रोत्साहन तथा नेपालमै उच्चस्तरीय आइटी रोजगारी सिर्जना गर्ने ।
- ➢ राष्ट्रिय Cyber Security Operation Center स्थापना गर्ने, प्रत्येक सरकारी संस्थामा नियमित Security Audit गर्ने तथा Cyber Emergency Response Team (CERT) लाई थप सुदृढ बनाउने ।
- ➢ राष्ट्रिय Integrated Government Data Platform निर्माण गरी सबै सरकारी निकायका सूचना प्रणालीलाई आपसमा जोड्ने जसले (Interoperability) सहज हुन्छ ।
- ➢ Digital Nepal Framework लगायतका नीतिको प्रभावकारी कार्यान्वयनका लागि स्पष्ट जिम्मेवारी, समयसीमा र नियमित अनुगमन प्रणाली लागू गर्ने ।
- ➢ प्रत्येक स्थानीय तहमा निःशुल्क डिजिटल साक्षरता कार्यक्रम सञ्चालन गर्ने तथा किसान, महिला, ज्येष्ठ नागरिक र साना व्यवसायीलाई डिजिटल सेवा प्रयोगको तालिम दिने ।
- ➢ विश्वविद्यालय, उद्योग र सरकारबीच सहकार्य गरी ICT Innovation Fund स्थापना गर्ने तथा AI, Robotics, Blockchain र Agritech मा अनुसन्धानलाई प्रोत्साहन गर्ने ।
- ➢ स्वदेशी सफ्टवेयर, डेटा सेन्टर, क्लाउड सेवा तथा डिजिटल समाधान एवं विकास गर्ने नेपाली कम्पनीलाई कर छुट, अनुदान र सरकारी प्राथमिकता दिने ।
- ➢ उद्योग, कृषि, पर्यटन र ऊर्जा क्षेत्रमा Automation, IoT, GIS, AI र ERP प्रणाली लागू गर्न सहुलियतपूर्ण ऋण तथा कर प्रोत्साहन उपलब्ध गराउने ।
- ➢ डेटा गोपनीयता, डिजिटल कारोबार सुरक्षा तथा सेवा पारदर्शिता सुनिश्चित गर्दै Digital Signature र Electronic Verification लाई व्यापक बनाउने ।
- ➢ परिवर्तन व्यवस्थापन(Change Management) (नयाँ प्रविधि, सफ्टवेयर वा कार्यप्रणाली लागू गर्दा संस्था र कर्मचारीमा आउने परिवर्तनलाई योजनाबद्ध रुपमा अगाडि बढाउने प्रक्रिया) सञ्चालन गर्ने, तथा कार्यसम्पादन मूल्याङ्कनलाई डिजिटल प्रणालीसँग जोड्ने, जुन नेपाल विद्युत प्राधिकरणमा सुरुवात भै सकेको छ ।

उपसंहार

नेपालको वर्तमान आर्थिक परिदृश्यमा परम्परागत कृषि र रेमिट्यान्समा आधारित अर्थतन्त्रले दीर्घकालीन दिगोपनको ग्यारेन्टी गर्न नसकिरहेको अवस्थामा विकसित सूचना प्रविधिको प्रयोगले अर्थतन्त्र रुपान्तरणको मार्ग प्रशस्त

गरिदिएको छ। सबल अर्थतन्त्र भनेको कुल गार्हस्थ्य उत्पादनमा हुने वृद्धि मात्र नभएर उत्पादनशीलतामा सुधार, वित्तीय पारदर्शिता, सुशासन, रोजगारी सिर्जना र अन्तर्राष्ट्रिय बजारमा प्रतिस्पर्धी क्षमताको विकास हुनु पनि हो। नेपाल सरकारले अघि सारेको 'डिजिटल नेपाल फ्रेमवर्क २०७६' ले परिकल्पना गरेका कुरालाइ समयको परिवर्तन सँगै सूचना प्रविधिमा आएको विकासको भरपुर उपयोग गर्नको लागि चाहिने आवश्यक पूर्वाधार निर्माण गर्दै डिजिटल फाउन्डेसनदेखि कृषि, स्वास्थ्य, शिक्षा र पर्यटनसम्मका आठवटै क्षेत्रहरू एवं अन्य आइपर्ने नयाँ क्षेत्रहरूलाई पनि समेट्दै र नेपालको श्रोत र साधनले भ्याएसम्म प्रविधिमार्फत एकीकृत गर्दै लैजानु पर्ने आवश्यकता छ। सूचना प्रविधिको विकास र विस्तारको केवल सफ्टवेयर निर्माणलाई मात्र नहेरी यसले ग्रामीण अर्थतन्त्रलाई कसरी चलायमान बनाउँछ, कसरी भ्रष्टाचारको जरो काट्छ र कसरी युवा जनशक्तिलाई स्वदेशमै उद्यमी बनाउँछ भन्ने पक्षलाई गम्भीरतापूर्वक विश्लेषण गर्नुपर्ने हुन्छ। तसर्थ, बदलिँदो विश्वको परिवेशमा नेपाललाई एक सबल, आत्मनिर्भर र गतिशील अर्थतन्त्रका रूपमा उभ्याउन विकसित सूचना प्रविधिको रणनीतिक उपयोग गर्नुको विकल्प छैन। प्रविधिको यो लहरलाई आत्मसात् गर्न सके मात्र नेपालले आफ्नो 'अतिकम विकसित' राष्ट्रको परिचयलाई बदल्दै समुन्नत राष्ट्रको मार्गमा ठोस पाइला चाल्न समर्थ हुनेछ।

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तथा लेखकका आफ्ना निजी विचार।

Load Dispatch Centre, Siuchatar

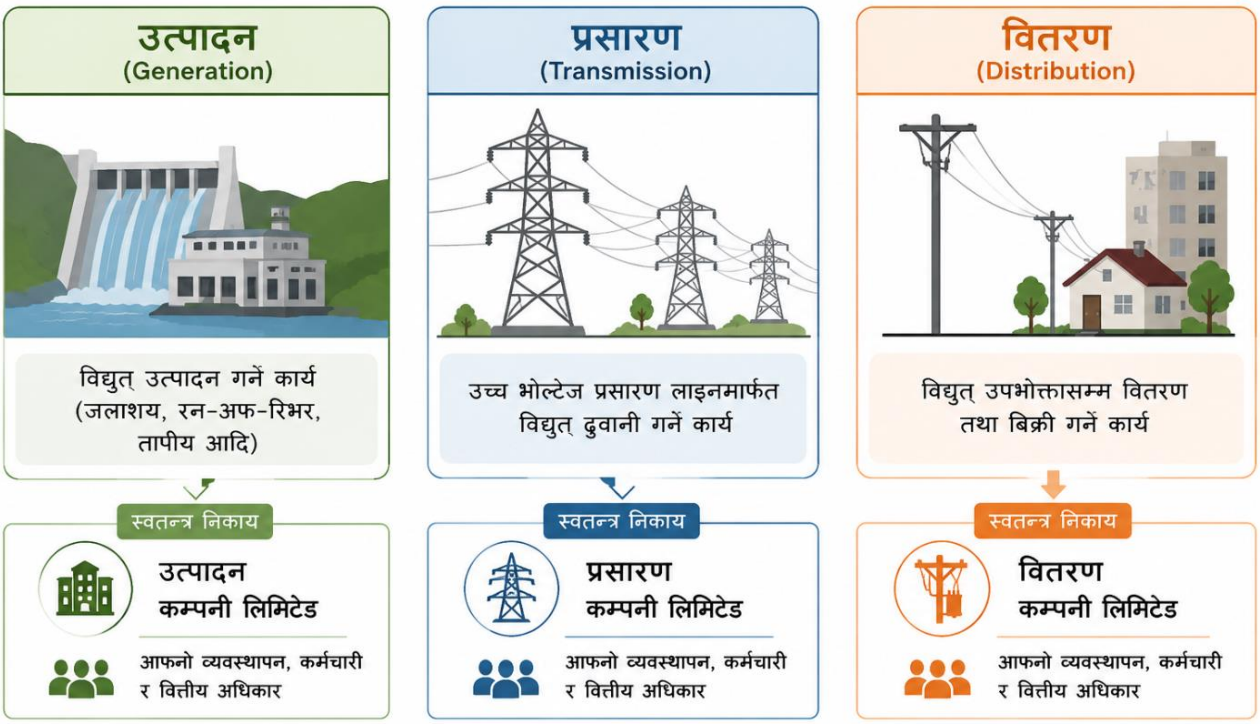
नेपाल विद्युत प्राधिकरणको पुनर्संरचना (Unbundling) मा कर्मचारी समायोजनः चुनौती र समाधान

अनन्त शर्मा
सि.मि.रि
ने.वि.प्रा.

पृष्ठभूमि

विद्युत क्षेत्रको परम्परागत संरचनामा उत्पादन, प्रसारण, वितरण तथा व्यापारिक कार्य एउटै संस्थाले सञ्चालन गर्ने व्यवस्था रहन्छ, जसलाई Vertically Integrated Utility भनिन्छ। नेपाल विद्युत प्राधिकरण पनि यही मोडेलमा आधारित संस्था हो। तर ऊर्जा क्षेत्रमा मितव्ययिकता, प्रभावकारिता तथा कार्यदक्षता बढाई थप प्रतिस्पर्धी, उत्तरदायी र दक्ष बनाउन विश्वका धेरै मुलुकहरूले यी कार्यहरूलाई अलग अलग संस्था मार्फत सञ्चालन गर्ने गरी Unbundling को अवधारणा अवलम्बन गरेका छन्। नेपालमा पनि विद्युत क्षेत्रको समग्र प्रभावकारिता अभिवृद्धि गर्न विगतदेखि नै यस अवधारणाको अवलम्बन गर्ने कुरा हुँदै आएको छ। तथापि राजनीतिक अस्थिरता तथा कमजोर प्रतिबद्धताका कारण यसको कार्यान्वयन हुन सकेको देखिदैन।

नेपालको ऊर्जा क्षेत्र हाल उत्पादन वृद्धि र ऊर्जा व्यापार विस्तारको नयाँ अवसरको चरणमा रहेको छ। तथापि, बढ्दो ऊर्जा माग, निजी क्षेत्रको सहभागिता, प्रविधिगत



चित्र १: आव २०८३/८४ बेजटद्वारा प्रस्तावित विद्युत क्षेत्र पुनर्संरचना

परिवर्तन तथा सुशासनको अपेक्षा अनुरूप संस्थागत संरचनालाई समय सापेक्ष बनाउनु अपरिहार्य बनेको छ ।

यसै सन्दर्भमा नेपाल विद्युत प्राधिकरणको पुनर्संरचना (Unbundling) महत्वपूर्ण सुधारका रूपमा अघि सारिएको छ । संस्थाको पुनर्संरचनामा संरचनागत, वित्तीय तथा प्राविधिक पक्षका साथै प्रभावकारी मानव स्रोत व्यवस्थापन पनि प्रमुख र निर्णायक पक्षका रूपमा रहन्छ । उचित ढंगले कर्मचारी समायोजन गर्न सकेमा मात्र नवनिर्मित संरचना तथा संस्थाले अपेक्षित कार्य सम्पादन गर्न सक्दछन् । प्रभावकारी व्यवस्थापन, सेवा सुरक्षा, वृत्ति विकास, सेवा-सुविधा, संस्थागत अपनत्व तथा मनोबलका सवाललाई सम्बोधन नगरी कुनै पनि पुनर्संरचना प्रभावकारी हुन सक्दैन । त्यसैले नेपाल विद्युत प्राधिकरणको पुनर्संरचना प्रक्रियामा कर्मचारी समायोजनका चुनौतीहरूको विश्लेषण गर्दै व्यावहारिक तथा नीतिगत समाधानको खोजी गर्नु आवश्यक छ ।

नेपाल विद्युत प्राधिकरण पुनर्संरचनाका प्रमुख उद्देश्यहरू निम्न रहेका छन् :

- विद्युत क्षेत्रलाई एकीकृतबाट विकेन्द्रीकृत संरचनामा रूपान्तरण गर्नु ।
- उत्पादन, प्रसारण तथा वितरण कार्यबीच स्पष्ट कार्यविभाजन र उत्तरदायित्व सुनिश्चित गर्नु ।
- संस्थागत वित्तीय जोखिम तथा क्रस-सब्सिडीकरणलाई क्रमशः न्यूनीकरण गर्नु ।
- संस्थागत दक्षता, कार्यसम्पादन तथा निर्णय प्रक्रियामा सुधार ल्याउनु ।
- विद्युत क्षेत्रको सुशासन, पारदर्शिता र जवाफदेहितालाई सुदृढ गर्नु ।
- विद्युत पूर्वाधार विकासका लागि आवश्यक लगानी आकर्षित गर्न अनुकूल वातावरण तयार गर्नु ।
- निजी क्षेत्रको बढ्दो सहभागितालाई व्यवस्थित तथा प्रभावकारी बनाउनु ।
- प्रतिस्पर्धात्मक विद्युत बजार विकास तथा अन्तरदेशीय विद्युत व्यापारका लागि संस्थागत आधार निर्माण गर्नु ।
- उपभोक्तालाई भरपर्दो, गुणस्तरीय र लागत-प्रभावकारी विद्युत सेवा उपलब्ध गराउनु ।

नेपाल विद्युत प्राधिकरण (NEA) को पुनर्संरचनामा कर्मचारी समायोजनको महत्व :

संस्थाको पुनर्संरचनाको सफलता संरचनागत परिवर्तनमा मात्र सीमित नरही मानव स्रोत व्यवस्थापनको प्रभावकारितामा समेत निर्भर रहने भएकाले कर्मचारी समायोजन यसको सबैभन्दा संवेदनशील पक्षका रूपमा रहेको हुन्छ । पुनर्संरचनामा कर्मचारी समायोजनको महत्व देहाय बमोजिम रहेको छः

- नयाँ संरचनामा दक्ष जनशक्ति सन्तुलित रूपमा व्यवस्थापन गर्न ।
- कुन कर्मचारी कुन कम्पनीमा जाने भन्ने विषयमा उत्पन्न हुन सक्ने द्वन्द्व र असन्तुष्टि न्यूनीकरण गर्न ।
- प्राधिकरणभित्र रहेका अनुभवयुक्त कर्मचारीको ज्ञान र सीपको उचित उपयोग सुनिश्चित गर्न ।
- नयाँ कम्पनीहरूबीच क्षमताको असन्तुलन हुन नदिन मानव स्रोतको न्यायोचित वितरण गर्न ।
- सेवा अवरोध, प्रशासनिक अस्थिरता तथा संक्रमणकालीन जटिलता न्यूनीकरण गर्न ।
- कर्मचारीको सेवा-सुविधा र करियर सुरक्षा सुनिश्चित गर्दै संस्थागत विश्वास कायम राख्न ।
- समग्रमा, नव-परिवर्तनप्रति कर्मचारीको मनोबल तथा स्वामित्वभाव बढाई पुनर्संरचना सफल बनाउन ।

कर्मचारी समायोजनका सैद्धान्तिक आधार

कर्मचारी समायोजन संवेदनशील विषय हो । कर्मचारीको मनोबल, संस्थागत दक्षता तथा सेवा प्रवाहको गुणस्तर

समायोजन प्रक्रियासँग प्रत्यक्ष रूपमा सम्बन्धित हुन्छ। त्यसैले समायोजन गर्दा स्थापित व्यवस्थापन सिद्धान्त तथा अन्तराष्ट्रिय अभ्यासलाई आधार बनाउन आवश्यक हुन्छ। नेपाल विद्युत प्राधिकरणको पुनर्संरचना (unbundling) मा देहायका सैद्धान्तिक आधार लिन सकिन्छः

क) योग्यता तथा कार्यसम्पादनको सिद्धान्त

- कर्मचारीको शैक्षिक योग्यता, दक्षता, अनुभव तथा कार्यसम्पादनलाई समायोजनको मुख्य आधार बनाउनुपर्छ।
- व्यक्तिगत पहुँच, राजनीतिक प्रभाव वा अन्य गैरव्यावसायिक आधारमा गरिएको समायोजनले संस्थागत दक्षता कमजोर बनाउँछ।
- यसले योग्य जनशक्तिको उचित उपयोग सुनिश्चित गर्छ।

ख) समानता तथा न्यायको सिद्धान्त

- समायोजन प्रक्रियामा सबै कर्मचारीप्रति निष्पक्ष र पारदर्शी व्यवहार गरिनुपर्छ।
- समान प्रकृतिको कार्य गर्ने कर्मचारीबीच सेवा-सुविधा र अवसरमा अनावश्यक विभेद हुनु हुँदैन।
- यसले कर्मचारीमा विश्वास र संस्थाप्रतिको प्रतिबद्धता बढाउँछ।

ग) उचित व्यक्तिलाई उचित जिम्मेवारी (Right Person–Right Job)

- कर्मचारीको सीप, ज्ञान र अनुभव अनुसार जिम्मेवारी निर्धारण गरिनुपर्छ।
- उत्पादन, प्रसारण र वितरण क्षेत्रका प्राविधिक जनशक्तिलाई विशेषज्ञता अनुसार व्यवस्थापन गर्नुपर्छ।
- यसबाट उत्पादकत्व तथा कार्यसम्पादनमा सुधार आउँछ।

घ) सहभागितामूलक सिद्धान्त

- कर्मचारी तथा ट्रेड युनियनलाई समायोजन प्रक्रियामा सहभागी गराइनुपर्छ।
- संवाद, परामर्श र सहमतिमा आधारित निर्णयले प्रतिरोध न्यूनीकरण गर्छ।
- परिवर्तनप्रति स्वामित्व भावना विकास हुन्छ।

ङ) परिवर्तन व्यवस्थापन सिद्धान्त (Change Management Theory)

- पुनर्संरचनाको उद्देश्य र आवश्यकता कर्मचारीलाई स्पष्ट रूपमा जानकारी गराइनुपर्छ।
- पुनःतालिम, क्षमता विकास तथा अभिमुखीकरण कार्यक्रम सञ्चालन गरिनुपर्छ।
- यसले नयाँ संरचनामा कर्मचारीको सहज अनुकूलन सुनिश्चित गर्छ।

कर्मचारी समायोजनका प्रमुख चुनौतीहरू

विशेष गरी दशकौं देखि एउटै संस्थागत संरचनाभित्र कार्यरत जनशक्तिलाई नयाँ संगठनात्मक ढाँचामा समायोजन गर्नु सरल कार्य होइन। सेवा सुरक्षा, वृत्ति विकास, कार्यसंस्कृति तथा कर्मचारी मनोविज्ञानसँग सम्बन्धित विभिन्न प्रश्नहरूका कारण पुनर्संरचना प्रक्रियामा निम्न चुनौतीहरू देखापर्न सक्छन्।

क) रोजगारी सुरक्षा तथा भविष्य प्रतिको सुनिश्चितता कायम गर्नु

पुनर्संरचनाको प्रक्रियाले कर्मचारीमा आफ्नो पद, सेवा निरन्तरता र भविष्य प्रतिको अनिश्चितता सिर्जना गर्छ। विशेषगरी नयाँ उत्पादन, प्रसारण र वितरण कम्पनीहरूमा आफू कहाँ समायोजन हुने भन्ने स्पष्ट नहुँदा परिवर्तनप्रति प्रतिरोध बढ्ने सम्भावना रहन्छ।

ख) सेवा-सुविधा र वृत्ति विकासमा समानता सुनिश्चित गर्नु

नयाँ संरचनामा विभिन्न कम्पनीमा फरक-फरक सेवा सर्त लागू हुन सक्ने भएकाले तलब, भत्ता, बढुवा प्रणाली, निवृत्तिभरण तथा तालिमका अवसरमा असमानता देखिन सक्छ, जसले कर्मचारीबीच असन्तुष्टि बढाउन सक्छ ।

ग) दक्ष जनशक्तिको न्यायोचित वितरण सुनिश्चित गर्नु

कर्मचारीहरूको सीप र अनुभव अनुसार उत्पादन, प्रसारण र वितरण कम्पनीहरूमा न्यायोचित वितरण गर्नु ठूलो चुनौती हो । गलत वितरणले केही संस्थामा जनशक्ति अभाव र केहीमा अत्यधिक भार सिर्जना गर्न सक्छ ।

घ) ट्रेड युनियन तथा सरोकारवालाको सहयोग प्राप्त गर्नु

कर्मचारी संगठनहरूलाई विश्वासमा नलिई अघि बढाइएमा विरोध, आन्दोलन वा असहयोगको अवस्था सिर्जना हुन सक्छ । यसले पुनर्संरचनाको गति र प्रभावकारितामा प्रत्यक्ष असर पार्न सक्छ ।

ङ) संगठनात्मक संस्कृति र कार्यशैलीमा अनुकूलन गराउनु

लामो समय एउटै संस्थामा काम गरेका कर्मचारीलाई नयाँ कम्पनीको फरक नेतृत्व शैली, निर्णय प्रक्रिया र कार्यसंस्कृतिमा अनुकूलन गराउनु चुनौतीपूर्ण हुन्छ ।

च) अफवाहजन्य वातावरणको प्रतिकार गर्नु

संक्रमणकालीन अवस्थामा पर्याप्त सूचना प्रवाह नहुँदा अफवाह फैलिने, अनिश्चितता बढ्ने र कर्मचारीको मनोबल कमजोर हुने अवस्था देखिन सक्छ ।

छ) संक्रमणकालीन प्रशासनिक व्यवस्थापनको उचित सम्बोधन गर्नु

पुरानो संरचनाबाट नयाँ संरचनामा जाँदा सम्पत्ति, दायित्व, पद तथा जिम्मेवारी हस्तान्तरण जटिल हुने भएकाले प्रशासनिक अस्थिरता उत्पन्न हुन सक्छ ।

ज) संस्थागत ज्ञान र अनुभवको संरक्षण गर्नु

अनुभवी कर्मचारीको उचित व्यवस्थापन नभएमा प्राधिकरणसँग रहेको दीर्घ अनुभव, प्राविधिक ज्ञान र कार्यपद्धति कमजोर हुने जोखिम रहन्छ ।

झ) भौगोलिक तथा क्षेत्रीय सन्तुलन कायम गर्नु

नेपालको विविध भौगोलिक अवस्था अनुसार कर्मचारीलाई दुर्गम तथा सुगम क्षेत्रमा सन्तुलित रूपमा खटाउनु पनि व्यावहारिक चुनौती हो, जसले कर्मचारीको स्वीकार्यता प्रभावित गर्न सक्छ ।

ञ) राजनीतिक प्रभाव तथा बाह्य हस्तक्षेप हुन नदिनु

कर्मचारी समायोजनमा राजनीतिक, क्षेत्रीय वा अन्य बाह्य प्रभाव पर्न सक्ने सम्भावना रहन्छ । यसले योग्यता र संस्थागत आवश्यकता भन्दा अन्य आधारलाई प्राथमिकता दिने जोखिम बढाउन सक्छ ।

नेपालको अनुभव: संघीयता कार्यान्वयनमा कर्मचारी समायोजन

नेपालमा कर्मचारी समायोजनको सबैभन्दा ठूलो अभ्यास संघीयता कार्यान्वयनसँगै भएको थियो । संघ, प्रदेश र स्थानीय तहबीच कर्मचारी व्यवस्थापन गर्न कर्मचारी समायोजन ऐन, २०७५ जारी गरी हजारौं निजामती कर्मचारीलाई तीनै तहमा समायोजन गरिएको थियो । यस प्रक्रियाले राज्यको नयाँ संरचना अनुसार जनशक्ति व्यवस्थापनको आधार तयार गर्नुका साथै कर्मचारी समायोजनका विभिन्न व्यावहारिक चुनौतीहरू उजागर गरेको थियो ।

समायोजनका क्रममा कर्मचारीको रोजाइ र संस्थागत आवश्यकताबीच सन्तुलन कायम गर्न कठिनाइ भएको, दुर्गम क्षेत्रमा कर्मचारी पठाउन चुनौती देखिएको, वृत्ति विकास तथा पदोन्नतिका अवसरबारे अन्योलता उत्पन्न भएको तथा केही कर्मचारीले समायोजनप्रति असन्तुष्टि व्यक्त गर्दै अदालतसम्म पुग्नु परेको अवस्था

सिर्जना भएको थियो । त्यस्तै, संघबाट स्थानीय तहमा समायोजन भएका कर्मचारीहरूको भूमिका, जिम्मेवारी तथा कार्यसंस्कृतिमा समेत समायोजनको चुनौती देखिएको थियो ।

यद्यपि उक्त अनुभवले स्पष्ट मापदण्ड, कानूनी आधार, पारदर्शी प्रक्रिया, कर्मचारीसँग निरन्तर संवाद तथा सेवा-सुविधाको सुनिश्चितता भएमा ठूलो स्तरको कर्मचारी समायोजन सम्भव हुने तथ्य पनि स्थापित गरेको छ । यसबाट नेपाल विद्युत् प्राधिकरणको पुनर्संरचनामा कर्मचारी समायोजन गर्दा कर्मचारीको पेशागत सुरक्षा, वृत्ति विकास, सहभागिता र चरणबद्ध कार्यान्वयनलाई विशेष प्राथमिकता दिनुपर्ने महत्वपूर्ण पाठ प्राप्त हुन्छ ।

अन्तर्राष्ट्रिय अनुभव

विश्वका विभिन्न मुलुकहरूले विद्युत क्षेत्रको पुनर्संरचना गर्दा मानव स्रोत व्यवस्थापनलाई सुधार प्रक्रियाको केन्द्रमा राखेका छन् । सन् १९८० मा **बेलायतले** विद्युत क्षेत्रलाई उत्पादन, प्रसारण तथा वितरण कम्पनीहरूमा विभाजन गरी व्यापक संरचनात्मक सुधार गरेको थियो । यस क्रममा कर्मचारी कटौतीलाई मात्र प्राथमिकता नदिई पुनःतालिम, सीप विकास तथा स्वैच्छिक अवकाश कार्यक्रम मार्फत जनशक्ति व्यवस्थापन गरिएको थियो । कर्मचारी अधिकारको संरक्षण र परिवर्तन प्रक्रियाबारे निरन्तर संवादका कारण सुधार कार्य अपेक्षाकृत सहज रूपमा कार्यान्वयन हुन सकेको मानिन्छ ।

भारतमा सन् १९९० को दशकदेखि विभिन्न राज्यहरूले राज्य विद्युत बोर्डहरूलाई उत्पादन, प्रसारण र वितरण कम्पनीहरूमा पुनर्संरचना गर्ने प्रक्रिया अघि बढाएका थिए । यस क्रममा अधिकांश राज्यहरूले कर्मचारीको सेवा निरन्तरता, तलब-भत्ता, निवृत्तिभरण तथा अन्य सेवासुविधालाई सुरक्षित राख्ने नीति अवलम्बन गरेका थिए । कर्मचारीको पेशागत सुरक्षामा ध्यान दिइएका कारण सुधार प्रक्रियाप्रति देखिन सक्ने असन्तोष र प्रतिरोधलाई तुलनात्मक रूपमा नियन्त्रण गर्न सहयोग पुगेको थियो ।

त्यसैगरी **बंगलादेशले** ऊर्जा क्षेत्र सुधारका क्रममा एकैपटक व्यापक परिवर्तन नगरी चरणबद्ध (phased approach) रणनीति अपनाएको थियो । नयाँ संस्थागत संरचना लागू गर्नु अघि कर्मचारीको जिम्मेवारी पुनःनिर्धारण, क्षमता अभिवृद्धि तथा आवश्यक तालिमका कार्यक्रम सञ्चालन गरिएका थिए । यसले संक्रमणकालीन व्यवस्थापनलाई सहज बनाउनुका साथै सेवा प्रवाहमा नकारात्मक प्रभाव पर्न नदिने वातावरण सिर्जना गरेको थियो ।

यी अन्तर्राष्ट्रिय अभ्यासहरूले विद्युत् क्षेत्रको पुनर्संरचनाको सफलता केवल संस्थागत विभाजन वा कानूनी सुधारमा मात्र निर्भर नरही कर्मचारीको मनोबल, पेशागत सुरक्षा, क्षमता विकास तथा परिवर्तन व्यवस्थापनसँग समेत गहिरो रूपमा सम्बन्धित रहेको देखाउँछ ।

सुधार तथा अगाडिको बाटो

नेपाल विद्युत् प्राधिकरणको पुनर्संरचनालाई कर्मचारीमैत्री, प्रभावकारी र परिणाममुखी बनाउन देहायका सुधारहरू अवलम्बन गर्नु आवश्यक छः

क) वैज्ञानिक जनशक्ति योजना तथा सीप नक्साङ्कन

पुनर्संरचित संस्थाको कार्य प्रकृति र जिम्मेवारी अनुसार आवश्यक जनशक्तिको निर्धारण गरी कर्मचारीको योग्यता, अनुभव र दक्षताका आधारमा समायोजन गरिनुपर्छ ।

ख) पारदर्शी तथा वस्तुगत समायोजन मापदण्ड

राजनीतिक वा व्यक्तिगत प्रभावबाट मुक्त रही स्पष्ट, न्यायोचित र पूर्वघोषित मापदण्डका आधारमा कर्मचारी समायोजन गरिनुपर्छ ।

ग) पुनः तालिम तथा क्षमता विकास कार्यक्रम

नयाँ संरचना र कार्यप्रणाली अनुसार कर्मचारीको ज्ञान, सीप र नेतृत्व क्षमता अभिवृद्धिका लागि निरन्तर तालिम तथा अभिमुखीकरण कार्यक्रम सञ्चालन गरिनुपर्छ ।

घ) प्रभावकारी संवाद तथा परिवर्तन व्यवस्थापन

पुनर्संरचनाबारे कर्मचारीलाई नियमित जानकारी दिई सहभागितामूलक निर्णय प्रक्रियामार्फत परिवर्तनप्रति सकारात्मक वातावरण निर्माण गरिनुपर्छ ।

ङ) सेवा शर्त र वृत्ति विकासको सुनिश्चितता

तलब, सुविधा, पदोन्नति, अवकाश तथा सामाजिक सुरक्षासम्बन्धी विषयमा स्पष्ट व्यवस्था गरी कर्मचारीको मनोबल उच्च राख्नुपर्छ ।

च) गुनासो सुनुवाइ तथा विवाद समाधान संयन्त्र

समायोजन प्रक्रियामा उत्पन्न हुन सक्ने असन्तुष्टि तथा विवादलाई छिटो र निष्पक्ष रूपमा सम्बोधन गर्ने संस्थागत संयन्त्र विकास गरिनुपर्छ ।

छ) प्रविधिमैत्री मानव स्रोत व्यवस्थापन

HRMIS लगायतका डिजिटल प्रणालीको प्रयोगमार्फत कर्मचारीसम्बन्धी तथ्याङ्क व्यवस्थापन, कार्यसम्पादन मूल्याङ्कन तथा निर्णय प्रक्रियालाई थप पारदर्शी बनाइनुपर्छ ।

ज) चरणबद्ध र नतिजामूलक कार्यान्वयन

पुनर्संरचना तथा समायोजनलाई एकैपटक लागू गर्नुको सट्टा चरणबद्ध रूपमा कार्यान्वयन गरी नियमित अनुगमन तथा मूल्याङ्कन गर्नुपर्छ ।

निष्कर्ष

नेपाल विद्युत् प्राधिकरणको पुनर्संरचना ऊर्जा क्षेत्रको संस्थागत सुधारतर्फको महत्वपूर्ण कदम हुनसक्छ । तर यसको सफलता नयाँ संगठनात्मक संरचना निर्माणमा मात्र नभई त्यस संरचनालाई सञ्चालन गर्ने मानव स्रोतको न्यायोचित, दक्ष र संवेदनशील व्यवस्थापनमा निर्भर रहन्छ । कर्मचारी समायोजनलाई केवल प्रशासनिक प्रक्रिया वा पद व्यवस्थापनको विषयका रूपमा नभई संस्थागत रूपान्तरणको आधारशिलाका रूपमा ग्रहण गर्न आवश्यक छ । नेपालको संघीयता कार्यान्वयनबाट प्राप्त अनुभव, अन्तर्राष्ट्रिय अभ्यास तथा परिवर्तन व्यवस्थापनका सिद्धान्तहरूले देखाएझैं पारदर्शिता, सहभागिता, क्षमता विकास र पेशागत सुरक्षालाई केन्द्रमा राखेर समायोजन प्रक्रिया अघि बढाउन सके पुनर्संरचनाले अपेक्षित प्रतिफल दिन सक्छ ।

सन्दर्भ सामग्री

१) नेपाल सरकार, नेपालको संविधान, २०७२ । काठमाडौंः नेपाल कानून किताब व्यवस्था समिति ।

२) नेपाल सरकार, अर्थ मन्त्रालय । आर्थिक वर्ष २०८३/८४ को बजेट वक्तव्य । काठमाडौंः अर्थ मन्त्रालय ।

३) नेपाल सरकार, सङ्घीय मामिला तथा सामान्य प्रशासन मन्त्रालय। कर्मचारी समायोजन ऐन, २०७५ । काठमाडौंः नेपाल सरकार ।

४) नेपाल विद्युत् प्राधिकरण। वार्षिक प्रतिवेदन । काठमाडौंः नेपाल विद्युत् प्राधिकरण ।

५) World Bank. Rethinking Power Sector Reform in the Developing World. विश्व बैंक ।

६) Asian Development Bank. Energy Sector Governance and Reform. एसियाली विकास बैंक ।

७) Asian Development Bank. Governance and Institutional Risks and Challenges in Nepal. एसियाली विकास बैंक ।

८) विभिन्न सरकारी निकाय, अन्तर्राष्ट्रिय संस्थाहरू तथा ऊर्जा क्षेत्रसँग सम्बन्धित आधिकारिक वेबसाइटहरूबाट प्राप्त सामग्री ।

Deployment of Smart Meters for enabling efficient and Transparent open access in Transmission/ Distribution lines

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Abstract

Open access opens the possibility to any party for selling or buying electricity without any discrimination. It is essential for fostering the market competition and increasing the efficiency of the system. The Nepal Electricity Regulatory Commission (ERC) has issued the **Directive on Open Access in Electricity Transmission and Distribution System, 2082 (2026)** on January 15, 2026. The directive introduced is one step for the beginning of the liberalization of Nepal's power sector and initiation for the domestic energy market (ERC, 2025)

A **smart meter** is an advanced digital device that records electricity consumption in real-time and communicates data back to the utility company. Its use is significant for Remote Meter Reading, Time-of-Use (ToU) Pricing, Deviation Settlement, Outage Management, Prepaid Services, Load Limiting, Bi-directional Metering etc. To modernize the existing metering infrastructure, Nepal Electricity Authority has replaced Three Phase Electromechanical Whole Current Meters with Smart Whole Current Meters as well as Metering Unit operated TOD meters with the smart meters. In an open access regime, where multiple users utilize the same transmission network, system operators require continuous visibility of load flows and injections of power flow in to the network.

Therefore, the deployment of smart meters is a foundational requirement for enabling efficient and transparent open access in transmission systems

1. Introduction to Open Access in Power Sector

Open access refers to the possibility to any party for selling or buying electricity, with a cost-reflective fee (WB, 2013). This is subjected to transparence with defined system security constraints. This leads to connect to the system grid, making use of transmission and distribution systems, regardless of who owns and operates the power grid i.e. without discrimination, against payment of adequate fees for accessing and using this infrastructure (LOKSHA, 2013).

Furthermore, open access to the power grid is an essential element for introducing competition to electricity markets and increasing their efficiency. Open access facilitates expansion of competitive wholesale markets, participation of contestable retail consumers in the competitive market (WB, 2013).

2. Open Access directives, 2082 of Nepal

This directive has been aligned with regional energy trading standards so generator and load can easily trade electricity in both domestic and regional market. Its core objectives include:

- **Non-Discriminatory Access to the grid:** Ensuring any eligible entity can use the grid by paying a regulated fee, regardless of whether they are state-owned or private (ERC, 2025).

- **Encouraging Investment:** Providing a clear "exit strategy" for hydropower developers who previously had to wait years for a Power Purchase Agreement (PPA) with the NEA (ERC, 2025). It will further help expanding energy market and attraction in the investment on renewable energies (ERC, 2025)

- **Promoting Competition:** Permitting the large industrial consumers such as cement and steel plants to procure electricity from private generators based on cost efficiency or reliability considerations. (ERC, 2025).

- **Cross-Border Trade:** Establishing a legal framework for the private sector to export surplus electricity to neighboring countries (India/ Bangladesh) (ERC, 2025).

With the introduction of open access, generator with a capacity 5 MW or above can connect to the grid at 33 kV and higher voltage levels, subject to payment applicable for wheeling charge to the transmission utility. Bulk Consumers i.e industrial or commercial users with contract demand of 5 MW or more can buy power from the generator through primary voltage of 33 kV or higher, Furthermore, the directive allows the generator to sell power more than 10 MW to cross border trading by paying the wheeling charge (ERC, 2025) to grid owner. Open Access also allows to various consumers to purchase power from various sources at different times of the day as well. Traditional meters, which only record total consumption once a month, cannot handle this complexity, the application and the installation of the Smart Meters is essential for the smooth, secure, seamless operation and for maintaining the grid discipline (Bimenyimana.S, 2018).

3. Smart Meters and its application

A **smart meter** is an advanced digital device that records electricity consumption in real-time and communicates data back to the utility company. Unlike traditional analog meters, which require manual reading, smart meters use a two-way communication network (often using RF signals or cellular data) to provide a constant flow of information between the consumer and the service provider (Introduction to Smart Meters, 2026).

Smart meters provide high-resolution, time-stamped measurement of electricity consumption and injection. Unlike conventional meters, they support interval data recording, typically at 15-minute or shorter granularity.

Therefore, Smart meters are essential for open access because energy accounting must be precise across multiple participants such as generators, bulk consumers, traders, and distribution utilities. Without accurate temporal measurement, settlement disputes and imbalances become unavoidable. This cannot be done by traditional meters, which only record total consumption once a month.

Key Applications of Smart Meters

Smart meters are the backbone of a "Smart Grid." Their primary applications include:

- **Remote Meter Reading:** Eliminates the need for manual meter readers, reducing operational costs and human error.

- **Time-of-Use (ToU) Pricing:** Utilities can charge different rates based on the time of day (e.g., cheaper at night, more expensive during peak hours) to encourage better demand management. Since, electricity prices and grid availability fluctuate every hour, smart meters record consumption in 15-minute or hourly intervals, allowing the utility to know exactly when a consumer used power and which supplier's energy was on the grid at that moment.

- **Deviation Settlement:** In an OA market, if a factory buys 10 MW but only uses 8 MW, or overuses to 12 MW, they must pay a "Deviation Settlement Charge." Only a smart meter can provide the real-time data needed to calculate these penalties accurately.

- **Outage Management:** Smart meters can instantly notify the utility when power is lost, allowing faster restoration without waiting for a customer to report the fault.

- **Prepaid Services:** Much like a mobile phone, customers can "top up" their electricity credit, which helps in budgeting and ensures the utility receives payment upfront.

- **Load Limiting:** Utilities can remotely limit the amount of power a household draws during a grid emergency instead of resorting to a total blackout (load shedding).

- **Bi-directional Metering:** For "Captive" plants or consumers who also generate power (like solar or hydro developers), smart meters track both export and import of energy simultaneously.

Hence, Open Access allows consumers to procure power from various sources at different times. To handle this complexity smart meters are essential (Grid, n.d.)

4. Overview of Smart Meters installation in Power Sector of Nepal

To modernize the existing metering infrastructure in system with the latest technology in Nepal Electricity Authority, Smart Metering and Smart Grid Project under Metering and Automation Department, has replaced Three Phase Electromechanical Whole Current Meters as well as TOD meters with Smart Meters. These meters are equipped with e-sim, which is latest technology introduced by Nepal Telecom. All the meters installed are in communication with Head End System (HES) and energy & electrical instantaneous data, meter events and alarms received from the meter through Head End System is exported to Meter Data Management System (MDMS) for data analysis and reporting purpose.

All installed smart meters are connected to the Head End System (HES). Energy readings, instantaneous electrical data, meter events, and alarms collected from the meters are transmitted to the HES and subsequently exported to the Meter Data Management System (MDMS) for analysis and reporting. (NEA, 2025)

5. Smart Meters and its importance in open access of transmission networks

The deployment of smart meters is a foundational requirement for enabling efficient and transparent open access in transmission systems, particularly in a developing electricity market such as Nepal. Their importance can be understood from both technical and market-operation perspectives. (ADB, 2026)

The smart meters enable real-time or near real-time data communication. In an open access regime, where multiple users utilize the same transmission network, system operators require continuous visibility of load flows and injections. This improves operational security and allows the Nepal Electricity Authority, acting as the transmission system operator, to manage congestion, maintain grid stability, and enforce scheduling discipline (Rajaguru., 2023).

Smart metering is critical for energy accounting and settlement systems. Open access requires clear segregation of energy flows for billing purposes, including transmission charges, wheeling charges, losses, and imbalance penalties. Smart meters integrate with Meter Data Management Systems and facilitate automated settlement processes, reducing manual intervention and associated errors. This is particularly important if Nepal evolves toward a competitive electricity market structure. (ADB, 2026)

Moreover, smart meters support time-of-use and dynamic tariff mechanisms. In open access, pricing signals are necessary to reflect network conditions and encourage efficient consumption. Smart meters enable differentiated tariffs based on peak and off-peak periods, which can reduce system stress and defer infrastructure investment (Grid, n.d.).

Most importantly, they enhance transparency and trust among market participants. Open access introduces multiple stakeholders with potentially conflicting commercial interests. Smart meter data, when made accessible through secure platforms, provides an auditable and verifiable basis for transactions, reducing disputes and improving regulatory oversight. **(ADB, 2026)**

Ultimately, smart meters facilitate integration with advanced grid functionalities. For example, they support demand response programs, distributed generation monitoring, and future market mechanisms such as ancillary services. These capabilities align with Nepal's long-term objectives of integrating hydropower variability and potential cross-border electricity trade.

Basically, from a regulatory and compliance standpoint, smart meters enable enforcement of grid codes and open access regulations. Deviations from scheduled generation or consumption can be detected accurately, allowing the application of deviation settlement mechanisms.

No doubts Smart meters act as an enabling infrastructure for non-discriminatory network access, accurate loss allocation and congestion management, transparent commercial settlement and improvement of system reliability and operational control.

6. Conclusion

Smart meters are not merely an upgrade in metering technology; they are a prerequisite for transitioning Nepal's transmission network from a vertically integrated utility model to a more open, competitive, and transparent electricity market framework.

Nepal has ambition plan to generate 28,500MW by 2035 for 13,500 domestic use and 15,000 MW for the regional trade. And efficient and reliable electricity supply is a key factor of economic growth (editology, 2025). This is possible with increasing private sector participation in hydropower generation and the prospect of regional electricity trade with neighboring countries. The open access to grid and active wholesale market help mobilize private investment in generation (WB, 2013). However, the absence of robust metering infrastructure would become a structural bottleneck for the open access of the grid and the competitive power market.

Since, Open Access is like a multi-lane highway where different companies drive their "electricity trucks." The smart meter is the automated toll booth and GPS tracker—it's the only way to know who is driving where, how much they owe, and if they are breaking the speed limit. Without it, the highway remains closed to private traffic.

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Liveline Maintenance in Action:
NEA Techinicians Working Safely to Ensure Uninterrupted Power Sypply in Butwal.

Transmission Line Uprating with ACCC Conductors in Nepal's Integrated Power System: Challenges and Maintenance Considerations.

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Nepal's power sector is undergoing rapid transformation, driven by growth in both electricity generation and demand. With expanding hydropower projects and increasing electrification across urban and rural areas, the transmission network must evolve accordingly to ensure reliable and efficient power evacuation and delivery.

Traditionally, transmission capacity has been enhanced through the construction of new lines. However, in Nepal, development of new corridors is increasingly challenging due to difficult terrain, environmental constraints, forest clearances, and public concerns regarding land acquisition and Right of Way (RoW). Rapid urbanization has further increased the cost and complexity of acquiring RoW.

Given these challenges, maximizing the utilization of existing transmission infrastructure has become a strategic necessity. Enhancing the capacity of existing corridors is essential to accommodate growing power flows, particularly between generation hubs and load centers.

Several technical solutions can be explored, including reconductoring with higher capacity conductors, voltage uprating, circuit addition, HVDC systems, and dynamic line rating. Among these, the adoption of new generation High Performance Conductors (HPC) has emerged as a highly effective option.

HPCs, including High Temperature (HT) and High Temperature Low Sag (HTLS) conductors, can operate at higher temperatures with lower sag compared to conventional conductors. This enables significant increase in current carrying capacity within the same corridor without major structural modifications. These technologies have been successfully implemented globally and are increasingly adopted in Nepal.

While HPCs offer clear advantages in capacity enhancement and optimal RoW utilization, they also introduce new operational and maintenance challenges. Addressing these through proper training, updated practices, and institutional readiness is essential to ensure long-term system reliability.

Conventional ACSR and AAAC conductors used in Nepal's transmission system operate at maximum temperatures of about 85°C and 95°C, respectively. Their ampacity is limited by thermal constraints, as aluminum anneals above ~93°C, leading to loss of mechanical strength. Hence, increasing current capacity with these conductors is not feasible.

To enhance ampacity within existing corridors, options include larger size conductors or High-Performance Conductors (HPC), both requiring evaluation of infrastructure compatibility.

HPCs are designed for continuous operation at ≥150°C, with some up to 250°C without degradation. They can carry 1.5–2 times higher current than ACSR while maintaining similar size, weight, and tensile strength, allowing installation on existing towers with minimal modification.

In Nepal, increasing hydropower generation and demand have created congestion in key corridors, where HPCs provide an effective solution for overcoming thermal limits.

HPCs can be applied in reconductoring or new lines, but their cost is typically 1.5–5 times higher than conventional conductors. Therefore, techno-economic analysis must consider losses at higher temperatures, accessories, re-stringing, and substation equipment ratings.

For new lines, system studies are required to identify suitable applications. Ultimately, HPC selection should be based on case-by-case life-cycle cost analysis, which may justify higher initial investment through long-term benefits.

Transmission capacity (MVA) depends on both voltage (kV) and current (kA); therefore, it can be increased by enhancing either or both. Utilities like NEA must evaluate various options based on technical feasibility, cost, and system requirements. Key methods include:

- **Higher Size Conductors:** Replacing existing conductors with larger ones increases ampacity but may require strengthening of towers and structures.

- **Circuit Addition:** Adding another circuit can increase power transfer, though it is often limited by space and structural constraints. Conversion from single to double circuit may be feasible where clearances allow.

- **Voltage Uprating:** Increasing operating voltage significantly enhances capacity and reduces losses. However, it requires upgrades in substations, insulation, and sometimes tower modifications. Use of insulated cross-arms and HTLS conductors can further optimize this option.

- **HVDC Systems:** Suitable for bulk power transfer over long distances, but involves high investment due to converter stations and complex system requirements.

- **Dynamic Line Rating (DLR):** Real-time monitoring of weather and conductor conditions allows temporary increase in line capacity, typically by 10–15%.

- **High Surge Impedance Lines (HSIL):** By modifying line configuration (e.g., increasing bundle size or reducing phase spacing), surge impedance loading and capacity can be improved, mainly for EHV lines.

- **High Performance Conductors (HPC):** Reconductoring with HT/HTLS conductors enables higher ampacity within the same corridor. Although costlier, this option is effective in constrained corridors and should be adopted based on detailed techno-economic analysis.

Before implementing any uprating method, it is essential to verify that all associated equipment (e.g., breakers, CTs, connectors) can handle the increased capacity. Compliance with safety limits for electrical clearances, electric and magnetic fields, and RoW requirements must also be ensured.

High Performance Conductors

Conventional ACSR (Aluminum Conductor Steel Reinforced) conductors employ hard-drawn aluminum strands, which begin to experience significant loss of mechanical strength at operating temperatures above approximately **93°C**. Consequently, they are not suitable for sustained high-temperature operation. To address this limitation, **High-Temperature Low-Sag (HTLS)** conductors utilize either **fully annealed aluminum** or **thermal-resistant aluminum alloys**. Thermal-resistant alloys are typically produced by alloying aluminum with zirconium, resulting in materials such as **Thermal-Resistant Aluminum Alloy (TAL)**, **ZTAL/UTAL**, and **XTAL**. While annealed aluminum provides higher electrical conductivity due to its lower resistivity, it has reduced mechanical strength. In contrast, zirconium-alloyed aluminum exhibits slightly higher resistivity but offers significantly improved mechanical strength and stability at elevated temperatures.

HTLS conductors are designed for continuous operation at temperatures of **150°C or higher**, with certain conductor types capable of operating continuously at temperatures up to **250°C**. These conductors comprise aluminum or aluminum-alloy strands that provide electrical conductivity, supported by a high-strength core that carries the majority of the mechanical load. Depending on the conductor design, the core may be manufactured from materials such as **galvanized steel**, **aluminum-clad steel**, **mischmetal steel**, **INVAR steel (iron–nickel alloy)**, **high-strength steel**, **metal matrix composites (MMC)**, or **polymer matrix composites (PMC)**, including **carbon-fiber composites**. In conductors utilizing annealed aluminum, the mechanical strength is derived predominantly from the reinforcing core, whereas in alloy-based HTLS conductors, both the core and the aluminum-alloy strands contribute to the overall mechanical performance, enabling reliable operation under high-temperature and high-tension conditions.

High Performance Conductors (HPCs), also known as **High-Temperature Low-Sag (HTLS)** conductors, are classified primarily based on the **conductor material** and the **core technology** used to achieve higher current-carrying capacity and reduced thermal sag. Brief description of some of the type of High-Performance Conductors presently available are given in following section.

a) *(Z)TACIR / STACIR (INVAR Core Conductor)*

(Z)TACIR (Zirconium Thermal-Resistant Aluminum Conductor INVAR Reinforced) and STACIR are **High-Temperature Low-Sag (HTLS)** conductors that have a stranded construction similar to conventional ACSR conductors. The main difference lies in the materials used for the conductor core and the outer aluminum strands, enabling operation at significantly higher temperatures with lower thermal sag.

Instead of the conventional galvanized steel core used in ACSR, these conductors employ an **INVAR core**, which is an iron–nickel alloy (Fe–36%Ni) with a very low coefficient of thermal expansion. The core may be either galvanized or aluminum-clad to improve corrosion resistance. The outer conductive layer consists of **thermal-resistant aluminum alloy (ZTAL/TAL)** strands, which retain their mechanical strength at elevated temperatures.

(Z)TACIR/STACIR conductors are designed for **continuous operation at temperatures up to 210°C**, allowing approximately **twice the current-carrying capacity** of conventional ACSR conductors of similar size. The low thermal expansion of the INVAR core, approximately one-third that of conventional steel, significantly reduces conductor sag during high-temperature operation, making these conductors suitable for uprating existing transmission lines without major modifications to towers or clearances.

Although the tensile strength of the INVAR core is lower than that of conventional galvanized steel, resulting in an overall conductor tensile strength approximately **8% lower than ACSR**, the conductor still provides satisfactory mechanical performance for transmission applications. Since its construction is similar to ACSR, the installation procedures, stringing methods, and maintenance practices remain largely unchanged. Standard ACSR accessories can generally be used with only minor modifications, such as slightly longer compression fittings to accommodate the higher operating temperatures and current ratings.

b) *Polymer Matrix Composite (PMC) Core Conductors (Carbon Composite Core Conductors – CCC)*

Typical conductors: *ACCC, CFCC, HVCRC, ACFR*

Figure: ACCC conductor

Polymer Matrix Composite (PMC) core conductors use a carbon-fiber composite core, typically made of carbon fibers embedded in a resin or epoxy matrix, surrounded by annealed aluminum or thermal-resistant aluminum alloy strands. The composite core is protected against galvanic corrosion using a glass-fiber sleeve, an aluminum alloy tube, or other protective methods.

Compared with conventional ACSR conductors, PMC core conductors offer significantly higher tensile strength, lower weight, and a much lower coefficient of thermal expansion. These characteristics result in reduced sag at high operating temperatures, increased current-carrying capacity, longer span lengths, fewer transmission structures, and lower line losses.

The composite core also provides excellent resistance to corrosion, vibration, ultraviolet radiation, corona, thermal oxidation, and fatigue. However, because composite materials are more brittle and less flexible than steel, they require special fittings and careful handling during installation. Appropriate sheave sizes, pulling tensions, and installation procedures specified by the manufacturer must be followed to prevent damage to the composite core.

In regions with heavy ice loading, higher-modulus or extra-high-strength composite cores may be required to limit conductor sag under mechanical loading.

c) *G(Z)TACSR (Gap-Type Conductor)*

G(Z)TACSR (Gap-Type Aluminum Conductor Steel Reinforced) consists of a galvanized steel core surrounded by thermo-resistant Aluminum alloy strands. A small gap is maintained between the steel core and the Aluminum layer, which is filled with high-temperature grease to reduce friction, prevent corrosion, and allow independent thermal expansion of the core and outer strands.

Compared with conventional ACSR, G(Z)TACSR offers significantly lower sag and can operate at much higher temperatures while maintaining similar electrical and corrosion performance. Its low-sag characteristic is achieved because the steel core primarily carries the mechanical load above the knee-point temperature.

Installation of G(Z)TACSR is more complex than ACSR and requires special stringing procedures and high-temperature grease. Proper installation practices must be followed to ensure reliable performance. In snow-prone areas, trapezoidal outer strands may be used to reduce snow accumulation and improve conductor performance.

High-Performance Conductor Technologies Adopted in the Integrated Nepal Power System (INPS)

S.N.	Transmission Corridor	Length (km)	Voltage (kV)	Existing Conductor (Ampacity / Power Transfer)	Upgraded Conductor (Ampacity / Power Transfer)
1	Bhaktapur – Baneshwor-Patan	16.5	66	LGJ 120 / Wolf (300 A / 35 MW)	ACCC Silvassa (600 A / 70 MW)
3	Chapali – Chabahil	10	66	Double Circuit Dog (2 × 300 A / 2 × 35 MW)	ACCC Silvassa (600 A / 2 × 70 MW)
4	Patan – Suichatar	6.4	66	Double Circuit Wolf (2 × 400 A / 2 × 46 MW)	ACCC Copenhagen (2 × 780 A / 2 × 89 MW)
5	Birgunj – Parwanipur – Simara	20	66	Double Circuit Wolf (2 × 400 A / 2 × 46 MW)	STACIR/Invar (2 × 850 A / 2 × 97 MW)
6	Kushaha – Kataiya	15	132	Single Circuit Bear/Panther (482 A / 110 MW)	3M ACCR (900 A / 205 MW)
7	Khimti – Lamosanghu	42.3	132	Single Circuit Bear (600 A / 100 MW)	ACCC Cordoba (1200 A / 170 MW)
8	Hetauda – Pathlaiya	36	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)

S.N.	Transmission Corridor	Length (km)	Voltage (kV)	Existing Conductor (Ampacity / Power Transfer)	Upgraded Conductor (Ampacity / Power Transfer)
9	Pathlaiya – Dhalkebar	102	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)
10	Kushaha – Duhab i	28	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)
11	Suichatar – Matatirtha	5.0	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)
12	Suichatar – Teku	4.5	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)
13	Suichatar – Balaju	4.0	132	Single Circuit Duck (650 A / 125 MW)	ACCC Amsterdam (1200 A / 250 MW)
14	Pathlaiya – Parwanipur	17	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	Bear Equivalent HTLS (2 × 1200 A / 2 × 250 MW)
15	Butwal-Sunwal-New Butwal	25.3	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)
16	Damauli Bharatpur	39	132	Single Circuit Wolf (1 × 400 A / 1 × 95 MW)	ACCC Copenhagen (1 × 780 A / 1 × 160 MW)
17	Kushaha-Duhabi	28	132	Double Circuit Bear (2 × 600 A / 2 × 125 MW)	ACCC Cordoba (2 × 1200 A / 2 × 250 MW)

From the analysis presented in the above table, it is evident that **Aluminum Conductor Composite Core (ACCC)** is the most widely adopted High Temperature Low Sag (HTLS) conductor technology for transmission line uprating within the Integrated Nepal Power System (INPS). The increasing application of ACCC conductors is primarily attributed to their superior current-carrying capacity, low thermal sag characteristics, and their ability to significantly enhance the power transfer capability of existing transmission corridors without requiring major modifications to the line geometry.

Material and Structural Comparison of ACCC and Legacy ACSR

Successful integration of ACCC conductors into an existing transmission network originally designed for Aluminum Conductor Steel Reinforced (ACSR) conductors requires a clear understanding of the fundamental differences between the two conductor technologies. Conventional ACSR conductors comprise a galvanized steel core surrounded by multiple layers of hard-drawn, round 1350-H19 aluminum strands. In this configuration, the steel core provides the mechanical strength required to withstand tensile loading, while the aluminum strands primarily carry the electrical current.

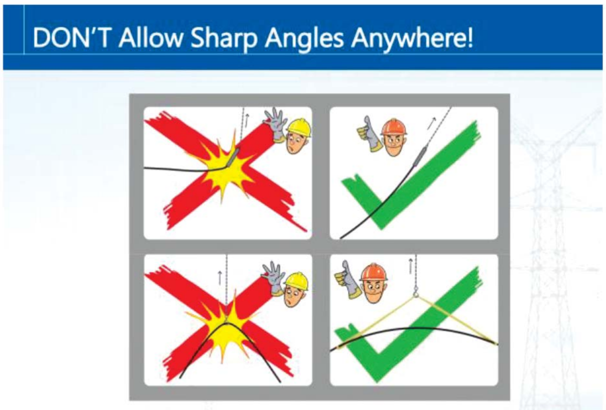

Figure: Handling Guidelines of ACCC conductor

In contrast, the ACCC conductor employs a lightweight, high-strength composite core consisting of carbon fibers embedded within a thermoset epoxy resin matrix and protected by an outer layer of boron-free glass fibers. This advanced composite core exhibits a significantly lower coefficient of thermal expansion than steel while maintaining high tensile strength, thereby substantially reducing conductor sag under elevated operating temperatures.

Furthermore, ACCC conductors utilize compact, trapezoidal-shaped, fully annealed 1350-O aluminum strands instead of conventional round hard-drawn aluminum wires. The annealed aluminum offers a higher electrical conductivity of approximately **63% IACS (International Annealed Copper Standard)** compared with approximately **61% IACS** for hard-drawn 1350-H19 aluminum used in ACSR conductors. The trapezoidal strand geometry eliminates the interstitial air gaps present in conventional round-wire constructions, enabling approximately **28–29% greater aluminum cross-sectional area** within the same overall conductor diameter. This increased conductive area, combined with the superior mechanical properties of the composite core, results in significantly higher ampacity, lower electrical resistance, reduced line losses, and improved overall transmission efficiency while maintaining existing electrical clearances.

Integration Challenge: System and Electrical Compatibility

The principal engineering challenge associated with integrating Aluminum Conductor Composite Core (ACCC) conductors into the Integrated Nepal Power System (INPS) is that the existing transmission network was originally designed and optimized for conventional Aluminum Conductor Steel Reinforced (ACSR) conductors. Reconductoring with ACCC significantly increases the thermal rating of the transmission line while simultaneously altering its electrical, thermal, and mechanical characteristics. Consequently, unless the associated transmission assets are comprehensively evaluated and upgraded, the increased conductor capacity cannot be fully utilized.

a) *Substation and Terminal Equipment Limitations*

Replacing a conventional 132 kV Bear ACSR conductor with an ACCC Cordoba conductor can increase the continuous current-carrying capacity from approximately **600 A** to over **1200 A**. However, the terminal equipment at both substations is generally designed based on the original conductor rating. As a result, the transmission line may no longer be the limiting component; instead, the thermal and electrical ratings of the connected substation equipment become the primary constraints.

The major equipment requiring technical assessment includes:

Current Transformers (CTs): Existing CTs may not possess adequate thermal or accuracy ratings for the increased line current. Operation beyond their design limits can lead to magnetic core saturation, distorted secondary currents, and unreliable protection system performance.

Disconnect Switches, Busbars, and Connectors: Line disconnectors, busbars, clamps, and terminal connectors are designed for specific continuous current ratings and permissible temperature rise. Increased current loading may result in excessive heating, accelerated contact degradation, increased contact resistance, and reduced equipment reliability.

Protection Coordination: ACCC conductors generally exhibit **25–40% lower electrical resistance** than equivalent ACSR conductors, resulting in reduced positive-sequence line impedance. These changes influence fault current distribution and the operating characteristics of distance protection (ANSI 21), overcurrent protection, and system coordination. Accordingly, comprehensive protection studies and relay setting revisions are essential following reconductoring to ensure system selectivity, reliability, and stability.

b) *Field Installation and Handling Challenges in Nepal's Terrain.*

The deployment of Aluminum Conductor Composite Core (ACCC) conductors in the Integrated Nepal Power System (INPS) presents significant construction and installation challenges due to Nepal's rugged topography, steep elevation changes, deep river valleys, and landslide-prone terrain. Reconductoring projects, such as the **Khimti–**

Lamosanghu 132 kV transmission line, involve long-span crossings and difficult access conditions, requiring specialized installation techniques that differ substantially from those used for conventional ACSR conductors.

Unlike the ductile galvanized steel core of ACSR conductors, the ACCC conductor incorporates a high-strength carbon fiber composite core embedded in a thermoset epoxy matrix and protected by a glass fiber layer. Although the composite core provides excellent tensile strength and very low thermal expansion, it is considerably more sensitive to transverse loading, excessive bending, torsion, and impact during installation. Improper handling may induce matrix cracking, fiber delamination, or internal structural damage that is not externally visible but can adversely affect the long-term mechanical performance of the conductor.

To prevent damage during stringing, the minimum bending radius specified by the manufacturer shall be strictly maintained throughout the installation process. This requirement becomes particularly challenging in Nepal's mountainous terrain, where long spans, large vertical angles, and restricted working space increase the complexity of conductor handling.

Accordingly, installation of ACCC conductors requires specialized tension-stringing equipment and manufacturer-approved installation procedures, including:

c) *Special Tools and Equipment Requirements*

ACCC conductors cannot be installed or maintained using the standard toolkits designed for legacy Aluminum Conductor Steel Reinforced (ACSR) lines. Doing so risks crushing the core or scoring the soft, annealed aluminum strands. The following specialized equipment is mandatory:

Stringing and Tensioning Equipment

- Large-Diameter Stringing Blocks (Sheaves): Standard ACSR stringing blocks are too small and will over-bend the composite core. ACCC requires large sheaves (typically 28-inch to 36-inch groove diameters, or at least 25 times the conductor's outer diameter) to maintain a safe bending radius.

Figure: Tandem Sheaves

- Controlled Back-Tension Pullers and Tensioners: Precision hydraulic tensioners and pullers are required. They must maintain steady, continuous back-tension to prevent

Figure: Bull-Wheel Tensioner

- conductor "galloping" at the bull-wheel and eliminate "birdcaging" of the trapezoidal aluminum strands.

- ACCC-Specific Come-Along Clamps: Standard pocket-style or wedge come-alongs will slip or crush the core. Line crews must use automatic or bolted alloy-steel come-along clamps featuring extended, interchangeable aluminum jaws (typically 270 mm to 340 mm in length) designed to distribute radial clamping force over a wider surface area.

Figure: Come-Along Clamp

Jointing, Splicing, and Sashing Tools

- Conductor Strippers and Trimming Tools: To prevent scoring the core, manual hacksaws are discouraged. Installers must use specialized circular trimming tools (e.g., RIDGID cable trimmers) that precisely cut the outer trapezoidal aluminum layers without nicking or scratching the central composite core.

- Calibrated Torque Wrenches: The mechanical integrity of the wedge collet relies on exact torque. A calibrated torque wrench must be used to tighten the steel eye/clevis into the collet housing to a minimum of 85 ft-lb (115 Nm).

- 60- to 100-Ton Hydraulic Compression Presses: Traditional crimping dies can distort the collet. High-tonnage presses with precise, clean dies matching the conductor size are required to swage the outer aluminum sleeves. In steep terrain, lighter 45-ton tools utilizing 360-degree swage flex-die technology are preferred to reduce the physical burden on linemen.

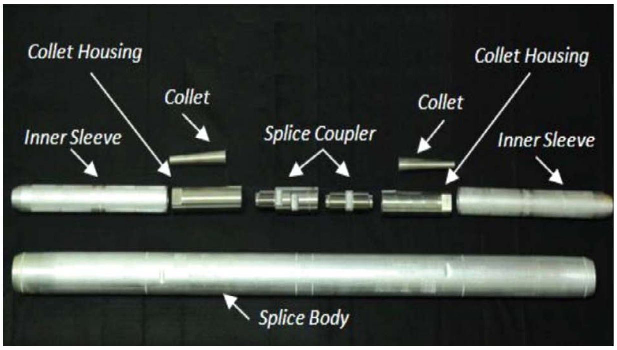

Figure: Compressive Joint

- Silicon Carbide Sanding Paper (220 grit): Necessary to remove the outer epoxy sheen of the core to expose the white glass-fiber barrier layer, maximizing friction for the collet grip.

Operational Maintenance and Diagnostic Tools

- ACCC InfoCore Confirmation Kits: Traditional line inspections cannot verify internal core health. The ACCC InfoCore system uses optical fibers embedded directly within the composite core during manufacturing. Maintenance crews use a portable kit consisting of a specialized core-cutter, polisher, infrared light transmitter, and receiver to verify core continuity at both ends of a span in minutes.

- Infrared (IR) Thermography Cameras: Because ACCC runs at high continuous temperatures (up to 180°C), thermal imaging is critical during routine patrol maintenance to detect localized "hot spots" at collet joints, splices, and terminal fittings before joint degradation occurs.

d) *Highly trained manpower requirement*

The physical handling of ACCC conductors is highly sensitive to the skill level of field crews. While legacy steel cores are highly forgiving of rough handling (such as dragging the conductor over rocks or letting it hang unsupported), ACCC will fail catastrophically if subjected to similar stresses.

Key Skill Deficits in Nepal's Context

- Intricate Splice Assembly: The collet-and-wedge jointing process is a meticulous mechanical assembly. Field crews must keep all components perfectly clean, sand the core without damage, inject the exact amount of filler compound to prevent moisture ingress, and apply uniform swaging pressure. Minor deviations can cause joint failure.

- Extreme Terrain Physics: Stringing conductors across deep river gorges and steep cliffs in Nepal creates large elevation changes. Linemen must understand how to manage sheave entry angles and back-tension dynamically to ensure the maximum bending limit of the core is never exceeded.

- Lack of Local Supervision: On large-scale projects involving multiple stringing crews, a limited number of certified supervisors cannot monitor all teams simultaneously. This lack of supervision has historically led to undetected installation errors and subsequent line breakages.

How NEA Can Tackle the Manpower Shortage

As the NEA expands its use of high-capacity, low-sag conductors across key transmission paths, relying on foreign contractors for stringing and maintenance is unsustainable. The utility can adopt several strategic measures to build local self-reliance.

Establish a Dedicated Training Wing at the NEA Training Centre

NEA should establish a specialized HTLS and Advanced Conductor Training laboratory within its central facility, such as the NEA Training Centre in Kharipati or the Engineers' Training Centre.

- This wing should be equipped with permanent sample lines, rigging frames, dynamic tensioners, and jointing tools.

- Training should focus on hands-on practical exams: mandatory stripping of aluminum, wedge-collet assembly, core sanding, torque wrench calibration, and 360-degree swaging.

- No technician should be permitted to splice or string ACCC on an NEA line without passing a standardized certification exam at this facility

Institutionalize Mandatory "Train-the-Trainer" Certification

Rather than training field crews on a project-by-project basis, NEA should select a core team of senior transmission engineers and line foremen to undergo official Master Installer Certification from global manufacturers (such as CTC Global).

- These certified NEA engineers will serve as an internal mobile training unit.

- They can conduct pre-construction refresher courses directly on-site before stringing begins on new projects, reducing training.

Enforce Rigorous Technology Transfer in EPC Tender Documents

NEA's Project Management Directorate must revise its standard bidding documents for high-voltage transmission lines.

- All international Engineering, Procurement, and Construction (EPC) contracts involving ACCC conductors should mandate that the conductor manufacturer provides hands-on certification training for both the contractor's stringing crews and NEA's regional maintenance personnel prior to stringing.

- The contract should require the delivery of certified ACCC jointing and diagnostic toolkits. (Including torque wrenches, cable trimmers, and Info Core diagnostic systems) to local NEA grid divisions upon project handover.

Equipping and Standardizing Regional Grid Maintenance Hubs

To address emergency maintenance needs, NEA should establish specialized "Emergency Restoration Units" within its regional grid offices (such as Dhalkebar, Butwal, and Kathmandu).

- These hubs should be equipped with standardized, pre-staged ACCC repair kits, including come-along clamps, specialized compression dies, splice sleeves, and spare lengths of matching conductor sizes.
- Crews in these hubs must conduct quarterly emergency drills to practice executing live or dead-line splices under pressure, ensuring rapid restoration capability following landslides, windstorms, or operational failures.

Transition to Standard-Compatible High-Performance Conductor

As Nepal expands and reinforces its transmission network, particularly across remote and mountainous terrain, the selection of advanced conductors should consider not only electrical and mechanical performance but also constructability, maintainability, and life-cycle cost. Several next-generation HTLS conductor technologies have been developed to retain installation and maintenance practices similar to those of conventional ACSR conductors. These conductors incorporate innovative core designs and protective features that enable the use of standard compression fittings, stringing blocks, come-along clamps, dead-end hardware, and conventional installation procedures, thereby reducing the need for specialized tools, highly trained installation crews, and complex maintenance protocols. Such compatibility can significantly simplify field operations in geographically challenging regions where mobilizing specialized equipment and expertise is difficult. However, conductor selection should not be based solely on installation convenience. Nepal Electricity Authority (NEA) should undertake a comprehensive technical and economic assessment of available HTLS conductor technologies, considering factors such as ampacity, thermal performance, mechanical characteristics, sag behavior, compatibility with existing infrastructure, installation requirements, maintenance needs, long-term reliability, life-cycle cost, and overall suitability for Nepal's operating and environmental conditions. This systematic evaluation will enable the selection of the most appropriate conductor technology for each transmission corridor while ensuring optimum technical performance and economic value.

Conductor Stringing Work in Progress for the 400 KV Dhalkebar-Hetauda Transmission Line in Hetauda

Life Cycle Cost Analysis in Procurement of Energy Component

Pradeep Singh
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1. Introduction

Procurement in energy sector demands a wise selection of equipment with superior performances along with state-of-the-art technology. Procurement sof equipment like power transformers, solar photovoltaic (PV) systems, generators, turbines and other critical components involve decisions whose financial consequences extend far beyond the initial purchase. The equipment installed today need to remain in service for 20 to 25 years, during which operational costs, maintenance expenditures, and end-of-life disposal can collectively exceed initial acquisition cost by a significant margin.

Despite this reality, most of the procurement in Nepal default to selecting "lowest substantial responsive bidder" considering bidders experience and subsequently upfront price, primarily due risk facing further complaint and reviews, and ultimate cancellation of bidding process. This approach seems administratively straightforward with less hassles, however, chances increases as it systematically underestimates the true cost of ownership which urges suppliers to offer sub-quality, less efficient equipment that ultimately imposes higher costs over entire operation time.

Life Cycle Cost Analysis (LCCA) addresses this gap by requiring decision-makers to evaluate and compare the total cost of competing bids across the entire useful life of an equipment. When applied rigorously, LCCA enables procuring entities to identify the option that delivers the best long-term economic value — a principle increasingly recognized in international procurement law under the concept of the "Most Economically Advantageous Tender" (MEAT). Functional guarantees are directly and deeply intertwined with the MEAT (Most Economically Advantageous Tender) approach, especially in complex engineering, Supply- and- install, design built and turnkey infrastructure contracts (like those under FIDIC Yellow or Silver Books).

This article provides a conceptual and practical overview of LCCA, surveys its application in leading international procurement frameworks, and examines its legal basis, existing practice and further possibilities in context of Nepal, with particular reference to the energy sector.

2. Conceptual Basis of Life Cycle Costing

2.1 Definition

Life Cycle Costing (LCC) is defined by ISO 15686-5:2017 as: “the sum of acquisition costs, operation costs, maintenance costs, replacement costs, and end-of-life/disposal costs, minus any residual (salvage) value, all typically expressed in discounted present value terms.”

This may be expressed as:

LCC	=	Initial Capital Costs	+	Operating Costs	+	Maintenance Costs	+	End-of-Life Costs	–	Residual Value

2.2 Cost Components

The component of Life Cycle Cost can be categorized as below:

a. Initial Capital Costs: It includes purchase price, transportation, insurance, custom duties, and installation. Brand values and Incoterm-specific logistics costs are also included at this stage.

b. Operating Costs: It includes energy consumption, staff cost, consumables and regulation cost (e.g. royalty, government fees, etc.) incurred throughout equipment operational life.

c. Maintenance Costs: It includes scheduled maintenance, spare parts, unplanned repairs, and warranty-related expenditures.

d. End-of-Life Costs: It includes dismantling/decommissioning, disposal, or recycling cost. This category is growing in importance as battery-based technologies (such as electric vehicles and grid-scale storage) introduce significant disposal liabilities.

e. Residual Value: It includes any recoverable value from resale, repurposing, buy-back or salvage at the end of the asset's life, which is subtracted from total costs.

2.3 Importance of LCCA for Energy Equipment

Mostly the energy equipment incurs huge initial investments which have operational period for 25-30 years, with high degree of reliability and low operation cost. Life cycle cost analysis for a transformer with a lower purchase price may have significantly higher no-load and load losses, costing far more in electricity over 25–30 years. Similarly, solar PV and inverters with a lower upfront cost may require more frequent replacement, increasing total lifecycle expenditure.

High-efficiency turbine runners command a premium but deliver superior generation output over decades of operation.

3. Evolving Global Practice

3.1 United States

The United States federal government has established a mandatory LCCA framework for energy and water conservation investments through 10 CFR Part 436 (Federal Energy Management Program). This regulation requires federal agencies to apply LCCA to building energy systems, water systems, and conservation measures, using a methodology codified in NIST Handbook 135. Agencies such as the General Services Administration (GSA) and the Department of Defense routinely apply LCCA using the Building Life-Cycle Cost (BLCC) software tool developed by NIST.

3.2 European Union

Within the European Union, LCCA is explicitly enabled as an award criterion under Directive 2014/24/EU (Article 68) and Directive 2014/25/EU (Article 83). Contracting authorities may include acquisition, operational, maintenance, and end-of-life costs, and may also incorporate verified environmental externalities such as carbon dioxide costs. The European Commission has published sector-specific LCC tools for lighting, information technology equipment, and vehicles to facilitate consistent implementation.

3.3 Implementation in other developed nations:

- Germany mandates LCCA consideration for energy-consuming products and services at the federal procurement level.
- Spain applies LCCA in energy-efficient building and equipment procurements, leveraging EU tools.
- The United Kingdom, post-Brexit, retains equivalent principles under the Public

Contracts Regulations 2015 (Regulation 68).

- Switzerland, the Netherlands, Sweden, Denmark, Austria, and Norway integrate LCCA or equivalent derivatives into green public procurement frameworks, with varying degrees of systematic adoption across buildings, transport, and office equipment.

Overall, international frameworks reflect a clear directional shift from lowest upfront price to long-term economic and environmental value, with the United States emphasizing mandatory energy-focused rules and Europe emphasizing flexible, criteria-based integration within broader best-value procurement.

4. Legal Framework and Practice in Nepal

4.1 Existing Provision in Regulation

Nepal's public procurement is governed primarily by the Public Procurement Act (PPA) 2063 and the Public Procurement Regulations (PPR) 2064, administered by the Public Procurement Monitoring Office (PPMO). Legal provisions and standard bidding documents do not explicitly mandate LCCA as a compulsory award criterion, however some provision try to incorporate this concept:

a. PPR Rule 42 (Technical Specifications for Goods): Requires bidding documents to specify spare parts availability over the life of the goods, warranty periods, maintenance provisions, and guaranteed performance and quality

b. PPMO Standard Bidding Documents (SBDs): Some SBDs especially ICB/NCB have provisioned for consideration of Operating and Maintenance cost (O&M) during bid evaluation when such costs over the life cycle of the Goods represent an important cost in relation to the capital or investment cost of the Goods.

4.2 Nepal Electricity Authority: A Proven Precedent

Nepal Electricity Authority (NEA) has long been implementing a highly practical form of LCCA for the procurement of power and distribution transformers through its "Capitalization Value of Loss Rate" methodology. Rather than evaluating bids on purchase price alone, NEA adds the capitalized present value of future energy losses - comprising no-load loss, load loss, and cooler loss - to the bid price using a standardized formula:

Evaluated Price	=	Bid Price	+	NLL Rate × No-Load Loss	+	LL Rate × Load Loss	+	CL Rate × Cooler Loss

NLL = No-Load Loss; LL = Load Loss; CL = Cooler Loss (all capitalized over asset life)

This methodology converts the long-term cost of transformer inefficiency and operating cost - incorporating assumptions on the prevailing electricity tariff, applicable interest rate, expected transformer life, and operational loss factors - into an equivalent capital cost which is directly comparable at the bid evaluation stage. The result is a rigorously applied LCCA framework that discourages suppliers from offering inexpensive with high-loss equipment, promotes energy-efficient and reliable procurement, reduces technical losses in the system, and delivers better long-term value.

Critically, NEA has achieved this without requiring any amendment to the Public Procurement Act. The methodology is incorporated into Standard Bidding Documents and the Bid Data Sheet (BDS), demonstrating that LCCA can be exercised within Nepal's existing legal norms.

4.3 Applicability to Other Energy Assets

The NEA transformer model can be adapted and extended to other major energy sector procurements in Nepal, including:

a. Solar PV Systems: Evaluation criteria can incorporate inverter efficiency ratings, degradation rates, and projected energy yield differentials over a 20–25 years period.

b. Hydropower Turbines and Generators: Runner efficiency and cavitation resistance directly affect generation output and maintenance frequency over its operational life. Turbines are more susceptible to wear due to high sediments. Turbine efficiencies tend to decrease with time. An appropriate pre-declaration of turbine efficiency charts, to be submitted by the bidder, can be used to find out the overall efficiency loss ultimately relating to monetary terms. As example: Guaranteed Weighted Average Efficiency (GWAE) and guaranteed output are used for hydro turbines as well as Guaranteed Weighted Average Efficiency (GWAE) is used for Generators.

c. High-Voltage Transmission Equipment: Line losses and insulation degradation rates represent quantifiable lifecycle cost differentials between competing bids.

d. Battery Energy Storage Systems: Disposal and recycling costs for lithium-ion batteries represent an emerging and material end-of-life cost that must be factored into LCCA for grid-scale storage procurements. In fact, procurement in EU have been mostly

e. Other critical equipment: Equipment like valves, protection devices, precision components, SCADA can be standardized to meet required efficiency throughout its life.

5. Limitations and Way Forward

5.1 Current Limitations

Despite its notifiable benefits, the wider adoption of LCCA in Nepal's public procurement faces several practical challenges:

- Limited Institutional Capacity: Many procuring entities outside the energy sector lack the technical expertise to formulate LCCA methodologies, define appropriate discount rates, or verify the operational data submitted by bidders.
- Data Availability: Unavailability of categorical and reliable data on operational costs, failure rates, and energy consumption among equipment has not systematically collected, making it difficult to develop factual based capitalization rates.
- Devising evaluation criteria: Design and institutionalization of LCCA criteria to mitigate ambiguity into the bid evaluation process creates challenges and required subtle analysis.
- Supplier knowledge and awareness: Domestic and regional suppliers may be unfamiliar with LCCA data requirements, minimizing probability of competition in LCCA-based tenders.

5.2 Recommended Steps Forward

To address these limitations and expand the application of LCCA across Nepal's energy sector, the following measures can be adopted:

a. Regulatory Formalization and Guidance: In the long run, amending explicitly necessary provision in the existing legal framework to formally recognize LCCA as a permissible and preferred evaluation criterion for capital equipment with operational lives exceeding ten years. In this regard, concerned public entities and governing authorities like PPMO should formulate a sector-specific guidance on LCCA methodology for energy equipment, providing standard discount rates, capitalization formulas, and evaluation criterion.

b. Data Acquisition: Categorization of critical components (Generator, turbines, valves, switch gears, hydraulic components, pumps etc.), and collection of required information underlining current operational performances energy equipment, enabling practical capitalization rates.

c. Capacity Building: Institutional capacity building for concerned staffs on LCCA methodology, categorization of data requirements, and evaluation procedures.

6. Conclusion

Life Cycle Cost Analysis reflects an engineering decision feasible both legally and practically effective tool for improving the quality of procurement decisions in energy sector. NEA's Capitalization of Loss methodology for transformer procurement provides convincing proof of the concept. LCCA principles can be operationalized within existing legal frameworks, without legislative amendment, to deliver significant better long-term value for public expenditure.

The shift from lowest-bid procurement to the Most Economically Advantageous Tender (MEAT) principle adheres to slight technical adjustment with broader commitment to sustainable, efficient, and accountable use of public resources. As Nepal scales its unlimited possibilities in hydropower, solar, and grid infrastructure investments, the systematic adoption of LCCA across energy sector procurements, both in public and private, will be essential to ensuring that capital expenditure today does not create unnecessary operational burdens tomorrow.

The path forward is clear: build institutional capacity, establish standard inputs and methodologies, explore and pilot LCCA in suitable procurements - irrespective of size and cost, and formalize its status within the regulatory framework compatible to international best practices.

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Financing Nepal's Power Future: The Rise of Energy Bonds

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Introduction

Nepal's hydropower sector has turned out to be one of the largest borrowers in Nepal's banking system as a whole. As of mid-July 2026, commercial banks, development banks, finance companies, and infrastructure development banks all hold around NPR 500 billion in outstanding loans to the energy sector, out of a total system-wide lending capacity of roughly NPR 6000 billion. The conventional lending of the central bank has been actively encouraging banks, hydropower developers, and public entities to raise capital through a class of debt instrument which is known as 'energy bonds'. For the whole set of parking savings in fixed deposits, energy bonds would represent a comparatively unfamiliar but increasingly relevant asset class.

A bond is a loan in reverse - here, instead of a bank lending money to a borrower, an investor lends money directly to the issuer. A company, bank, or government body issues a bond in exchange for a promise of periodic interest payments and seeks the return of principal at its maturity. In Nepal's context, most such instruments remain issued by companies seeking legal structure and which are commonly referred to as 'debentures'. 'Energy Bond' simply is a bond that is earmarked for financing energy or hydropower-related projects, issued by a bank, power utility, or project developer to raise funds specifically for electricity generation, distribution infrastructure, or transmission pattern.

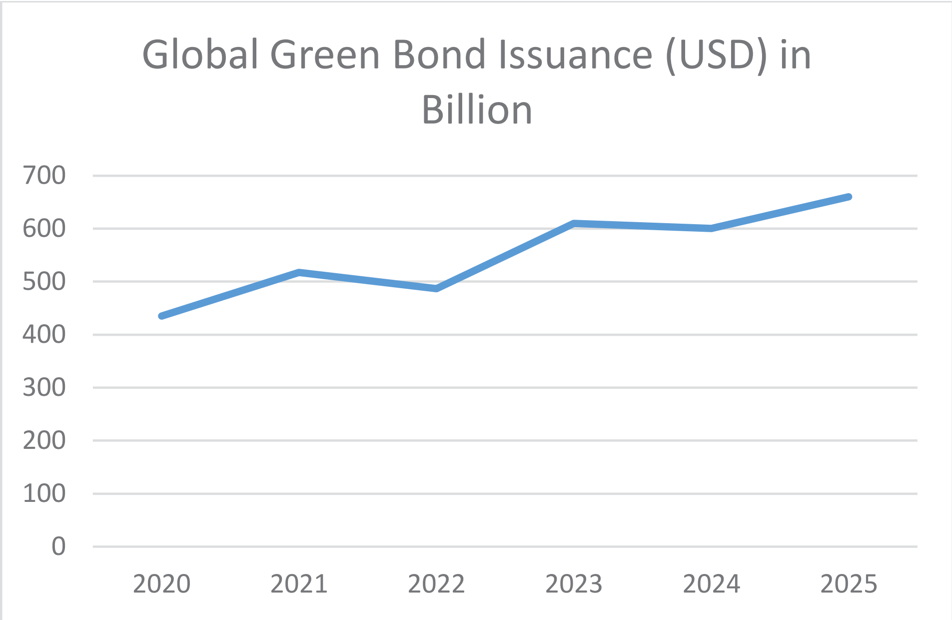
Energy bonds in Nepal carry the same set of core features as any other debenture, seeking face value, a coupon (interest) rate, a maturity period typically ranging from five to ten years, and a repayment schedule (Investopaper, 2024). There are energy bonds which are secured against project assets, while others are unsecured and would rely purely on the issuer's creditworthiness here. This distinguishes an energy bond from ordinary corporate debentures seeking proceeds - where the funds are raised contractually or administratively channeled toward hydropower generation, transmission lines, or related infrastructure rather than general working capital.

Importance of Energy Bonds

Energy bonds have been providing different economic, financial, and environmental benefits. They help in mobilizing long-term capital required for capital-intensive energy infrastructure. There lie energy projects typically involve high initial investment with long payback periods, and bond financing provides stable and relatively lower-cost funding compared to short-term bank borrowing (Fabozzi, 2021). Energy bonds help to diversify financing sources beyond government budgets and commercial bank loans. It reduces fiscal pressure while encouraging institutional investors like pension funds, insurance companies, and sovereign wealth funds for participating in infrastructure financing (OECD, 2023).

Energy bonds also help to accelerate the transition towards renewable energy by directing capital into environmentally sustainable projects. Here, green and climate bonds have turned out to be important tools for financing solar, wind, hydropower, geothermal energy, battery storage, and smart grid technologies seeking supporting national climate commitments and carbon reduction goals. On one hand, energy bonds have been directly contributing to energy security by financing domestic energy production, it has also encouraged private sector participation through transparent investment frameworks - ultimately standardizing reporting and environmental disclosure format. Through successful energy bond programs, the creation of positive spillover effects stimulating employment, technological innovation, and local capital market development is actually possible.

States, Energy bonds holds long history of utilization of municipal bonds and green bonds for financing electricity generation, renewable energy projects, and transmission of infrastructure. In Europe, energy bond markets are closely linked with climate policies within the European Green Deal. There, countries like Germany, France or the Netherlands have been regularly issuing sovereign green bonds for financing renewable energy with smart grids and hydrogen projects and energy efficient infrastructure. China has emerged as one of the world's largest issuers of green and energy-related bonds. Chinese policy banks, state owned enterprise and commercial banks all actively issue green bonds to finance renewable energy with electric vehicle infrastructure and grid expansion.



Source: Asia Capital Markets Report 2025.

Green bond issuance has rapidly expanded after 2020. Here, although issuance slowed during 2022-23 because of higher global interest rates, it recovered in the year 2024. This shows that renewable energy remained one of the largest uses of proceeds for these bonds.

International Practices

Energy bonds have evolved into major financing mechanisms through different models. In the United

Here, Government policies have standardized eligible projects and have strengthened disclosure requirements too. India has also adopted green and energy bonds for financing renewable energy, particularly solar and wind projects. Public sector organizations like National Thermal Power Corporation (NTPC), Indian Renewable Energy Development Agency (IREDA), and Power Finance Corporation have successfully raised substantial capital through green bond issuance.

Reasons for Promotion of Energy Bonds Recently

Nepal is pushing towards energy bonds, and it is best understood as a response to structural financing constraints. Here, hydropower projects are extremely capital intensive, and they have long gestation periods before generating any form of revenue; they will all require financing tenures which will get stretched beyond what is conventional short- to medium-term bank deposit support. Relying on bank loans alone concentrates the whole set of risk within the banking system, and it can crowd out the whole lending function to the next set of productive sectors. It is also referred to as 'financial resource mix' rather than continued dependence on any bank debt alone for financing the whole set of energy infrastructure (Merolagani, 2026).

Besides, there are different concrete regulatory measures that show examples of this shift. Central Bank of Nepal has relaxed the single obligor limit - creating a cap on how much banks' core capital can be lent to a single borrower or the sector. So, from the standard itself, 25 percent will be applicable to most of the sectors, and as much as 50 percent for energy and transmission line-based infrastructure. Then, there are banks that have been permitted to set aside only 1 percent for loan loss provisioning during a hydropower project's construction (grace) period, substantially lower than provisioning requirements elsewhere. This will reduce the cost of capital for banks financing such projects (Merolagani, 2026).

Then after, for projects having larger than 40 megawatts, banks can capitalize interest that accrued during the whole grace period rather than seeking ways to require immediate cash payment easing early-stage cash flow-based pressures. And then, seeking specific relevance to retail investors, NRB has been able to create a policy framework under which banks can issue energy bonds. Mechanism intending to mobilize additional capital beyond what directs whole lending alone could provide in the whole process. The context of mid 2026 shows that commercial and development banks that has collectively invested around NPR 10 to 11 billion in energy bonds. So, at the time when it remains modest relative to roughly 500 billion in outstanding energy sector loans, it brings signals in the whole direction, with regulators seeking the market to move around.

Recent and Upcoming Energy Bond Issuances

There are different retail investors that seeks ways to evaluate this asset class and benefit from looking at some concrete recent examples instead of seeking abstract policy-based statements.

- Nepal Electricity Authority (NEA) bonds: During late 2025, NEA has announced plans, following the cabinet's approval, to issue energy bonds worth NPR 20 billion in different phases to finance four major hydropower projects. This will include 1100 megawatt Upper Arun Hydropower Project. NEA's own initiative and leadership has clearly brought signal that future bond proceeds should be directed not just on toward generation capacity but, it will be signaled that future bond proceeds will be directed not just toward generation capacity. It will rather look into ways for strengthening transmission along with the distribution process.
- Dedicated bonds for flagship projects: Monetary Policy for the current fiscal year has created room for dedicated bonds that have to be issued for government prioritized mega projects like the Budhi Gandaki Hydroelectric Project, which allows these projects to raise resources outside the conventional bank lending channel.
- Green Bonds: Although different from energy bonds, but they are closely related to energy bonds itself. Green bonds are an emerging category of energy bonds where debt instrument proceeds are earmarked specifically for environmentally sustainable projects, certified against any kind of recognized framework. In 2025, Nepal Infrastructure Bank Limited (NIFRA) intends to support whole Global Green Growth Institute (GGGI), and Korea International Cooperation Agency (KOIIA) intends to secure regulatory approval from both NRB and SEBON

for the whole country's first green bond issuance with it. The Green Bond Framework aligns to International Capital Market Association's Green Bond Principles seeking EU taxonomy and Nepal's own Green Finance Taxonomy as well (GGGI, 2025).

- Bank's Bonds: NMB bank issued first ever green bond worth $60 million, investment-backed by International Finance Corporation (IFC), British International Investment (BII), and MetLife. It can be depicted that the value for this bond would range around $60 million, which targets financing for small and medium enterprise, solar power, electric vehicles, biomass, and green buildings. Although they vary from an ordinary bank's debenture, it intends to label them down and make use of proceeds, trying to mitigate credit risks from their end.

The Green Finance Taxonomy

Nepal Rastra Bank had structurally underpinned the growth of energy and green bonds in Nepal by considering the whole Green Finance Taxonomy in 2024. This would be a less visible but structurally important development that underpinned the whole growth of energy and green bonds. Considering this support from the Alliance for Financial Inclusion (AFI), the taxonomy is necessary for classification of the system, intending to define with economic activities, their assets, and projects seeking legitimate labeling of green or environmentally sustainable aspects. It was developed jointly by NRB, SEBON, along with Nepal Insurance Authority, Ministry of Finance, and Ministry of Forests and Environment, considering peer-reviewed regional central banks like Bangko Sentral ng Pilipinas and Bank Negara Malaysia (Alliance for Financial Inclusion, 2025).

As far as retail investors are considered, the taxonomy matters for two practical reasons. Retail investor looks taxonomy for practical reasons because it directly intends to reduce the risk of 'greenwashing' where issuers overstate the environmental credentials of bond for attracting capital by anchoring green-labeled bonds to defined, government-backed standards. And then, it again expects the whole process to make it easy for Nepali issuers to eventually attract international climate funds across a broader green set of capital that potentially deepens the domestic bond market, creating more issuance for local investors letting them to participate in academic research on the banking sector. The adoption of green finance practices includes bond issuance, which remains largely compliance-driven rather than deeply embedded in bank strategy, acting as barriers like limited technical expertise and inconsistent regulatory guidance (Shrestha, 2025).

Set of Risks and Returns in Energy Bonds

Just like other Nepalese debentures, Energy bonds are marketed as lower risk, having fixed income, which is an alternative to equities, where there is recent debenture issuance in Nepal offering coupon rates above 9 percent for tenures of five to ten years. They can be compared with bank fixed deposit rates, even though the comparison depends on prevailing interest rate-based conditions at the time of issuance. Here, 'lower risk' does not mean 'risk free' and investors should be able to weigh at least four categories of risks:

- Credit Risk or Default Risk: The investor's return depends entirely on the issuer's ability to pay interest and repay principal. Here, unsecured debentures, which are not backed by pledged assets work around to carry higher default risk rather than secured debentures that typically offer higher coupon rates for compensating investors for that risk. So, for energy bonds - they are issued directly by the hydropower project company rather than a bank, and investors are also exposed to hydropower-specific risks like delays in construction, overrunning costs, and hydrological variability affecting revenue which is once the projected as operational.
- Interest Rate Risk or Market Risk: The market price of a bond moves inversely with the prevailing interest rate, and if the rate rises after an investor buys a bond, the resale value on the secondary market intends to fall and vice versa.

- Liquidity Risk: Nepal's secondary market for debenture has not been so attractive, and there lies a large set of minimum trading lots. There is low daily turnover relative to equities. Here, investors who will require to exit before maturity should not assume that they can do it so quickly or without any price based discount.
- Reinvestment Risk: Here, bonds have been paying periodic fixed interest. Investors who have been planning to reinvest those interest payments would be facing risk that prevails through the time of reinvestment, lowering the bond's original coupon.

So, seeing the positive side - debentures, which also includes energy bonds, can be ranked ahead of both ordinary and preference shareholders in the event of a company's liquidation. This means that bondholders are repaid before shareholders (Nepal Laws, 2025). This priority in repayment in one reason debentures are generally considered safer than equity.

Conclusion

Energy bonds have turned out to be an important financial instrument for mobilization of long-term capital for supporting energy infrastructure, renewable energy development, and transition towards low carbon economies. International experiences hereby demonstrate that governments, public utilities, development banks, and private corporations with increasing utilization of green and energy related bonds for financing projects like renewable power generation, electricity transmission, smart grids, and energy efficiency improvements. The growth of the global market for sustainable and green bonds highlights whole increasing confidence of investors in increasing environmentally responsible investments. International evidence suggests that through a well-developed energy bond market - the contribution layer to energy security, infrastructure modernization, and private sector participation - sustainable economic growth can be achieved while reducing reliance on traditional public financing sources.

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Concept Note: GIS Framework for Distribution Network of Nepal Electricity Authority

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Abstract

The electric power distribution network is geographically most extensive and heavy capital-intensive infrastructure of the Nepal Electricity Authority (NEA). Spanning 77 districts, NEA's distribution network comprises thousands of circuit kilometers of Medium Voltage (MV) and Low Voltage (LV) lines, over 40,000 distribution transformers, and serves more than 5.2 million consumers across ultra-variable terrain from the Terai plains to high-altitude Himalayan valleys. Traditionally, asset information has depended in paper schematics, CAD files, and tacit field memory, leading to technical loss bottlenecks, unmapped consumer connections, delayed fault recovery and high operational expenses.

This article presents an enterprise vision for a standardized Geographic Information System (GIS) framework at NEA. Rather than treating GIS as software alone, this strategy outlines Phase wise Standardization, Field Data Collection, and Regional Consolidation, using open-source tools (QGIS/QField) and offline-first mobile workflows. It details the accompanying nationwide technical training program for Distribution Center and Provincial Engineers, and charts the long-term roadmap toward a centralized, cloud-hosted enterprise architecture and Distribution Management System (DMS) once substantial network data has been established.

1. Introduction & The Strategic Vision

Power distribution is fundamentally a spatial science. Every feeder, pole, transformer, and meter drop operate within a physical coordinate space and an interconnected electrical network topology. NEA's rapid expansion have achieved over 98% national electricity access. However, rapid physical expansion without a centralized spatial registry introduces severe operational inefficiencies:

- **Asymmetric Asset Knowledge:** Field operations rely heavily on the tacit memory of local line personnel rather than centralized operational records.
- **Imbalanced Phase Loading:** Lack of consumer-to-transformer phase mapping leads to severe neutral current flow, premature distribution transformer (DT) burnouts, and uncollected non-technical losses.
- **Delayed Fault Localization:** Manual physical line patrols across mountainous terrain result in mean time to repair (MTTR) figures exceeding hours for non-substation feeder faults.

This has created a crucial need for a single, reliable digital record of physical infrastructure. The implementation roadmap is structured into three progressive horizons:

- **Phase 1 (Current Strategy):** Schema standardization, offline vector field surveys, and local data consolidation.

- **Phase 2 (Workforce Readiness):** Comprehensive, hands-on training programs for Distribution Center and Provincial Engineers.

- **Phase 3 (Future IT Integration):** Migration to centralized cloud infrastructure, enterprise PostGIS deployment, and integration with advanced analytical engines.

To address this, a unified GIS Framework is conceptualized. In this initial stage, the objective is not immediate cloud automation or complex real-time software integration, but rather building the digital foundation and workforce readiness: standardizing data schemas, training field engineers, and conducting systematic field mapping.

2. Why GIS Matters: The Data-First Imperative

The implementation of an enterprise Geographic Information System should not be viewed primarily as an information technology project, but as an organizational capability-building initiative. Experience across electric utilities demonstrates that sophisticated platforms such as Distribution Management Systems (DMS), Outage Management Systems (OMS), Enterprise Asset Management (EAM), and Advanced Distribution Management Systems (ADMS) derive their value only when supported by complete, standardized, and continuously maintained spatial asset data.

At present, NEA's distribution information exists in varying forms including paper drawings, CAD files, locally maintained records, and institutional knowledge held by experienced field personnel. Although these resources have supported network operation for decades, they do not provide the standardized digital asset inventory required for enterprise-wide planning, engineering analysis, or automated operational workflows. Consequently, organizations attempting to deploy advanced utility software before establishing a reliable spatial database frequently encounter low system utilization, inconsistent data quality, duplicated field surveys, and costly software customization.

Accordingly, the proposed framework adopts a Data First, System Later philosophy. The immediate business objective is not the deployment of enterprise GIS software, but the creation of a trusted national spatial asset baseline accompanied by a workforce capable of maintaining it.

This initial investment delivers several strategic benefits:

- Establishes a standardized national digital inventory of distribution assets.

- Eliminates repeated asset surveys conducted independently by different projects.

- Improves planning efficiency through accurate network information.

- Reduces engineering effort required for project design and asset verification.

- Provides a common spatial reference for future digital initiatives.

- Develops internal GIS competency across Distribution Centers and Provincial Offices.

- Significantly lowers implementation risk for future enterprise systems by ensuring high-quality source data before software deployment.

Rather than representing the final destination, this framework constitutes the essential preparatory phase upon which NEA's long-term digital utility transformation can be successfully constructed.

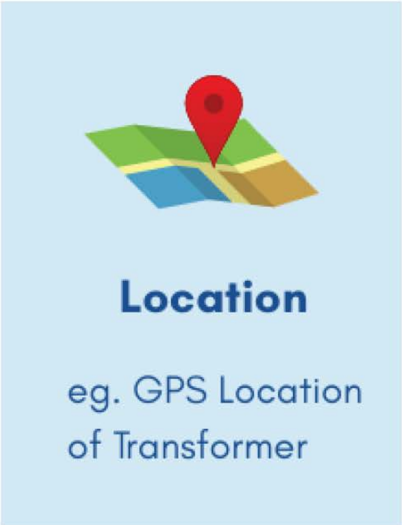
3. Core Philosophy of the Spatial Asset Model

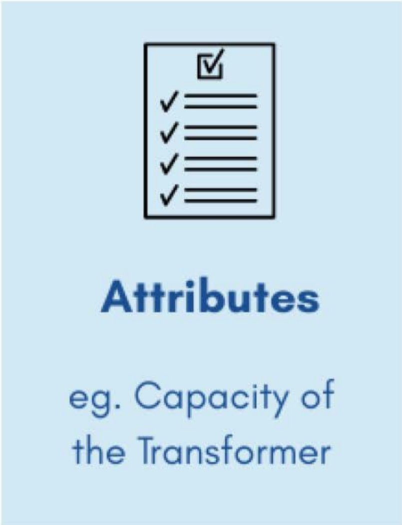
The proposed framework models the physical network as a continuous topological graph. Every asset represented in the GIS framework must maintain a tripartite identity:

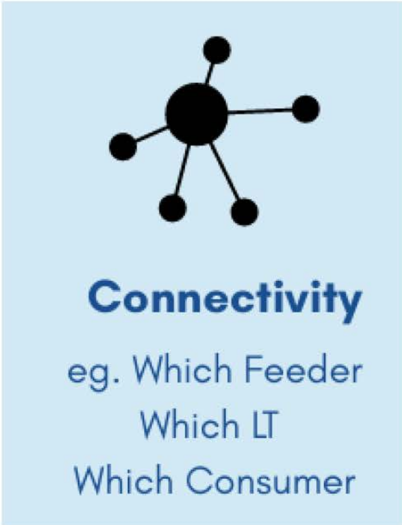
1. **Spatial Identity:** Absolute physical coordinates (WGS 84 / UTM Zone 44N & 45N), elevation parameters, and structural photograph attachments.

2. **Engineering Attributes:** Standardized equipment specifications including conductor type, transformer kVA rating, pole type (height and material composition), and installation dates.

3. **Network Connectivity:** Directional node-edge transforming simple points on a map into an analytical electrical model.







4. Standardized Asset Hierarchy & Attribute Schemas

To prevent schema fragmentation across NEA's 8 Provincial Offices and over 120 Distribution Centers (DCs), the conceptual framework establishes a uniform 4-Tier Hierarchy based on NEA organizational chart and operational management:

Tier 1: Primary Network Assets

- **Grid Substations:** Substation Code, MVA Capacity, Voltage Ratios, Bus Layouts.
- **MV / LV Feeders:** Line Name, Voltage Class (33 kV, 11 kV, 400 V), Conductor Types, Line Lengths.

Tier 2: Distribution Infrastructure

- **Distribution Transformers:** Unique DT Code, kVA Rating, Primary/Secondary Voltages, Phase Configuration.
- **Poles & Structures:** Structure ID, Height, Material Type (STP, PSC), Stay etc.

Tier 3: Consumer & Service Level

- **Service Connections:** Customer ID, Tariff Class, Meter Serial Number, Connected Phase etc.

Tier 4: Spatial Reference Layers

- **Base maps:** Administrative Boundaries (District/ Palika/Ward), Road Networks, Vegetation Mapping, Satellite Imagery.

5. Offline Field Data Collection Schema Development

In Nepal's geography, constant cellular connectivity cannot be assumed during field audits. Therefore, Phase 1 adopts an Offline-First Field Data Collection Strategy utilizing lightweight, open-source mobile vector tools (such as QField) running on standard Android devices.

1. **Pre-Configured Datasets:** A core team working on this model have already developed a standard dataset to prepare schema-constrained GeoPackage files which can be downloaded for specific Distribution Center area over local office Wi-Fi.

2. **Standardized Input Forms:** Dropdown lists, enforced fields, and auto-generated IDs prevent manual data-entry errors in the field.

3. **Standard Mobile GPS:** Mobile devices can pair via Bluetooth with portable GNSS receivers, ensuring sub-meter positional accuracy for critical infrastructure but this may not be practically possible due to absence of such device, hence standard GPS with accuracy of 3 m to10 m will be implemented as available in commonly used android cellphones.

6. Capacity Building: Nationwide Workforce Empowerment

A core pillar of this ideational phase is establishing a comprehensive, hands-on training curriculum for Distribution Center Engineers and Provincial Engineers. Technical tools are only as effective as the teams operating them.

Target Training Curriculum

- **Distribution Center (DC) Engineers:** Provincial Level Training covering QGIS desktop management, QField Data Capture, GeoPackage maintenance, basic spatial topology checks, and attribute validation for local gatekeeping and quality assurance.

- **Field Technicians & Surveyors:** DC Engineer led training on each DC focusing on mobile data capture, GPS positioning, photo tagging, and boundary identification to produce planning level accuracy and standardized field maps.

- **Provincial Engineers:** Concentrates on regional data merging, edge-matching across DC boundaries, spatial analysis, and progress reporting to maintain high-quality consolidated regional network models.

7. Data Governance & Consolidation Pipeline

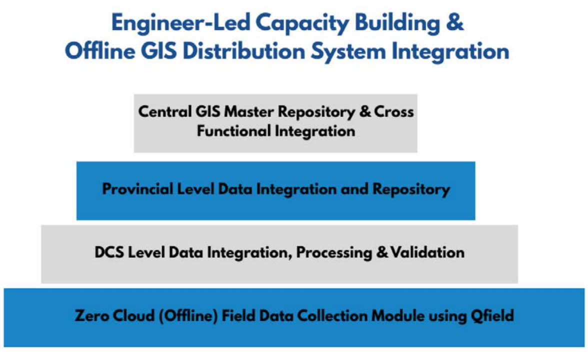
To ensure that collected field data meets professional engineering standards, the framework defines a structured multi-tiered quality control pipeline:

- **Layer 1 (Field Survey):** Edge capture using standardized mobile forms with required fields and dropdown constraints enforcing clean data entry.

- **Layer 2 (Distribution Center QA/QC):** DC Engineers review submitted files in QGIS using automated topology rules to snap line dangles and check orphaned poles.

- **Layer 3 (Provincial Consolidation):** DC datasets are merged into unified Provincial Geodatabases while reconciling boundary alignments and projection parameters.

- **Layer 4 (National Data Baseline):** Aggregation into a consolidated national distribution network dataset, establishing the required data volume to justify enterprise IT deployment.



8. Long-Term Vision: Cloud Architecture & Intelligent Grid Layer

Once a substantial threshold of verified field data is collected and consolidated nationwide, NEA can confidently achieve the transition to Phase 2: Building the Cloud IT Layer. Deploying complex enterprise software prior to acquiring clean asset data often leads to low adoption and high implementation costs.

Future System Capability Expansion

- **Cloud-Hosted Central Spatial Database:** Migrating consolidated local files into a centralized PostgreSQL/PostGIS cloud engine for organization-wide access.
- **Distribution Management System (DMS) Integration:** Running 3-phase load flow analyses, simulating feeder re-configurations, and optimizing voltage profiles.
- **Outage Management System (OMS):** Tracing fault locations along connected network paths and notifying affected downstream consumers automatically.
- **Enterprise Asset Management (EAM):** Tracking asset depreciation, maintenance histories, and replacement schedules across the entire equipment lifecycle.

9. Implementation Challenges and Strategic Recommendations

Challenge Domain	Operational Risk	Strategic Mitigation Strategy
Data Maintenance Drift	Network extensions made in the field are not updated in the GIS database, leading to decay in data accuracy.	Link project clearance and contractor final payments directly to verified, "As-Built" GIS vector submissions.
Projection Distortions	Nepal spans two UTM zones (Zone 44N and 45N), causing edge-matching errors at boundary districts.	Enforce central storage in suitable CRS with unified dynamic reprojecting at client levels.
Change Management	Resistance from legacy field staff accustomed to paper ledger systems.	Institutionalize mandatory spatial tool training at the NEA Training Center; establish dedicated GIS Cadre positions at every Distribution Center.

10. Conclusion

The conceptual GIS Framework for the Nepal Electricity Authority represents a practical, staged approach to digital utility transformation. By recognizing that data collection, workforce training, and regional consolidation must precede cloud software integration, this framework establishes a clear image with realistic path forward. Past experiences have shown that deploying enterprise-level grid modernization tools directly is rarely effective or sustainable until a substantial portion of the workforce becomes proficient with the underlying systems Furthermore, isolated GIS efforts by motivated individuals have historically failed to become institutionalized across the organization.

Hence, it is proposed that the systematic development of the people, standards, workflows, and spatial data is necessary for enterprise GIS to become sustainable, economic and efficient. Empowering Distribution Center and Provincial Engineers with standardized tools and structured training will convert NEA's physical infrastructure into a reliable, high-quality digital dataset. A specialized central Distribution System GIS development project team comprising of Distribution System, GIS and IT Experts should be established to govern this network data developing cloud-based architecture and intelligent grid layer. This foundation will serve as the engine for NEA's future cloud architecture, smart-grid initiatives, and operational excellence for years to come.

Powering the Future: Achieving Net-Zero in a Fossil-Fuel Dominated World

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1) Introduction- Concerning the Reality of Global Energy Mix

The world is racing toward a cleaner future, yet it continues to stand on a fossil-fuel footing. Despite decades of climate commitments, the modern global energy system remains heavily dependent on fossil fuels, which still account for nearly 80% of total energy consumption. In contrast, renewable energy sources including solar, wind, and hydropower contribute around 15% globally, with nuclear power providing the remaining 5% (Fig.1). This imbalance highlights a massive gap between rapid technological advancements and the slow pace of the actual green transition. Consequently, global energy systems remain highly exposed to price volatility, supply disruptions, and rapid environmental degradation. This reality has forced a critical paradigm shift: modern energy security can no longer just focus on an uninterrupted energy supply. Instead, it demands a sustainable approach that simultaneously balances four interconnected dimensions:

- **Availability:** Securing stable, continuous energy supplies.
- **Affordability:** Ensuring costs do not burden consumers
- **Accessibility:** Delivering reliable power infrastructure to all segments of society.
- **Sustainability:** Restructuring the energy mix to drastically reduce carbon emissions

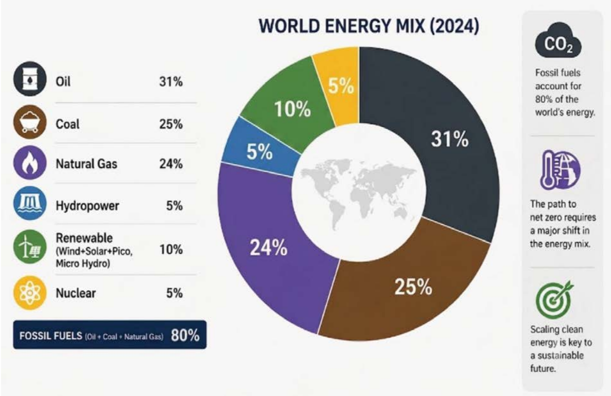

Fig 1: world energy mix scenario of 2024

2) Nepal's Current Energy Profile

A similar scenario to the global energy mix is observed in developing nations like Nepal. While Nepal has achieved massive success in ensuring its electricity grid access to its people, powered by renewable hydropower, its overall energy mix tells a completely different story.

According to the Energy Sector Synopsis Report 2024, Nepal's total energy consumption for 2024 was 532.42 Petajoules (PJ). When categorized by fuel type (Fig. 2), traditional biomass fuels account for the maximum share at 63.87%, followed by commercial fossil fuels at 25.80%. Despite massive grid advancements, grid electricity contributes just 7.23%, and isolated renewable energy sources represent 3.10% of total consumption. This indicates a stubborn, continued reliance on conventional biomass for heating and cooking, alongside imported petroleum for transportation.

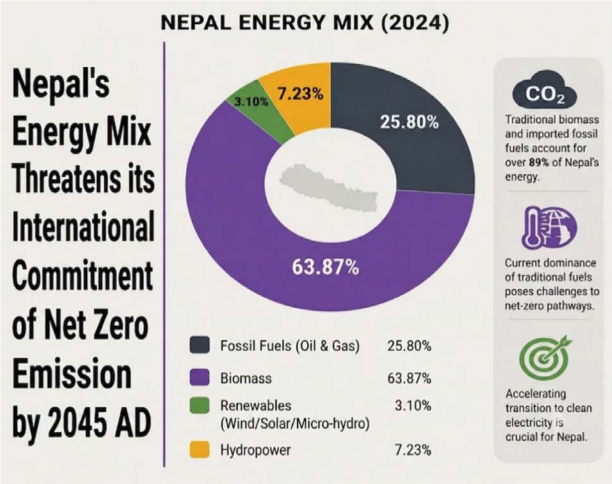

Fig 2: Nepal energy mix scenario of 2024

3) The 2035 Roadmap: Nepal's Targeted Energy Restructuring

The Government of Nepal introduced the 'Energy Development Roadmap and Action Plan-2081'. This ambitious framework targets an installed capacity of 28,500 Megawatts (MW) of electricity by 2035, allocating 15,000 MW for regional export and scaling domestic demand up to 13,500 MW (a massive leap from today's peak demand of roughly 2,000 MW). As shown in Fig 3, this transition will fundamentally restructure the nation's consumption landscape. As the grid expands, grid electricity will step up to cover 38.62% of total consumption, forcing traditional fuels down to 58.88%. Meanwhile, off-grid renewable supply will slightly decrease to 2.50% as the grid reaches a greater share of communities.

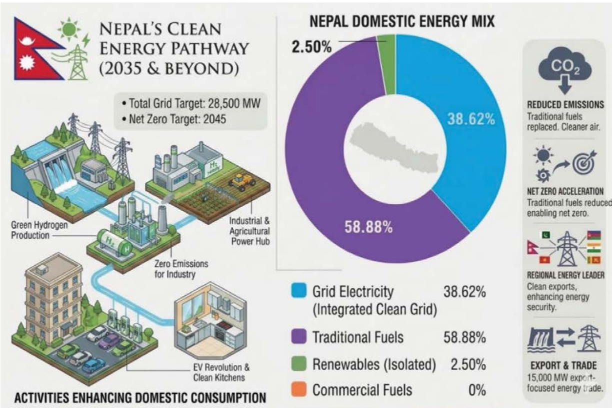

Fig 3: Nepal energy mix scenario of 2035 as per Energy development roadmap

4) The Hurdles to Our Future and Way Forward: Redefining Energy Security

The transition toward a sustainable energy system is heavily constrained by a complex interplay of technical, economic, and institutional bottlenecks. As integration of utility-scale solar and wind energy remains a major barrier due to its intermittent nature, it demands massive investments in advanced battery energy storage systems and digitized grid management to maintain a stable, uninterrupted supply. While hydropower offers reliable and dispatchable power, however, rapidly scaling this capacity is constrained by extensive project timelines and environmental concerns. Furthermore, a heavy reliance on run-of-river plants designed with a low probability of exceedance (Q_{design}) creates severe seasonal gaps in energy generation. Beyond these physical constraints, further difficulties arise from policy inconsistencies, regulatory bottlenecks, and an economic infrastructure stubbornly locked into fossil fuel dependencies.

The Way Forward-

To overcome existing barriers, Nepal must shift its focus from simply increasing power generation to strategically managing its energy system. The most effective pathway lies in focusing on developing peaking run-of-river (PROR), storage, and pumped-storage hydropower projects to bridge the dry-season deficit when ROR plants generation drops to minimum capacity. Simultaneously, the country must increase domestic demand to prevent wet-season power spillage by aggressively replacing imported petroleum and cooking gas with electric options in the transport and domestic sectors.

Furthermore, achieving the investment targets of Nepal's 2035 Energy Development Roadmap requires removing regulatory bottlenecks to attract private capital and foreign direct investment (FDI). Simultaneously, we must introduce innovative financing tools like climate finance and green bonds to fund sustainable practices. These efforts must be paired with active engagement in regional cooperation frameworks to enable cross-border investments and seamless energy trading, ultimately securing a reliable, integrated South Asian energy market.

5) Why Nepal's Energy Transition Target Matters: A Strategic Advantage

While Nepal's commitment to achieve net-zero emissions by 2045 reflects exceptional climate leadership, the true significance of this target lies in a regional competitive advantages. Unlike neighboring giants that struggle to break their heavy reliance on fossil fuels, Nepal possesses a massive, untapped asset that the rest of South Asia desperately needs: predictable, large-scale hydropower. This resource gives Nepal strategic opportunities because major regional economies like India, despite their bold net-zero commitments, face immense hurdles in replacing dirty energy. India's green strategy relies heavily on solar and wind power, which are inherently intermittent and difficult to integrate into a grid without causing severe instability; furthermore, India's own domestic hydro potential is strictly limited. Nepal’s abundant hydropower solves this regional crisis by acting as a giant, natural battery that can export reliable, clean electricity to balance out the fluctuations of India’s solar and wind generation, making India's net-zero transition technologically viable. A similar market exists in Bangladesh too, as energy demand is skyrocketing due to growth in population as well as economic activities, but it remains heavily dependent on depleting energy sources like domestic gas and other fossil fuels. Geographical constraints leave Bangladesh with virtually no capacity to develop its own large-scale wind, solar, or hydro infrastructures. Considering these prospects, we can say that Nepal’s clean energy offers the nation an opportunity to fulfil its own net zero emission as well as by taking part in fulfilling the obligation of net-zero emission of neighboring countries, Nepal will position itself as a hub country of green growth across South Asia. Through the dual strategy of replacing costly fossil fuel imports and generating massive export revenues from India and Bangladesh, Nepal can eliminate its trade deficit and protect itself from volatile oil markets. Ultimately, this shift redefines Nepal, transforming its landlocked geography into a regional hub for green growth.

6) Conclusion

Ultimately, shifting to a clean energy paradigm is no longer an optional environmental choice; it is an imperative national security priority for ensuring long-term energy security, macroeconomic stability, and planetary survival. For Nepal, this transition represents far more than a localized shift in power generation; it serves as a pioneer model for regional decarbonization in a world that still heavily reliant on fossil fuels. To evolve from a reality where traditional biomass and imported petroleum constitute over 89% of national energy consumption to a future where grid electricity commands nearly 39% by 2035 is a profound transformation. Realizing the targets of the 2035 Roadmap requires proactively overcoming technical, seasonal, and regulatory bottlenecks while scaling up storage and pumped-hydro projects.

Furthermore, Nepal’s net-zero transition is not a burden of compliance, but a profound economic opportunity. Nepal has the potential to become the green battery of South Asia. By unlocking its large-scale hydropower, the country can stabilize India’s intermittent solar and wind grids, fuel Bangladesh’s booming economy, and displace dirty fossil fuels across the region. Achieving this requires comprehensive domestic energy restructuring combined with robust regional market integration. In doing so, Nepal will not only protect its economic autonomy and reduce trade deficits but also emerge as a prominent regional leader in climate action.

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INTEGRATED RIVER BASIN MANAGEMENT IN NEPAL: LESSONS FROM THE HINDU KUSH HIMALAYAN REGION FOR SUSTAINABLE WATER GOVERNANCE

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Abstract

HKH region, known as the "Water Tower of Asia," is a critical freshwater source supporting nearly two billion people across Asia. However, due to various regions there is unprecedented pressure on the region's river systems highlighting the urgent need for integrated and cooperative water resource management. This article describes the concept, principles, and significance of IRBM as a holistic approach to managing water, land, and related natural resources at the river basin scale. It discusses the relevance of IRBM in addressing various issues in the HKH region. Furthermore, the article also analyzes the major barriers that hinder effective implementation of IRBM. In context of IRBM This article also discusses practical insights from the 2025 ICIMOD Multiscale IRBM Training and field learning in China's Yangtze River sub-basin. Furthermore, it assesses Nepal's current status of river basin management, key challenges, and opportunities. The article concludes that strengthening IRBM is essential for enhancing water security, building climate resilience, conserving ecosystems, and promoting sustainable development across the HKH region, particularly in Nepal.

Keywords: *Integrated River Basin Management; Hindu Kush Himalaya; Water Security; Climate Change Adaptation; Transboundary Water Governance; River Basin Management.*

1) INTRODUCTION

The Hindu Kush Himalayan (HKH) region, often referred to as the "Water Tower of Asia," is one of the world's most significant freshwater sources. Stretching across eight countries namely Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. The region contains the headwaters of ten major river systems, including the Indus, Ganges, Brahmaputra, Mekong, Yangtze, and Yellow rivers. These rivers support the livelihoods, food security, energy production, biodiversity, and economic development of nearly two billion people. However, this region is currently navigating a period of profound and accelerating transformation, with its core biophysical and socio-economic components facing unprecedented stress. As per the HKH snow update, 2025 by International Centre for Integrated Mountain Development (ICIMOD), year 2025 has not only been the third consecutive year of below normal snow persistence, but it also hit a twenty three year record low of 23.6% below normal. This physical instability directly impacts water security, as the "Water Tower of Asia" struggles with erratic river flows that threaten the livelihoods of nearly two billion people downstream. Simultaneously, the region's biodiversity, which anchors four global hotspots (The Himalaya Hotspot, The Indo-Burma Hotspot, The Mountains of South-West China, The Mountains of Central Asia) is under siege from habitat fragmentation and "elevation-dependent warming," where high-altitude temperatures rise faster than the global average (historical data over the past six decades shows that the mean temperature has increased at a rate of 0.2˚C per decade, significantly outpacing the global average increase of 0.13˚C per decade for the same period (Molden et al., 2021).

Socially and economically, the HKH remains a paradox of vast natural wealth and deep human vulnerability, with 31% of the population living below the poverty line (The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People (Wester et al., 2019)) and facing an escalation of "cascading disasters" like Glacial Lake Outburst Floods (GLOFs). Since 1975, glaciers in the Hindu Kush Himalaya have undergone a dramatic thinning, with an average cumulative ice thickness loss of approximately 27 meters, a trend that has significantly destabilized high-altitude glacial lakes (Maurer et al., 2019).

Consequently, the current status of the HKH is defined by a closing window for adaptation, necessitating urgent, transboundary cooperation to manage these interconnected systemic risks.

This article discusses the concept of Integrated River Basin Management, its principles, relevance, challenges, opportunities, and future prospects in the context of the Hindu Kush Himalayan region and Nepal.

2) BACKGROUND:

Integrated River Basin Management (IRBM) provides a holistic framework that treats entire river basins as single, interconnected units, allowing for the coordinated management of water, land, and related resources. It offers a holistic framework to address these complex and interconnected issues by integrating technical knowledge with governance principles.

The primary objective of IRBM is to maximize social and economic benefits equitably without compromising the sustainability of vital ecosystems. It integrates water resource management with land use planning, biodiversity conservation, disaster risk reduction, agricultural development, hydropower generation, and community participation.

Integrated Water Resources Management (IWRM) has been defined by the Technical Committee of the Global Water Partnership (GWP) as “a process which promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (GWP, 2000).

While the International Union for Conservation of Nature (IUCN) embraces the broad consensus that IRBM is a process to coordinate the conservation, management, and development of water, land, and related resources across sectors within a given river basin, the IUCN distinctly frames IRBM through an ecosystem centric and governance first lens.

Similarly, IRBM is defined by World Wide Fund for Nature (WWF) as the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems. In its operational guidelines, WWF narrows this down to a clear, actionable mandate as IRBM is a process that maintains a balance between the human use of water and the preservation of natural ecosystem functions. Rather than treating the river basin simply as an economic or administrative unit, the IUCN emphasizes that ecosystems are the primary infrastructure of a basin and that effective management requires good water governance and Nature based Solutions (NbS).

This approach is vital for balancing the "mountain paradox" of increasing water-related disasters (like GLOFs and flash floods) with the growing socio-economic demand for hydropower and irrigation. By prioritizing ecosystem-based adaptation and transboundary cooperation, IRBM ensures that upstream conservation efforts directly support the water security of the 31% of the population living below the poverty line, ultimately safeguarding the "Water Tower of Asia" for the two billion people downstream who depend on its increasingly erratic flow.

The fundamental principles of IRBM include:

- River basin as the planning unit
- Integrated management of land and water resources
- Stakeholder participation
- Ecosystem conservation
- Equitable water allocation
- Cross-sectoral coordination
- Adaptive management based on scientific evidence
- Transboundary cooperation

Though IRBM and IWRM are fundamentally similar to each other, however still there exists some differences between them. They differ in their scope and focus. IWRM is rather a broad approach that promotes the coordinated development and management of water, land, and related resources across all sectors to maximize economic and social welfare while ensuring environmental sustainability. It considers water resources at national, regional, and local levels and addresses issues such as water allocation, governance, and policy. Opposite to that, IRBM is a more specific application of integrated management that focuses on an entire river basin as the natural planning and management unit. It emphasizes the sustainable use and protection of rivers, tributaries, wetlands, and associated ecosystems within a watershed while balancing the needs of upstream and downstream users. IWRM provides the overarching framework for integrated water management, whereas IRBM applies these principles specifically within the geographical boundaries of a river basin, making it particularly effective for addressing basin-scale water challenges and transboundary water management.

The Mekong River Basin is one of the good examples of IRBM in practice. The river flows through six countries including China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. This makes cooperation essential for managing shared water resources. Through the Mekong River Commission (MRC), the four lower Mekong countries (Laos, Thailand, Cambodia, and Vietnam) work together to coordinate water resource planning, flood management, hydropower development, fisheries conservation, environmental protection, and drought preparedness.

Some of the other best examples of IRBM in practice around the world are Murray–Darling Basin Authority (Australia), International Commission for the Protection of the Danube River (Europe), Tennessee Valley Authority (United States), Rhine Commission (Western Europe), Orange–Senqu River Commission (Southern Africa) etc.

3) IMPORTANCE OF IRBM IN HKH REGION:

As like other parts of the world, the concept of IRBM is equally important and relevant in the context of HKH region. Its importance can be highlighted from the following points;

3.1 limate Change Impacts:

Climate change is rapidly altering hydrological systems throughout the HKH. Rising temperatures have accelerated glacier retreat, reduced snow cover, and changed precipitation patterns. Initially, glacier melting increases river flows, but long-term glacier loss threatens future water availability. Extreme events such as floods, droughts, GLOFs, and landslides are becoming more frequent and severe. IRBM promotes adaptive management strategies that improve resilience through coordinated planning, climate monitoring, ecosystem restoration, and disaster preparedness.

3.2 Increasing Water Demand

Rapid population growth, urbanization, agricultural expansion, and industrial development have significantly increased water demand across the region. Competing water users often create conflicts between irrigation, domestic supply, hydropower generation, ecosystem conservation, and environmental flow requirements. IRBM facilitates equitable water allocation by balancing multiple water uses while maintaining river ecosystem health.

3.3 Transboundary Nature of Rivers

Most HKH rivers flow across international borders. Upstream activities such as dam construction, water diversion, pollution, and land use change can significantly affect downstream countries. IRBM encourages transboundary cooperation through data sharing, joint monitoring, basin wide planning, conflict resolution, and collaborative water governance.

3.4 Ecosystem Conservation

The HKH region hosts globally important biodiversity hotspots, including alpine ecosystems, wetlands, forests, and river habitats. Unsustainable development threatens these ecosystems, reducing ecosystem services such as water purification, flood regulation, and habitat provision. IRBM integrates ecological conservation into water resource planning by maintaining environmental flows, protecting wetlands, restoring degraded catchments, and reducing pollution.

4) CHALLANGES OF IRBM IN HKH REGION:

There are many challenges for the implementation of Integrated River Basin Management in the context of HKH Region. Some of these challenges include;

4.1 Biophysical & Climate Challenges:

Climate change is accelerating glacier melt, altering monsoon patterns, and reducing winter snowpack. This causes extreme variability in river flows, leading to a "too much water, too little water" syndrome where severe summer floods alternate with winter water scarcity. Similarly, the young, tectonically active nature of the Himalayas makes the basins prone to cascading disasters. Landslides, debris flows, and GLOFs frequently damage downstream infrastructure and alter river courses, disrupting long-term basin planning.

4.2 Geopolitical & Governance Barriers

No single, comprehensive treaty covers entire major basins like the Brahmaputra or Ganges. Existing agreements are primarily bilateral (e.g., India-Pakistan, India-Nepal) and focus narrowly on water allocation rather than holistic ecosystem or basin management. Similarly, Hydro-meteorological data is often treated as a matter of national security rather than a public good. Minimal transboundary data-sharing often restricted only to real-time monsoon flood data prevents the collaborative, basin-wide modeling required for true IRBM.

4.2 Institutional & Structural Roadblocks

National governance frameworks frequently separate water into isolated sectors: irrigation, hydropower, drinking water, and environmental conservation rarely coordinate. IRBM requires cross-sectoral integration, which is resisted by traditional line agencies. Similarly, river basin boundaries naturally transcend political and administrative lines (local, provincial, and national). Aligning decentralized local government mandates with national and international basin objectives remains an administrative nightmare.

4.3 Socio-Economic & Inclusion Gaps

Mountain communities upstream often bear the ecological costs of conservation or infrastructure development (like hydropower), while downstream plains reap the economic benefits. Similarly, mechanisms to balance this such as Payments for Ecosystem Services (PES) are poorly developed in the region. Basin scale planning is heavily dominated by top down, engineering centric models. Traditional, community led water management practices (like ancient irrigation networks and mountain spring shed preservation) are routinely sidelined.

5) PRACTICAL INSIGHT FROM IRBM TRAINNING:

Taking the importance of IRBM into the consideration, over the past five years, ICIMOD has been conducting Multiscale IRBM trainings. Furthermore, to broaden this reach and impact, ICIMOD has initiated a Massive Open Online Course (MOOC) platform on water and climate in the HKH region, along with a field-based learning visit to a river basin in the HKH region and beyond. As a continuation of the program ICIMOD has organized the 2025 IRBM training with the focus on fostering youth leadership and Gender Equality, Disability, and Social Inclusion (GEDSI) integration into river basin management. One of the authors of this article got the opportunity for the Exposure Visit and Field Learning in China, from 7 to 15th November, 2025. The title of Module 8 was "Linking IRBM Theory to Practice: Learning Visit to the Yangtze Sub-basin in China."

The major learning from the IRBM tanning was as follows;

5.1 Multi-Level Institutional Collaboration:

The visit highlighted the necessity of cross-border and cross-agency cooperation, bringing together international bodies (ICIMOD), academic institutions (Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, Southwest University), and multi-level government departments (Chongqing Department of Water Resources) to align regional goals.

5.2 Mainstreaming Biodiversity into Water Policy:

The Food and Agriculture Organization and the Global Environment Facility (FAO-GEF) project ("A New Green Line") demonstrated how to restructure institutional frameworks so that biodiversity conservation, sustainable hydropower, and eco-tourism are deeply integrated into local, provincial, and national water resource planning rather than treated as secondary priorities.

5.3 The "Park City" Infrastructure Model:

The Tianfu New Area planning showcases a shift from traditional gray infrastructure to ecological urbanism. By systematically embedding green corridors and natural spaces as core urban infrastructure, cities can manage urban water resources effectively, mitigate heat island effects, and preserve environmental balances.

Figure 1: Tianfu New Area Planning Exhibition Hall, Chengdu, Sichuan, China.

5.6 Data-Driven Watershed Mapping:

Technical sessions underscored the role of advanced technology specifically remote sensing-based surface water mapping ("From Pixels to Policy") in analyzing complex river basin dynamics and translating physical data into enforceable policy decisions.

5.7 Green Hazard Mitigation:

The case study of the Reshui River Basin illustrated how combining ecological engineering with traditional preventive measures (green mitigation) can sustainably manage mountain hazards like landslides and debris flows without destroying local ecosystems.

5.6 Balancing Scale and Multi-Objective Infrastructure:

The massive Three Gorges Dam system proved how single river interventions must balance competing, large-scale priorities like regional flood control, massive renewable energy generation, and inland navigation improvement.

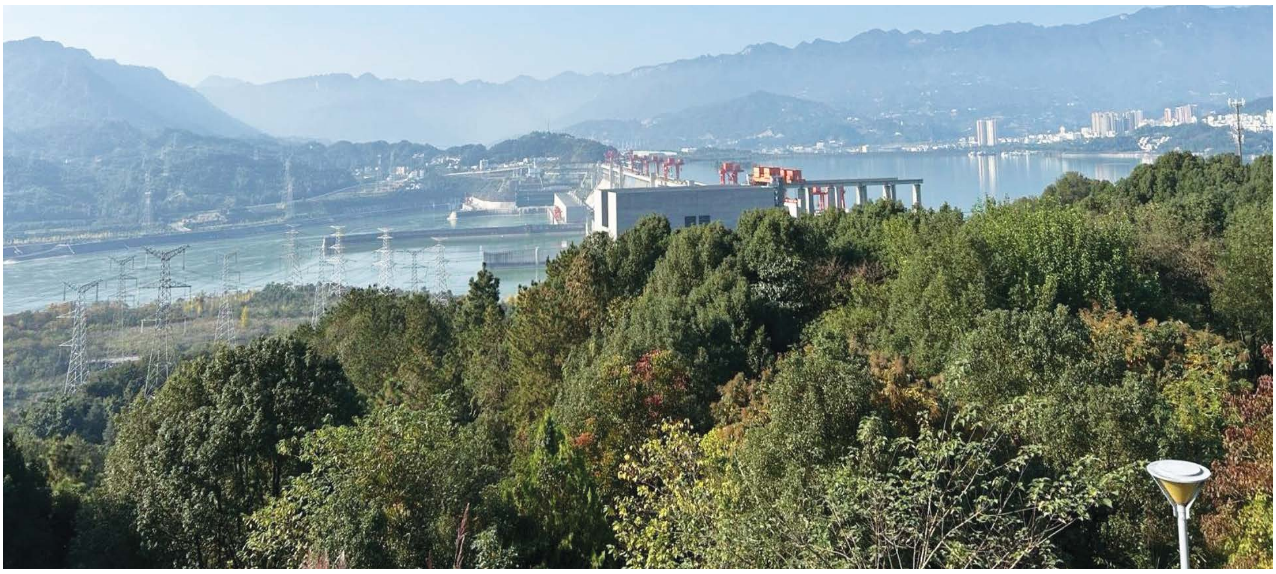

Figure 2: Three Gorges Dam, Hubei province, China.

5.7 Cascading "Counter Regulation" Systems:

The operational relationship between the Three Gorges Dam and the downstream Gezhouba Dam serves as a classic IRBM lesson in system regulation. Gezhouba acts as a critical counter regulation dam, smoothing out unstable water discharges from the larger upstream dam to ensure stable navigation levels and prevent ecological shocks downstream.

Figure 2: Three Gorges Dam, Hubei province, China.

5.8 Community and Civil Society Engagement:

Active partnerships with Civil Society Organizations (CSOs) and local volunteer citizens in areas like the Tang River highlight that sustainable watershed stewardship requires ground level public participation alongside strict engineering protocols.

6) CURRENT STATUS, CHALLENGES AND OPPORTUNITY OF IRBM IN NEPAL

Nepal has gradually incorporated river basin management concepts into national water policies and legislation. The National Water Resources Policy emphasizes integrated water resources management, while several government institutions are responsible for water related sectors, including irrigation, hydropower, watershed management, drinking water, and disaster management. The Department of Water Resources and Irrigation, Department of Hydrology and Meteorology, Department of Forests and Soil Conservation, provincial governments, municipalities, and local water user groups all play important roles. However, coordination among these institutions remains limited. River basin master plans have been prepared for several basins, including the Koshi and Bagmati, but implementation remains fragmented due to institutional overlap, inadequate funding, and insufficient technical capacity.

6.1 Major Challenges

6.1.1 Institutional Fragmentation:

Multiple ministries and agencies manage different aspects of water resources with overlapping mandates, leading to poor coordination and inefficient resource utilization.

6.1.2 Climate Change:

Changing precipitation patterns, glacier melting, and increasing frequency of floods and droughts create uncertainty in water availability.

6.1.3 Rapid Urbanization:

Urban expansion has increased river pollution, encroachment on floodplains, and degradation of wetlands, particularly in river systems such as the Bagmati.

6.1.4 Sedimentation

High erosion rates in Nepal's fragile mountain terrain result in excessive sediment loads that reduce reservoir storage, damage hydropower infrastructure, and increase flood risks.

6.1.5 Data Limitations

Comprehensive hydrological, meteorological, groundwater, and water quality data remain insufficient for effective basin planning.

6.1.6 Financial Constraints

Implementing basin wide management requires substantial investment in monitoring systems, watershed restoration, infrastructure, and institutional capacity building.

6.1.7 Transboundary Issues

Most major rivers originating in Nepal flow into India before eventually reaching Bangladesh. Effective basin management therefore requires regional cooperation on water sharing, flood forecasting, sediment management, and hydropower development.

6.2 Opportunities

Despite these challenges, Nepal has significant opportunities to strengthen the concept of IRBM. These opportunities include;

- Growing investments in hydropower provide opportunities to integrate environmental safeguards and watershed conservation into project planning.
- Advances in Geographic Information Systems

(GIS), remote sensing, drones, and hydrological modeling can improve basin assessment and decision making.

- Community forestry, one of Nepal's most successful natural resource management programs, demonstrates the potential for community participation in watershed conservation.
- International support from development partners offers technical expertise and financial resources for climate adaptation and integrated water management initiatives.
- The federal governance structure established under Nepal's Constitution provides opportunities for decentralized and participatory basin governance involving local governments.

7) CONCLUSION

IRBM represents a comprehensive and sustainable framework for managing Nepal's valuable water resources. By treating river basins as interconnected ecological systems, IRBM balances economic development with environmental conservation and social equity. Nepal's abundant rivers provide enormous opportunities for hydropower generation, agriculture, tourism, and biodiversity conservation, but these benefits can only be sustained through coordinated planning, strong institutions, stakeholder participation, and climate resilient management.

As Nepal continues its journey toward sustainable development, implementing effective IRBM will be essential for ensuring water security, reducing disaster risks, protecting ecosystems, and improving the livelihoods of present and future generations. A basin wide, participatory, and science-based approach offers the most promising pathway to achieving long-term resilience and sustainable management of Nepal's precious river resources.

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Chilime Substation and Transmission Hub, Rasuwa

The Vital Role of Surveying in the Development, Operation and Maintenance of the Power Sector

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Abbreviations

AI	Artificial Intelligence
CAD	Computer-Aided Design
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DSM	Digital Surface Model
DTM	Digital Terrain Model
EDM	Electronic Distance Measurement
ERS	Emergency Restoration System
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HEP	Hydro Electric Project
KMZ	Keyhole Markup Zipped
LiDAR	Light Detection and Ranging
NEA	Nepal Electricity Authority
PPK	Post-Processed Kinematic
RGB	Red, Green, Blue
RoW	Right-of-Way
RTK	Real-Time Kinematic
T/L	Transmission Line
UAV	Unmanned Aerial Vehicle

Abstract

Surveying provides the accurate geospatial information needed for planning, design, construction, operation, and maintenance of all infrastructure projects. Since the establishment of the Nepal Electricity Authority (NEA) in 1985, surveying has been the backbone of power development. Surveying practices have evolved from chains, tapes, plane tables, theodolites, levels, to advanced digital technologies such as Total Stations, Global Navigation Satellite System (GNSS), Differential Global Positioning System (DGPS), Unmanned Aerial Vehicles (UAVs), and Light Detection and Ranging (LiDAR). These technological advancements have significantly improved the accuracy, efficiency, and safety of engineering surveys. Modern geospatial technologies have also enhanced mapping, corridor planning, construction, monitoring, asset inspection, and Geographic Information System (GIS)-based asset management. The integration of high-resolution cameras, thermal sensors, LiDAR, artificial intelligence (AI), cloud-based GIS, and predictive maintenance systems is expected to transform surveying from a traditional

measurement discipline into an intelligent geospatial decision-support tool in future. This article reviews the evolution of surveying practices in NEA, highlights the role of emerging technologies, and discusses future opportunities for building a smarter, more reliable, and digitally enabled electricity network in Nepal.

Keywords: Surveying, Total Station, GNSS/DGPS, UAV, LiDAR, GIS

1. Introduction

Surveying has always been a vital part of infrastructure development and plays a key role in the planning, design, construction, operation, quantity measurement and maintenance of power projects. In Nepal Electricity Authority (NEA), surveying supports the development of hydropower plants, transmission lines (cadastral, settlement & tree counting), substations, distribution networks, and land acquisition. Since NEA was established in 1985, surveying has contributed significantly to the expansion of Nepal's electricity network. Over the years, the profession has evolved from using conventional instruments such as optical theodolites, levels, and steel tapes to modern technologies that provide faster, more accurate, and more reliable geospatial data.

Today, surveying in NEA has entered a new digital era with the use of Total Stations, GNSS/DGPS, UAVs, LiDAR, GIS, and remote sensing. These technologies have improved the efficiency of field surveys, enhanced mapping accuracy, and strengthened the planning, construction, inspection, and maintenance of power infrastructure. Looking ahead, emerging technologies such as artificial intelligence, thermal imaging and cloud-based geospatial systems are expected to further transform surveying into an intelligent tool for asset monitoring and management. This article reviews the evolution of surveying in NEA, from traditional methods to modern geospatial technologies, and discusses future trends that will support the development of a smarter and more resilient power system in Nepal.

2. Evolution of Surveying Technologies in NEA

Table 1: Evolution of Surveying Techniques in NEA

Period (A.D.)	Technology	Major Development
Before 1991	Plane Table/Theodolite	Conventional survey
1991–Present	Total Station	Digital surveying
2016–Present	DGPS/GNSS	Satellite positioning
2021–Present	UAV	Photogrammetry
2023 onwards	LiDAR Sensor mounted on UAV	3D point cloud and mapping
Future	AI + LiDAR+ Thermal Sensor+ UAV	Intelligent asset monitoring

3. Past, the era of conventional surveying

Before the introduction of modern digital equipment, surveying for hydropower projects, transmission lines, substations, and distribution systems in Nepal was carried out using conventional instruments such as optical theodolites, steel tapes, dumpy levels, and automatic levels. Among these, the optical theodolite was the main instrument used for measuring horizontal and vertical angles, establishing survey control, and setting out engineering structures. Survey data were recorded manually in field books, and all calculations for coordinates, elevations, and maps were completed by hand. These methods required skilled surveyors, careful observations, and considerable time to produce accurate results.

Surveying in Nepal's mountainous terrain was both challenging and labor-intensive. Survey teams often worked for days or weeks in remote areas, crossing steep hills, forests, and river valleys to collect the data needed for transmission line alignment and other engineering works. Although conventional surveying played a vital role in the successful development of NEA's early infrastructure, the process was slow and prone to human error. As power projects became larger and more complex, the need for faster, more accurate, and digitally managed surveys led to the adoption of electronic Total Stations, marking the beginning of a new era in surveying within NEA.

4. The Digital Transformation: Adoption of Total Station Technology

The introduction of the Total Station was a major step forward in modernizing surveying practices within the Nepal Electricity Authority (NEA). A Total Station combines an electronic theodolite, an Electronic Distance Measurement (EDM) device, and a built-in computer, allowing surveyors to measure angles, distances, and coordinates accurately and efficiently. Unlike conventional surveying methods, where measurements and calculations were recorded manually, Total Stations store data digitally and perform many calculations directly in the field. This reduced human error, improved accuracy, and saved significant time during both fieldwork and office processing. The collected data could also be easily transferred to CAD and GIS software for mapping and engineering design.

Total Stations soon became an essential tool for many NEA projects, including transmission line route surveys, tower spotting, foundation setting-out, substation layout, topographic mapping, hydropower construction, and as-built surveys.

They improved survey efficiency, reduced the number of personnel required, and helped complete projects more quickly. However, Total Stations still require a clear line of sight between the instrument(station) and the prism(or objects in case of reflectorless Total Station), which can be difficult in Nepal's mountainous terrain, dense forests, and long transmission corridors. These limitations led to the adoption of satellite-based surveying technologies such as GNSS, DGPS, and RTK, which further improved the speed, accuracy, and flexibility of engineering surveys within NEA.

Major projects surveyed using Total Station include Tanahu Hydroelectric Project (HEP), Upper Modi HEP, Uttarganga Storage HEP, New Khimti–Barabise 400 kV Transmission Line, Kaligandaki Corridor 220 kV Transmission Line, Kaligandaki–Ridi 132 kV Transmission Line, ERS Tower Survey at Parwanipur, Marshyangdi, Trishuli, Dumkibas and more.

Figure 1: Total Station Survey

5. Satellite-Based Surveying: The Adoption of GNSS and DGPS

The adoption of Global Navigation Satellite System (GNSS) and Differential Global Positioning System (DGPS) revolutionized surveying practices worldwide. Likewise, these technologies have played a vital role in modernizing surveying activities within the Nepal Electricity Authority (NEA), significantly improving the accuracy, efficiency, and reliability of engineering surveys for transmission lines, substations, and other infrastructure projects.

Unlike Total Stations, which require a clear line of sight between survey points, GNSS uses signals from satellites to determine accurate positions. This made surveying much faster and more efficient, especially in Nepal's mountainous terrain and long transmission line corridors. The introduction of Real-Time Kinematic (RTK) GNSS further improved fieldwork by providing centimeter-level accuracy in real time, reducing the need for lengthy survey procedures and office calculations.

Today, GNSS and DGPS are widely used in NEA for establishing survey control points, transmission line alignment and Right of way survey(cadastral, settlement & tree counting), substation surveys, hydropower projects, topographic mapping, and GIS database development. When combined with Total Stations, they provide accurate and reliable survey results even in challenging conditions. Although satellite signals can sometimes be affected by dense forests, steep valleys, or tunnels, GNSS has greatly increased the speed, accuracy, and efficiency of engineering surveys. As the demand for more detailed three-dimensional mapping and infrastructure monitoring grew, NEA gradually moved toward advanced technologies such as UAVs and LiDAR.

Major projects surveyed using DGPS include Control Point Survey of Hulingtar Dumkin Pump Storage HEP, Salleri Chyalsa HEP, Syarpu Pump Storage HEP, Damak Keraun Biratnagar 132 kV T/L, Dhaubadi Meghauli 132 kV T/L, Nijgadh harnaiya 400 kV T/L and more.

Figure 2: Static DGPS Observation

6. Bathymetric Surveying

Bathymetric surveying has become an important application of modern surveying technology within the Nepal Electricity Authority (NEA) for monitoring reservoir conditions. NEA uses the CEESCOPE Echo Sounder equipped with an inbuilt GNSS receiver to measure water depth and accurately determine the position of each sounding point simultaneously. The collected data are processed to generate bathymetric maps, reservoir bed profiles, contour maps, and reservoir capacity analyses, which help assess sediment deposition and changes in reservoir storage over time. This information supports reservoir operation, sediment management, hydropower planning, and long-term maintenance. Bathymetric surveys have been carried out at the Upper Tamakoshi Reservoir and Lower Marshyangdi Reservoir, while the Kulekhani-I Reservoir is surveyed annually to monitor sediment accumulation and evaluate changes in reservoir capacity. The integration of Echo Sounder technology with GNSS has significantly improved the accuracy, efficiency, and reliability of reservoir surveys compared to conventional methods.

Figure 3: Bathymetric Surveying in Lower Marshyangdi Reservoir

7. A New Perspective: The Emergence of UAV (Drone) Surveying

The introduction of Unmanned Aerial Vehicles (UAVs), commonly known as drones, has greatly improved surveying practices within the Nepal Electricity Authority (NEA). Unlike traditional ground surveys, drones can quickly capture high-resolution aerial images over large areas, making surveys faster, safer, and more efficient. This is especially useful in Nepal's mountainous terrain, dense forests, and remote locations, where conventional surveys are often difficult and time-consuming. Using photogrammetry software, drone images can be processed to produce orthophotos, Digital Elevation Models (DEMs), Digital Surface Models (DSMs), contour maps, and three-dimensional (3D) models.

Today, drones are widely used in NEA for transmission line route surveys, topographic mapping, construction monitoring, tower inspections, vegetation monitoring, and post-disaster assessments. When combined with RTK/

PPK GNSS, GIS, and other digital tools, drones provide highly accurate geospatial data for planning, construction, operation, and maintenance of power infrastructure. Although weather conditions, battery life, and aviation regulations can affect drone operations, UAV technology has significantly improved the speed, safety, and quality of surveying and is expected to play an even greater role in NEA's future infrastructure management.

UAV/Drone was used to capture photos and create orthophotos in Lower Marshyangdi HPS, Kulekhani Sisneri Pump Storage HEP, Uttarganga Storage HEP and more.

Figure 4: UAV Drone Survey

Figure 5: Orthophoto created from UAV Drone Survey

8. LiDAR Technology: The Next Generation of Precision Surveying

Light Detection and Ranging (LiDAR) is one of the latest and most advanced surveying technologies used for collecting accurate three-dimensional (3D) geospatial data. It works by sending laser pulses to the ground and measuring the time taken for the reflected signals to return. This process creates millions of 3D points, known as a point cloud, which accurately represents the terrain (by creating DTM, DSM, DEM), vegetation, buildings, transmission towers, and other structures. Unlike conventional photogrammetry, LiDAR can capture ground elevations even in areas covered by dense vegetation, making it especially useful in Nepal's mountainous and forested regions.

In the Nepal Electricity Authority (NEA), LiDAR is becoming an important tool for transmission line corridor mapping, existing transmission line monitoring, route planning, topographic surveys, vegetation monitoring, and infrastructure inspection. It can also be used to assess conductor clearances, monitor slopes, and create detailed 3D models for asset management. When integrated with drones, GNSS, GIS, and other digital technologies, LiDAR provides highly accurate and reliable data for planning, construction, operation, and maintenance of power infrastructure. Although LiDAR equipment and data processing are relatively expensive, its accuracy and efficiency make it a valuable technology for the future of surveying in NEA.

Major projects surveyed using LiDAR include Hulingtar Dumkin Pump Storage HEP, Salleri Chyalsa HEP, Syarpu Pump Storage HEP, Upper Tila HEP, Sunkoshi III Storage HEP, GIS Database Project for existing T/L of Koshi Province, Lapshiphedi Changunarayan132 kV T/L and more.

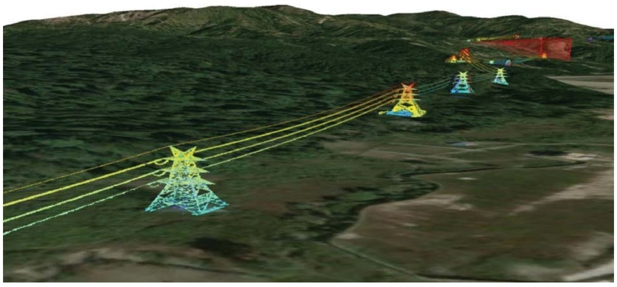

Figure 6: LiDAR Data Processing

9. Comparison of Cost, Accuracy, Time and Output

Table 2: Comparison of Cost, Accuracy, Time and Output of Surveying Techniques

Technology	Accuracy	Relative Cost	Field Time	Processing Time	Final Product
Theodolite	High	Low	Very High	Very High	Hard Copy
Total Station	Very High	Medium	High	Low	CAD/GIS
GNSS	High	High	Medium	Medium	CAD/GIS
UAV	Medium	Medium	Very Low	High	Orthophoto, DEM, DSM
LiDAR	High	Very High	Very Low	Very High	3D Point Cloud, Orthophoto, DEM, DSM

10. GIS-Based Survey Data Management and Applications in NEA

Modern surveying in the Nepal Electricity Authority (NEA) is not limited to collecting field data. Survey information collected using Total Stations, GNSS, UAVs, and LiDAR is integrated into Geographic Information Systems (GIS) for storage, analysis, and decision-making. GIS allows survey data to be visualized and analyzed in platforms such as Google Earth, making it easier to understand and use. Mapping data for transmission lines, substations, hydropower plants, NEA land properties, and Right-of-Way (RoW) can be delivered in Shapefile and KMZ formats, allowing efficient data sharing and visualization across different GIS platforms.

Regular updating of both spatial and attribute data ensures that NEA's maps remain accurate and up to date. These data can be used to prepare engineering drawings in AutoCAD, prepare customer-based mapping, perform GIS analysis, and maintain a centralized digital database. The integration of survey data into a one-click database system

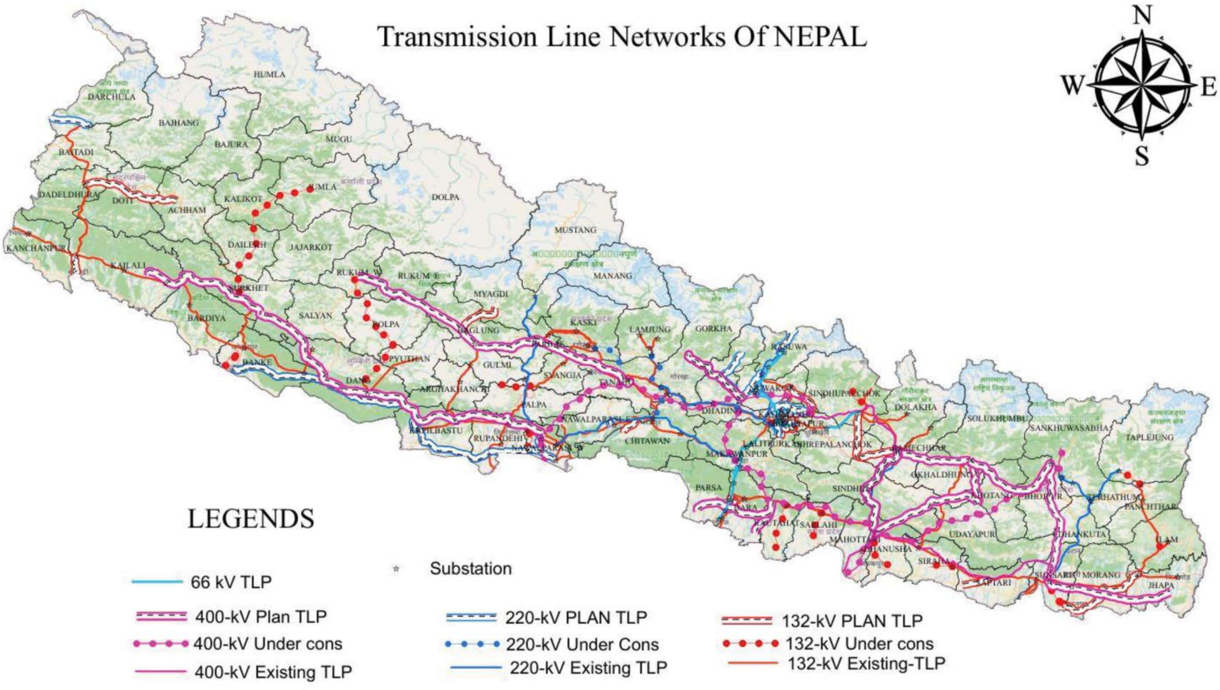

Figure 7: T/L Network of Nepal

enables quick access to information and supports planning, operation, maintenance, and asset management. It also makes geospatial information easier to use, even for staff with basic computer knowledge.

Survey professionals in the Transmission Directorate have prepared a map of Nepal containing existing, under construction and proposed transmission lines and substations using ArcGIS/QGIS software. Likewise survey professionals in Project Development Department have been taking LiDAR data of existing Transmission lines and processing them to create a GIS database. They have almost finished field works and processing works of transmission lines in the Koshi Province of Nepal.

11. Future Perspectives: Towards Intelligent Surveying and Asset Management

The future of surveying in the Nepal Electricity Authority (NEA) will go beyond traditional mapping and measurements. Modern technologies such as drones, LiDAR, Artificial Intelligence (AI) and cloud-based GIS will help collect accurate geospatial data and monitor power infrastructure in real time. Drones equipped with high-resolution cameras, thermal cameras, LiDAR, and RTK GNSS will enable faster inspection of transmission lines and substations. High-resolution images can identify damaged towers, conductors, insulators, corrosion, missing bolts, and vegetation encroachment, while thermal cameras can detect overheating equipment before failures occur. LiDAR will provide accurate 3D models, and AI will automatically identify defects and prioritize maintenance, supporting predictive maintenance and better asset management.

Future surveying will also make greater use of Web GIS and Mobile GIS, allowing customers to report location-based problems directly from the field and helping NEA provide faster and more efficient services. GIS, drones, and LiDAR will support continuous monitoring of Right-of-Way (ROW) conditions, vegetation, land use changes, and hazard-prone areas, while GIS-based analysis will help select suitable locations for new transmission lines and substations by considering hazards, soil, floods, conservation areas, settlements, and load centers. As these technologies generate large amounts of data, high-performance computers with powerful processors, sufficient RAM, and high-speed SSD storage will be essential for fast processing, 3D modelling, and informed decision-making, supporting NEA's digital transformation. Although the adoption of emerging technologies requires a significant initial investment, it will reduce survey time, improve efficiency, lower maintenance and operational costs, and provide substantial long-term benefits for NEA.

12. Recommendations

To strengthen surveying and geospatial data management within the Nepal Electricity Authority (NEA), a dedicated GIS Center should be established to develop, maintain, and regularly update a centralized geospatial database for all power infrastructure assets. NEA should also make the preparation of As-Built Drawings mandatory before the final payment of every infrastructure project to ensure an accurate and up-to-date spatial database for future planning, monitoring, and maintenance. NEA should further expand the use of Web GIS and Mobile GIS by adopting applications such as SW Maps and QField for location-based complaint reporting and field data collection. This will help identify problems more quickly, improve maintenance planning, support faster response to outages, and enhance asset management and customer service across the power network. Although the technologies will cost

13. Conclusion

The journey of surveying in the Nepal Electricity Authority (NEA) reflects the rapid advancement of technology in the power sector. From conventional instruments to modern technologies, each development has improved the accuracy, speed, safety, and efficiency of engineering surveys. These technologies have played a vital role in the planning, design, construction, operation, and maintenance of hydropower projects, transmission lines, substations, and other power infrastructure. The growing use of GIS will further enhance geospatial data management, asset monitoring, and decision-making across NEA.

Surveying will continue to evolve through the integration of high-resolution cameras, thermal sensors, LiDAR, Artificial Intelligence (AI), cloud-based GIS, and other advanced geospatial technologies. These innovations will support smarter asset monitoring, predictive maintenance, better decision-making, and more efficient infrastructure management. Although the adoption of these technologies requires significant initial investment, they will reduce survey time, lower long-term costs, optimize resources, improve customer service, and strengthen NEA's digital transformation. By investing in modern technologies and enhancing the technical capacity of its employees, NEA can build a more reliable, efficient, resilient, and sustainable electricity network to meet Nepal's growing energy needs.

Trisuli Power House, Nuwakot

Cross-Border Power Trade and Grid Harmonization in South Asia: A Comprehensive Analysis of BBIN and SAARC

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Abstract

Cross-border electricity trade (CBET) is becoming a key mechanism for regional energy cooperation in South Asia. The region faces growing electricity demand, an uneven distribution of resources, marked seasonal fluctuations in generation and consumption, and increasing pressure to shift toward low-carbon energy systems. Under these circumstances, regional power exchanges can strengthen energy security, lower electricity costs, improve overall resource utilization, and facilitate large-scale renewable integration by enabling geographic and temporal balancing of solar, wind, and hydropower. Two institutional platforms have played central roles in promoting CBET in the region: BBIN, which has become the most active operational forum for electricity trading, and SAARC, which offers a broader vision and a policy framework for long-term market integration. This study explores the development, opportunities, challenges, and future prospects of CBET in South Asia, with particular focus on grid connection standardization as the essential element for successful regional electricity integration.

1. Introduction

Electricity is shifting from a domestic utility to a strategic regional commodity that drives economic and political integration. Interconnected power systems enhance reliability, lower generation and reserve costs, optimize asset use, and smooth renewable energy variability across large geographic areas. These benefits are highly relevant to South Asia due to its complementary resources and diverse demand profiles, though progress has historically been slowed by fragmented markets, limited cross-border infrastructure, and institutional barriers. Over the past two decades, policy dialogues and pilot projects have begun paving the way for deeper cooperation.

The region exhibits clear natural complementarities that justify cross-border trade. Nepal and Bhutan possess vast hydropower potential with seasonal monsoon surpluses. India, offering the largest, most diversified market and the most advanced transmission infrastructure, serves as a logical regional hub and trading counterparty. Bangladesh represents a vital, fast-growing import center, while Sri-Lanka and Pakistan present further opportunities for targeted exchange. Together, these patterns enable temporal and spatial balancing: surplus hydro can meet deficits elsewhere, while solar and wind can be exported to regions with different generation profiles. Capturing these opportunities requires far more than building transmission lines. Reliable, commercially viable trade depends on harmonized technical standards, interoperable grid codes, robust metering, coordinated dispatch, and agreed congestion management protocols. It also demands compatible regulatory frameworks, transparent settlement mechanisms, and stable dispute resolution processes to build investor and sovereign confidence. Equally critical are institutional arrangements that foster data sharing, joint planning, and capacity building among system operators.

Consequently, grid connection standardization is a foundational prerequisite for regional electricity cooperation. Standardization mitigates technical risks, secures interconnections, ensures accurate commercial settlement, and supports large-scale renewable integration. This study focuses on the institutional and technical pathways to achieve interoperable regional operations, assesses the commercial instruments needed to mobilize infrastructure investment, and recommends measures to ensure an equitable distribution of costs and benefits among participating countries.

2. CBET in the Context of BBIN

The Bangladesh-Bhutan-India-Nepal (BBIN) sub regional framework is South Asia's most successful model for power sector cooperation. Originally focused on transport and logistics, BBIN naturally expanded into energy due to shared borders, existing transmission lines, and aligned economic interests, transforming physical connectivity into a mechanism for regional energy security.

The success of Cross Border Electricity Trade (CBET) within BBIN stems from resource complementarity, matching diverse seasonal surpluses with soaring regional deficits. Bhutan uses its massive hydropower to export clean electricity to India, generating vital national revenue. Nepal, transitioning from a deficit nation to a seasonal exporter, generates large hydro surpluses during the monsoon to export power when domestic generation peaks. Conversely, Bangladesh faces rapid industrialization and falling gas reserves, relying heavily on regional imports. Centrally located, India acts as both a major consumer and a vital transit corridor connecting the sub region's grids. To sustain these flows, the sub-region is expanding high voltage transmission infrastructure. The Muzaffarpur Dhalkebar 400 kV line has drastically increased trade between Nepal and India, while the proposed Butwal-Gorakhapur, Dododhara-Bareli, and Inaruwa-Purnima 400 kV lines will further strengthen grid stability and capacity. Additionally, the Bheramara High Voltage Direct Current (HVDC) Station acts as a technical bridge for large scale, synchronized imports into Bangladesh from India.

The most significant recent milestone is the shift from strict bilateral trade to trilateral electricity trade, enabling Nepal to export power directly to Bangladesh through Indian infrastructure. By moving past isolated, country to country deals toward an interconnected sub-regional market, BBIN nations have proven electricity can flow smoothly across multiple borders, establishing a blueprint for full scale grid integration and long term sustainability across South Asia.

3. SAARC and the Broader Regional Energy Vision

While sub-regional initiatives like BBIN focus on practical, localized implementation, the South Asian Association for Regional Cooperation (SAARC) provides the overarching political and institutional framework necessary for large scale electricity integration across South Asia. Established in 1985, SAARC brings together Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Though its original mandate was broadly defined to promote economic development, energy security has steadily risen to the top of its strategic agenda due to growing power deficits and the global shift toward clean energy.

A foundational milestone was achieved with the signing of the SAARC Framework Agreement for Energy Cooperation (Electricity) in November 2014. This landmark treaty fundamentally redefined how the region views power by formally recognizing electricity as a tradable commercial commodity rather than just a public utility. The agreement explicitly encouraged member states to enable voluntary cross border electricity trade through flexible bilateral, trilateral, and multilateral arrangements, while laying the groundwork for integrated grid operations, harmonized technical standards, and public private sector cooperation. Supporting this macro vision is the SAARC Energy Centre, which serves as the technical backbone of the organization. The center plays a vital role by conducting advanced technical feasibility studies, drafting uniform policy frameworks, and facilitating high level regional dialogues to align diverse national interests.

Admittedly, the broader progress of SAARC has frequently been constrained by deep rooted political tensions, particularly the complex geopolitical relationship between India and Pakistan, which has slowed down pan regional initiatives. Despite these friction points, SAARC remains indispensable. It stands as the most geographically comprehensive framework in existence, holding the ultimate institutional blueprint required to transform scattered bilateral agreements into a fully integrated, future South Asian Power Pool.

4. The Imperative of Grid Connection Standardization

Electricity systems are sensitive, complex networks that must be balanced continuously in real time. Any mismatch in system frequency, voltage, or protection settings can lead to widespread grid instability, catastrophic outages, or severe equipment damage. Consequently, pursuing cross border interconnection without strict standardization introduces unacceptable operational risks to all participating nations.

Grid connection standardization harmonizes technical parameters, operating procedures, communication protocols, and regulatory frameworks, enabling distinct national grids to operate together safely and efficiently. It serves as the indispensable technical backbone of cross border electricity trade. The primary requirement for synchronization is frequency management. Most South Asian nations operate their grids at a nominal frequency of 50 Hz, providing a natural technical foundation for interconnection. However, keeping this frequency within tight operational limits across multiple borders requires highly coordinated generation control and mutual reserve sharing.

Voltage standardization is equally critical for efficient transmission. Cross border lines in South Asia commonly utilize 132 kV, 220 kV, and increasingly 400 kV alternating current (AC) systems to enable large scale power transfer while reducing transmission losses. Where synchronous AC operation is technically difficult, High Voltage Direct Current (HVDC) technology provides an alternative, allowing safe power exchange between asynchronous systems while offering superior flow control and grid stability. Protection coordination represents another vital layer of operational security. Grid protection systems must detect and isolate faults within milliseconds. If neighboring systems use incompatible relay settings, a minor local fault can easily escalate into a cascading regional blackout. Harmonized protection schemes reduce this risk significantly.

Finally, modern cross border trade depends on advanced digital communication architectures. Systems such as Supervisory Control and Data Acquisition (SCADA), Energy Management Systems (EMS), and Phasor Measurement Units (PMUs) enable real time visibility, coordinated automated dispatch, and rapid emergency response. As these interconnections grow more extensive and digitally integrated, robust cyber security standards across national boundaries become increasingly important to protect regional energy infrastructure from emerging digital threats.

5. The Strategic Role of Grid Code Harmonization

A grid code defines the comprehensive technical and operational rules governing how utilities, generators, and consumers connect to and operate within a power system. Historically, each South Asian nation developed its own national grid code based entirely on unique domestic priorities, legacy infrastructures, and local regulatory environments. However, scaling cross border electricity trade beyond isolated, country to country arrangements requires these disparate rules to be systematically aligned.

Progress is already visible at the national level. For example, the Nepal Electricity Authority has actively incorporated regional harmonization principles into its updated Nepal Electricity Grid Code 2080, preparing its domestic infrastructure for deeper integration. Similarly, India's advanced transmission framework, managed under the Power Grid Corporation of India Limited, serves as a vital technical benchmark for regional interconnection standards due to its scale and modernization.

Ultimately, establishing a common regional grid code is essential for the future of South Asian energy architecture. By standardizing critical operational parameters such as frequency control response, voltage regulation limits, scheduled outage coordination, fault management protocols, and connection approval processes, a harmonized code creates a predictable and reliable environment. This regulatory and technical alignment is the missing link required to transform a collection of bilateral power lines into a truly integrated, multilateral regional electricity market.

6. Operational and Market Integration

Beyond basic technical compatibility, effective cross border electricity trade requires highly coordinated operational procedures. Core functions such as electricity scheduling, day ahead dispatch, transmission congestion management, and grid balancing must be handled collaboratively across national boundaries. Establishing dedicated regional dispatch coordination mechanisms ensures that cross border power flows remain physically secure, predictable, and economically optimized.

Concurrently, South Asia is gradually transitioning from rigid, government to government electricity trade protocols toward dynamic, market based mechanisms. The Indian Energy Exchange has become an important enabler of this structural transition, opening up avenues for neighboring countries like Nepal to participate directly in competitive day ahead and real time electricity markets. Transitioning to market based cross border trade dramatically improves price transparency, enhances resource allocation efficiency, and lowers risks for private sector developers, ultimately making regional energy commerce far more sustainable in the long term.

7. Systemic Benefits of Cross Border Electricity Trade

The economic, environmental, and strategic benefits of cross border power integration across the BBIN and SAARC regions are substantial:

- **Economic Efficiency:** Regional trade allows deficit nations to tap into cheaper surplus power across borders instead of investing heavily in expensive, redundant thermal generation. Fully coordinated power pool operations in South Asia could reduce regional generation costs by roughly five percent, saving billions of dollars.

- **Environmental Sustainability:** Hydropower rich nations like Nepal and Bhutan can export abundant clean energy, displacing carbon intensive fossil fuel generation elsewhere. This seasonal offset directly supports national climate targets, reduces air pollution, and lowers aggregate carbon emissions.

- **Enhanced Energy Security:** Interconnected networks enable mutual reserve sharing, real time emergency assistance, and seasonal balancing. By functioning as a collective network, countries can support one another during localized fuel shortages, equipment failures, or extreme weather, drastically reducing blackout risks.

- **Geopolitical Cohesion:** Successful energy commerce fosters tangible economic interdependence and mutual trust. Over time, these shared financial incentives strengthen regional cooperation, laying a peaceful foundation for collaboration in other critical sectors.

8. Persistent Challenges to Regional Integration

Despite a compelling business case, cross border electricity trade in South Asia must navigate formidable institutional and physical obstacles:

- **Geopolitical Friction:** Persistent political tensions remain a primary structural barrier, frequently stalling multilateral initiatives under the broader SAARC framework and limiting full regional cooperation.

- **Institutional and Regulatory Asymmetry:** Deep differences in national legal systems, market structures, and regulatory maturity create bureaucratic delays in cross border project approvals, contract enforcement, and policy harmonization.

- **Capital Intensive Infrastructure:** Building high voltage transmission lines, back to back HVDC converter stations, and modern switching substations requires massive capital investments and long implementation timelines. Financing these projects demands highly coordinated government guarantees and sustained multilateral development assistance.

- **Technical Capacity Gaps:** Varied levels of grid automation, digital control systems, and regulatory expertise among member nations create operational asymmetries, making real time grid integration technically complex.

9. Future Outlook and Strategic Horizon

The long-term trajectory for energy integration in South Asia remains highly promising. In the medium term, the BBIN framework will drive immediate progress through the commissioning of additional 400 kV transmission corridors, deeper cross-border market integration, and expanded hydropower development in Nepal and Bhutan. Over time, these incremental bilateral and trilateral links are projected to mature into a formal, unified BBIN regional electricity market.

At the macro level, SAARC retains the long-term vision of establishing a comprehensive South Asian Power Pool. This objective mirrors highly successful international models, such as the integrated European electricity market managed under the European Network of Transmission System Operators for Electricity (ENTSO-E) framework. Realizing this advanced stage of integration will require sustained political commitment, sweeping institutional reforms, and continuous capital investment in grid standardization.

10. Conclusion

Cross border electricity trade is fundamentally transforming the energy landscape of South Asia. Within this changing environment, the BBIN framework has proven to be the most agile and effective operational platform, demonstrating that regional electricity cooperation is both technically viable and economically highly lucrative. Meanwhile, SAARC provides the essential strategic macro framework needed to anchor long term, pan regional integration.

Ultimately, the scalability of both initiatives hinges on strict grid connection standardization. Without fully harmonized technical standards, aligned grid codes, synchronized system operations, and transparent, predictable regulations, large scale cross border power flows cannot be safely sustained. If South Asian nations successfully commit to resolving these technical and institutional challenges, cross border trade will deliver affordable electricity, robust energy security, and deep renewable energy integration, anchoring a prosperous and interconnected regional future.

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Overview of the Hetauda 400KV Substation Supporting Cross-border and Regional Power Transmission.

Repair or Replace? Techno-Economic Analysis of Distribution Transformer Maintenance Strategies in Nepal

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1. Introduction

Distribution transformers are the backbone of electricity distribution networks, stepping down sub-transmission voltages to consumer levels. As the final major component before electricity reaches end users, their performance directly influences power quality, reliability, and continuity of supply. Transformer failures result in service interruptions, increased technical losses, and reduced customer satisfaction, making effective maintenance and asset management essential. Preventive maintenance, condition monitoring, load management, and timely replacement of aging units improve system reliability and extend transformer service life. With growing electricity demand and network expansion, their importance has further increased. NEA currently operates 48,625 distribution transformers with a total installed capacity of 4,538.19 MVA (Nepal Electricity Authority, DCSD Report, 2025),. However, high failure rates caused by inadequate protection, limited condition monitoring, lightning, overloading, and network faults continue to pose significant operational and reliability challenges.

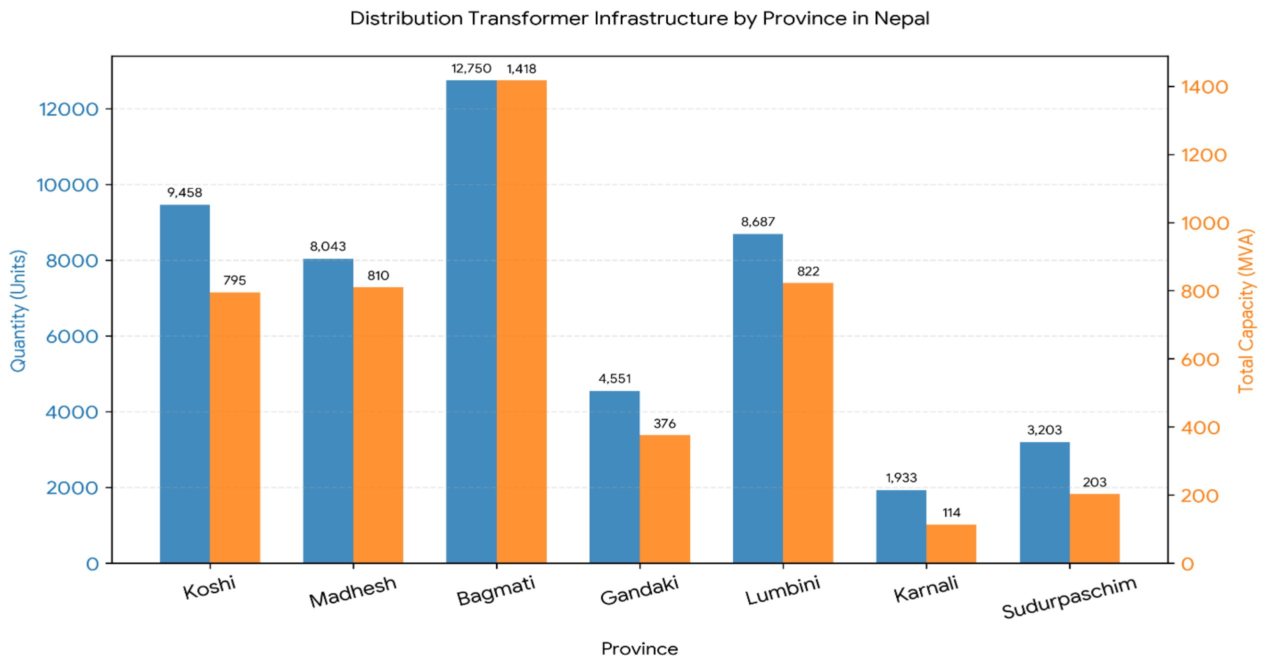


Figure-1: Distribution Transformer Installed in Nepal (Nepal Electricity Authority, DCSD Report, 2025)

Figure 1: Total Station Survey

According to the (Nepal Electricity Authority, DCSD Report, 2025), the Transformer Workshop Branch at Kharipati, Bhaktapur, which serves twenty distribution centers under the Bagmati Provincial Office, received 999 severely damaged distribution transformers for repair within a single year. These centers operate approximately 9,261 distribution transformers, corresponding to an annual failure rate of about 10.8%. Historical NEA records also indicate that the average annual transformer failure rate has remained close to 11%, meaning nearly one in every nine transformers fails each year. This high failure rate imposes substantial repair and replacement costs while adversely affecting system reliability and service quality. Moreover, Nepal's ongoing rural electrification and network expansion into remote hilly regions expose transformers to harsher operating conditions, including longer feeders, lightning, severe weather, and difficult maintenance access, which further increase failure risks. Field experience shows that over 90% of transformer failures are associated with winding damage, making winding failure the dominant cause of transformer outages in Nepal and often necessitating major repairs or complete replacement.

2. The Root Cause of Transformer Failure in Nepal

The major factors contributing to distribution transformer failures in Nepal are:

a) *Poor maintenance Practices*

Poor maintenance practices are a major contributor to the high distribution transformer failure rate in Nepal. In many cases, maintenance is performed only after a fault is suspected or a transformer has failed. Most utility management offices and distribution centers lack structured maintenance schedules, dedicated personnel, and adequate resources for transformer maintenance. Consequently, inspections are often limited to visual observations after consumers report an outage. In addition, many distribution centers have insufficient skilled technical staff to diagnose faults and perform on-site corrective actions. A common misconception that transformers require no maintenance while in operation has led to a run-to-failure approach, accelerating transformer deterioration, increasing failure frequency, and raising maintenance costs.

b) *Lack of Condition Monitoring and Asset Health Assessment*

Condition monitoring of distribution transformers is one of the most neglected aspects of transformer asset management in Nepal. In most electrification projects, transformers are installed, commissioned, and operated without systematic condition assessment throughout their service life. Monitoring is generally limited to loading measurements during peak demand periods to assess spare capacity for new consumer connections. Critical diagnostic activities such as insulation oil level inspection, oil Breakdown Voltage (BDV) testing, Dissolved Gas Analysis (DGA), transformer turns ratio testing, and other condition assessments are rarely conducted, despite their importance in detecting incipient faults and evaluating transformer health. This issue extends beyond distribution transformers, as even 6/8 MVA, 33/11 kV power transformers often lack regular condition monitoring under a predefined maintenance schedule. Consequently, many transformers remain in operation with undetected defects that eventually lead to major failures.

c) *Inadequate Lightning Protection and Earthing Practices*

Lightning is a major cause of distribution transformer failures in Nepal, particularly during the monsoon season (July–September), when lightning activity is most intense. Lightning surges impose severe electrical and mechanical stresses on transformer windings, leading to insulation breakdown, winding deformation, and, in severe cases, core damage. Although lightning cannot be prevented, the extent of damage largely depends on the effectiveness of the protection system. Proper earthing and correct installation of lightning arresters are essential, yet these are often not implemented according to technical standards in Nepal. Common issues include disconnected or improperly grounded lightning arresters, inadequate earthing systems, and the absence of routine earthing resistance measurements, especially in rural areas. In many cases, earthing is treated only as a project completion requirement rather than a critical protection measure, and its condition is rarely inspected after commissioning. The practice of using a common grounding point for system and lightning protection earthing, together with poor workmanship, further reduces protection effectiveness. Consequently, lightning surges frequently bypass protective devices, resulting in severe winding damage and transformer failure.

d) *Overloading and Inadequate Protection Coordination*

Overloading is another significant cause of distribution transformer failures in Nepal. Although transformers can withstand limited short-term overloads, excessive and unplanned load connections lead to overheating, insulation deterioration, and winding failure. Since routine loading assessments are rarely conducted, new consumers are often connected without verifying the transformer's available capacity. Owing to the high diversity of electrical loads, transformers may appear lightly loaded during off-peak hours but experience severe thermal stress during evening peak demand, especially in residential areas. A more critical issue is the additional loading caused by faults and leakage currents in the low-voltage network. Poorly maintained LT lines, inadequate clearances, deteriorated insulation, vegetation contact, and defective structures allow continuous leakage currents that increase significantly during the rainy season, imposing unwanted load on transformers. Another common practice is replacing frequently operated LT-side fuses or MCCBs with higher-rated devices instead of addressing the underlying overload or fault. In some cases, protective devices are grossly oversized, leaving transformers inadequately protected against sustained overloads. The combined effects of excessive loading, poor network conditions, leakage currents, and improper protection coordination significantly accelerate winding deterioration and contribute to frequent transformer failures in Nepal.

e) *Phase Load Imbalance and Improper Load Distribution*

Phase imbalance is another important cause of distribution transformer failures in Nepal. Ideally, three-phase transformer loads should be evenly distributed among all phases to ensure balanced currents and minimize neutral current. However, this is often difficult to achieve, particularly in rural and mountainous areas where transformer locations are determined by land availability rather than technical requirements. Scattered settlements, challenging terrain, and financial constraints further limit the development of balanced distribution networks, causing unequal phase loading, excessive voltage drop, and increased thermal stress on transformer windings. Even in urban areas, where phase balancing is feasible, new consumer connections are frequently made to the nearest available phase without assessing existing phase loading. Poor network documentation, mixed conductor types, and inadequate phase identification further complicate load management. Consequently, persistent phase imbalance leads to neutral overloading, higher losses, winding overheating, and premature transformer failure.

3. Current Distribution Transformer Maintenance Practices in Nepal: Gap Analysis with Global Standards

The present transformer maintenance practice in many distribution centers (DCs) of Nepal is mainly based on corrective maintenance rather than preventive asset management. Most activities begin only after transformer failure, while systematic health monitoring and condition-based maintenance practices are still limited.

Current Practice in Distribution Centers:

1. Preventive Maintenance:

- Filling/top-up of insulating oil once a year before festival season, mainly in urban areas only.

2. Failure Response Practice:

- Visual inspection
- Oil leakage inspection
- Removal of failed transformer
- Sending transformer to workshop
- Transformer rewinding
- Refilling of transformer oil
- Returning transformer into service
- Reuse of repaired transformer with reduced efficiency
- No detailed failure cause analysis
- Waiting for the next failure

3. Major Gaps Compared with Modern Utility Practices:

- Minimal condition monitoring
- No regular Dissolved Gas Analysis (DGA) testing
- Lack of transformer health indexing
- Multiple-time transformer rewinding practices
- No energy loss cost evaluation after repair
- No economic analysis for repair versus replacement
- Global Standard Practices:
- Economic analysis considering repair cost, energy loss, remaining life, and new transformer cost
- Preventive and condition-based maintenance
- Strict transformer loading control
- Detailed failure investigation and analysis
- Continuous failure rate monitoring
- Root cause investigation
- Scrapping of repeatedly failed transformers
- Defined repair versus replacement criteria

Adoption of these practices will help utilities move from a failure-based approach toward a reliability-centered transformer management system, reducing failures, technical losses, and unnecessary maintenance costs.

4. Repair versus Replacement: Economic Assessment of Failed Distribution Transformers

The decision to repair or replace a failed distribution transformer is a key aspect of asset management. For Nepalese distribution centers, a comparative economic analysis has been conducted to evaluate both alternatives by considering the major direct costs associated with repair and replacement. Although indirect and hidden costs are excluded, the analysis provides a clear assessment of the financial implications and supports more informed decision-making for transformer lifecycle management.

a) Repair Cost Analysis

The major cost components involved in repairing a distribution transformer are associated with replacement of damaged winding materials, insulation components, transformer oil, and skilled labor. In Nepal, most transformer repair costs are dominated by the cost of copper conductors and rewinding works. The major materials required during the repair process generally include:

- Super Enameled Copper Wire
- Copper DPC Strips
- Insulation Pressboard
- Insulation Papers
- Breather/Silica Gel
- Transformer Oil

Similarly, the major labor and service-related costs involved during transformer repair include:

- Transformer dismantling and reassembly
- Oil filtration works
- Core and coil heating in an oven
- Rewinding of transformer coils
- Transformer oil sample testing
- Replacement of nuts, bolts, gaskets, seals, insulation materials, and other accessories

Based on the available cost data from different sources and the Public Charter of NEA Central Workshop, Hetauda, the estimated net repair cost for commonly used distribution transformer ratings in Nepal has been calculated after considering the resale value of recovered scrap materials. The summarized cost comparison is presented in the following chart:

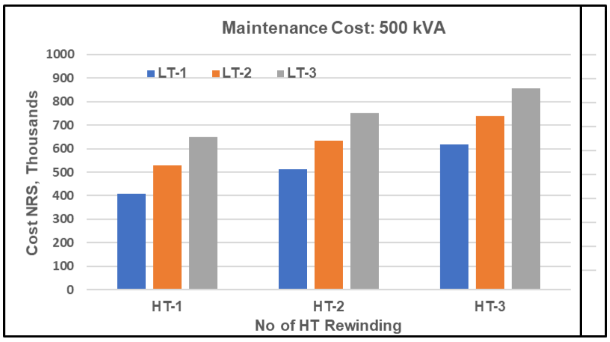
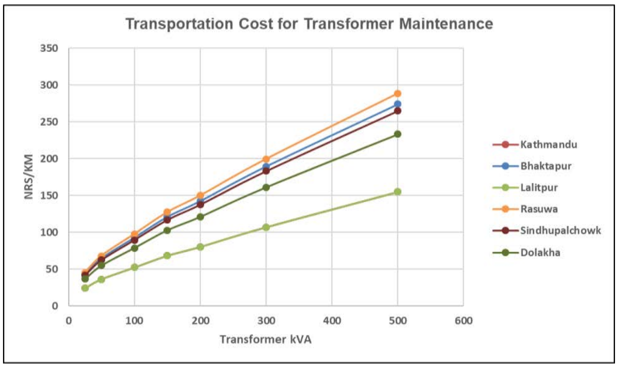


Figure-2: Sample Repair Cost for 500 kVA Transformer in Nepal (Source: NEA CW Charter)

b) Workshop Transportation Cost

Transportation of failed distribution transformers is a significant component of repair costs. A failed transformer must be transported from the distribution center (DC) to the repair workshop and returned after maintenance, often requiring additional transportation due to the repair duration. While new transformer installation also involves transportation, this analysis considers only the extra cost of moving failed transformers to and from the repair workshop. Based on the approved transportation rates under the NEA Bagmati Provincial Office, including loading and unloading charges, the one-way transportation cost per kilometer has been estimated for different transformer ratings. The following graphs illustrate the variation in transportation costs for different transformer capacities across various districts.



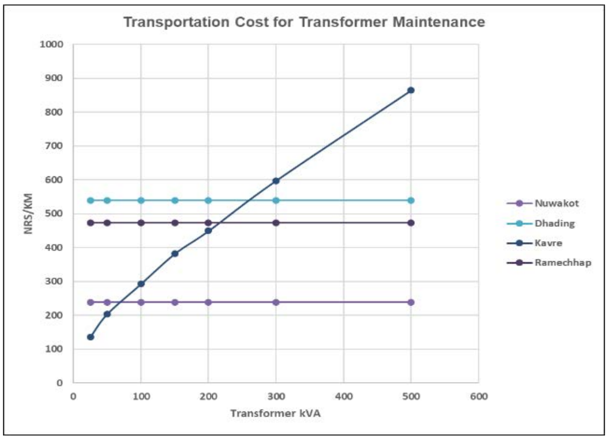


Figure-3: Transportation Cost of Various Size Transformer (As Per District Rate)

c) Energy Loss Cost Due to Degraded Transformer Efficiency

Repeated repair and rewinding of distribution transformers can reduce their efficiency and reliability. The performance of repaired transformers depends on workshop facilities, skilled manpower, repair practices, and compliance with proper standards. Due to limited resources, outdated techniques, and lack of standardized procedures, repaired transformers often operate with reduced efficiency and increased losses. Field experience indicates that transformer efficiency may decrease from around 98% in new condition to nearly 80% after multiple repairs. For a 100 kVA transformer, this can contribute approximately 20 kW additional losses, which becomes significant across a large transformer fleet. Therefore, transformer repair decisions should consider not only immediate repair costs but also long-term energy losses and lifecycle impacts.

d) Example Cost Calculation

Considering the three major cost components discussed above, transformer repair cost, transportation cost, and additional energy loss cost, a total cost assessment has been carried out for a practical case scenario. The following analysis represents a worst-case condition where a distribution transformer has suffered complete winding failure and requires repair at the designated transformer workshop.

Worst Case Scenario A: Repair of 100 kVA Distribution Transformer at Dupcheshwor Rural Municipality, Nuwakot

A distribution transformer rated 11/0.4 kV, 100 kVA installed under the Nuwakot Distribution Center at Dupcheshwor Rural Municipality has experienced complete winding burnout. The failed transformer needs to be transported to the Transformer Workshop located at Kharipati, Bhaktapur for repair and subsequently reinstalled at the same location.

The total cost associated with repairing and operating the transformer for one year is calculated as follows:

a) *Transformer Repair Cost*

The transformer repair cost mainly includes rewinding, replacement of damaged materials, insulation works, oil treatment, and other associated repair activities. After considering the resale value of recovered scrap materials, the net repair cost is calculated as:

- Total transformer repair cost at workshop = **NPR 4,83,130.00**
- Scrap value of damaged materials = **NPR 2,14,700.00**
- Net repair cost = NPR 2,68,430.00

b) *Transportation Cost*

The failed transformer needs to be transported from the installation site to the repair workshop and returned after completion of repair works. The road distance between the transformer location and Kharipati Workshop is approximately 96 km**.** Based on the approved district transportation rate for FY 2082/083:

- Transportation rate = **NPR 239/km/ transformer**
- One-way transportation cost = 239 × 96 = **NPR 22,944.00**
- Loading/unloading cost = **NPR 2,290.08**

Considering transportation in both directions:

Total transportation cost = 2 × (22,944 + 2,290.08) = NPR 50,468.16

c) *Energy Loss Cost Due to Reduced Efficiency*

A repaired transformer generally operates with reduced efficiency compared to a new transformer. Considering a repaired transformer remains in service for one year with reduced efficiency and experiences peak loading for approximately two hours per day:

- Additional transformer loss = 20 kW
- Annual energy loss = 20 × 8760 × 0.083
- Annual energy loss = 14,542 kWh

Taking the average energy cost of NEA as NPR 6.50/kWh:

Total energy loss cost = 14,542 × 6.50 = NPR 94,523

Therefore, the total annual cost of operating the repaired transformer is:

Total Cost = Repair Cost + Transportation Cost + Energy Loss Cost

Total Cost = 2,68,430 + 50,468 + 94,523 = 4,13,421.00

Total cost of repaired transformer for one year = NPR 4,13,421.00

Result of Scenario A

The analysis shows that repairing a severely damaged 100 kVA distribution transformer and operating it for only one additional year results in an effective cost of approximately NPR 4.13 lakhs. This estimation does not include indirect impacts such as outage duration, manpower requirements, repeated failure probability, and reliability concerns associated with repaired transformers.

Furthermore, distribution centers operating in hilly and mountainous regions face additional logistical challenges that can significantly increase repair costs. Many remote transformer locations were established before road connectivity reached those areas, making transportation difficult. In such cases, failed transformers often require manual handling after vehicle access ends. As availability of local manpower for carrying heavy equipment continues to decline, transportation and handling costs may become a significant additional burden, further reducing the economic advantage of repeated transformer repairs.

Scenario B: Replacement of the same 100 kVA Distribution Transformer at Dupcheshwor Rural Municipality, Nuwakot with new 100 kVA transformer

Replacement of a failed distribution transformer involves the procurement of a new transformer and associated installation activities. Unlike repaired transformers, a new transformer generally provides higher efficiency, better reliability, and a longer service life with lower maintenance requirements. For this analysis, only the major direct cost associated with replacing a failed transformer has been considered.

a) *New Transformer Cost*

The estimated market cost of a new 100 kVA, 11/0.4 kV distribution transformer is approximately:

- Cost of new 100 kVA transformer = NPR 7,00,000.00

b) *Scrap Value*

The failed transformer can also generate scrap value through the recovery of copper, steel, and other reusable materials. Considering the resale value of the old transformer:

- Scrap value of failed 100 kVA transformer = NPR 3,00,000.00

Therefore, the effective cost incurred by the distribution center for replacing the failed transformer is:

Net replacement cost = Cost of new transformer – Scrap value of old transformer

Net replacement cost = 7,00,000 – 3,00,000

Net replacement cost = NPR 4,00,000.00

The replacement cost is similar to repair cost in terms of initial investment. However, a new transformer provides better efficiency, reliability, lower failure risk, and reduced technical losses over its service life, making it a better long-term asset management option.

e) Decision Matrix for Repair versus Replacement

Based on the worst-case scenario analysis, the total effective cost of repairing a failed 100 kVA distribution transformer at Nuwakot Distribution Center is estimated at approximately NPR 413,421 for one additional year of service. In comparison, the effective cost of installing a new transformer, after accounting for the scrap value of the failed unit, is about NPR 400,000, making replacement approximately NPR 13,421 less expensive than repair. This demonstrates that repair is not always the most economical option under Nepalese distribution network conditions. While repair may have a lower initial workshop cost, factors such as reduced efficiency, increased energy losses, transportation expenses, higher probability of repeated failures, and reliability impacts can make replacement more cost-effective over the transformer's lifecycle. At present, repair decisions are often made without a structured evaluation of transformer age, failure history, remaining life, post-repair efficiency, and lifecycle cost. Therefore, distribution centers should adopt a Decision Support Tool (DST) that integrates technical and economic criteria to determine whether a failed transformer should be repaired or replaced. A sample DST decision matrix is presented below:

Table: Sample Decision Matrix for DST Output

Condition	Recommended Action
Minor winding damage	Repair
First failure and transformer age < 10 years	Repair
Single winding failure and transformer age < 5 years	Repair
Complete winding failure and transformer age < 5 years	Replace
Severe insulation damage	Replace
Complete LT winding failure with core damage/welding	Replace
Repeated winding failure	Replace
Transformer age > 20 years	Replace
Post-repair efficiency < 80%	Replace
Rewinding cost > 70% of new transformer cost	Replace

Implementation of such a decision-making approach would help NEA and its distribution centers optimize transformer asset management by reducing unnecessary repair expenses, minimizing technical losses, and improving overall system reliability.

f) *Benefit Cost Analysis: Repair Vs. Replacement*

A key factor often overlooked in distribution transformer repair decisions in Nepal is the comprehensive economic evaluation of repair and maintenance costs. In most distribution centers (DCs), repair decisions are made without considering the asset's full lifecycle cost. Since failed transformers are typically repaired at centralized NEA workshops operating under separate budgets, individual DCs do not directly bear the repair expenses, although these costs are ultimately incurred by NEA or the Government of Nepal. To improve asset management, each DC should implement a Decision Support Tool (DST) with a detailed Benefit-Cost (B/C) analysis to determine whether repair or replacement is the more economical option. The DST should incorporate both technical and economic factors, including transformer age, loading, failure history, health condition, remaining life, as well as DC-specific characteristics such as budget, technical manpower, transportation, geography, climate, and accessibility. A customized approach would provide a more reliable basis for transformer repair and replacement decisions across Nepal.

A simple example of B/C analysis for a distribution transformer repair decision is presented below:

Case A: Repair of 25 kVA Distribution Transformer

Assumptions:

- Repair cost = NPR 120,000
- Expected life extension after repair = 2 years
- Interest Rate = 10%

Annualized cost:

$$A = P * \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$A = 120000 * \frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1}$$

$$A = 69{,}143\ NPR/Year$$

Case-B: Replacement of Old 25 kVA Transformer with a New Transformer:

In this case, the failed 25 kVA distribution transformer is replaced with a new transformer instead of being repaired. The economic evaluation is carried out by considering the investment cost, expected service life, and annualized cost of the new transformer.

Assumptions:

- Cost of new 25 kVA transformer = NPR 350,000
- Expected service life = 15 years
- Interest Rate = 10%

Annualized cost:

$$A = P * \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$A = 350000 * \frac{0.1(1+0.1)^{15}}{(1+0.1)^{15} - 1}$$

$$A = 46{,}015\ NPR/Year$$

The above analysis shows that repairing an aging distribution transformer is not always more economical than replacing it with a new unit. While repair may involve a lower initial cost, reduced efficiency, higher technical losses, repeated failures, and uncertain remaining service life can increase long-term lifecycle costs. A well-designed DST can evaluate these technical and economic factors for each distribution center, enabling informed and cost-effective decisions on whether to repair or replace a failed transformer.

6. Recommended Strategy

The high failure rate of distribution transformers in Nepal indicates the need to shift from the existing reactive maintenance approach toward a proactive and data-driven transformer asset management strategy. Instead of focusing only on repairing failed transformers, distribution centers should implement systematic practices for monitoring transformer health, evaluating risks, and making economically justified repair or replacement decisions. The following strategies are recommended:

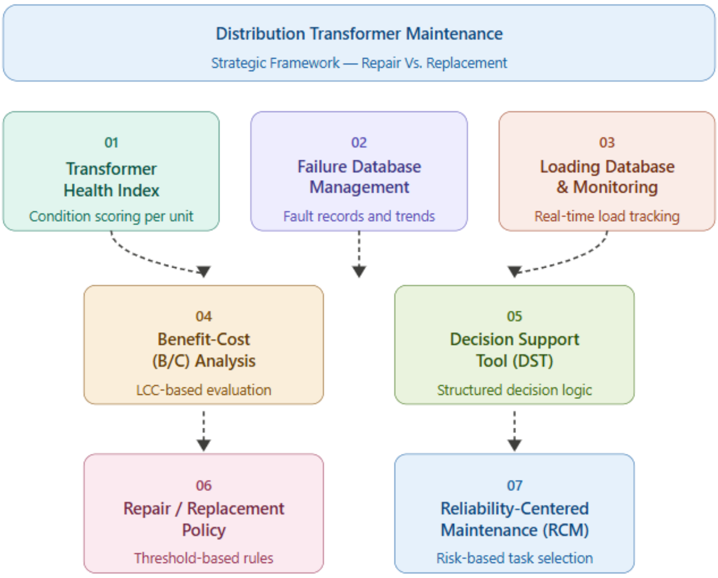


Figure-4: Recommended Strategy for Repair vs. Replace Decision

Analysis of Loss of Life of Transformer Based on Thermal Modelling

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Introduction

When a transformer fails while it is in use, the utility typically loses a lot of revenue, the environment may be harmed, there is a risk of an explosion or fire, and the cost of repair or replacement is high. Therefore, it is preferable to use the transformers as much as possible while maintaining a sufficient service life.

Transformer failure rates have been determined to follow the so-called "Bathtub Curve," as shown in figure1, based on experience and data collected by researchers and practitioners. Three stages of transformer life are shown by the conventional bathtub curve. The first stage is known as the infant-mortality period which has a decreasing failure rate. The infant mortality is followed by a nearly constant failure rate period, which is usually long. The third stage, which is mostly associated with equipment aging, marks the end of the curve and is a time of wear out with a rising failure rate. [1]

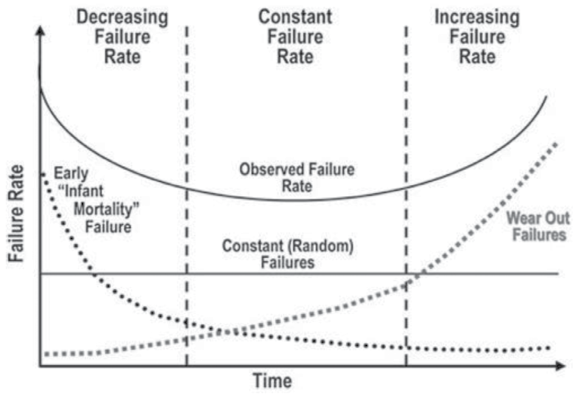

Figure1:- Typical transformer failure pattern.

The lifetime of an equipment may be conceptualized in three different ways:

(a) Physical Lifetime: This refers to the condition in which the equipment can no longer be used in its normal operating state.

(b) Technical Lifetime: This refers to the condition in which the equipment must be replaced for technical reasons even though it can be used physically. For example, the state at which maintenance becomes extremely difficult due to unavailability of spares.

(c) Economic Lifetime: The capital value of a piece of equipment decreases annually. Furthermore, as equipment ages, operating and maintenance expenses rise over time and may even surpass the equipment's depreciated worth. It is more economical to replace the equipment in these situations.

Overall, transformer failure is a probabilistic phenomenon that is primarily influenced by three factors: design, aging, and external triggering events. Therefore, end-of-life modeling aims to establish a relationship between aging conditions and transformer intrinsic dielectric qualities as well as transformer thermal life, which is defined as the number of service years required for solid insulation to lose its mechanical strength under operating conditions.

Transformer End of Life

Transformer life expectancy is influenced by a number of factors that are neither fully understood nor known. But generally, the following are significant:

(a) The initial mechanical, electrical, and thermal characteristics of the insulating materials.
It should be noted that different materials lose their qualities at different rates, and the same material may lose different qualities at varying rates as it ages.

(b) Mechanical, electrical, and thermal stresses.
Overload currents, local overheating, leakage fluxes, and cooling system malfunctions all contribute to thermal stresses. System transient over voltages, winding resonances, and other factors all contribute to electrical stresses. Short-circuit and inrush currents create mechanical stresses between leads, conductors, and windings.

(c) Normal load cycle along with the environmental factors like ambient temperature.

(d) The acceptable level of deterioration.
Deterioration to complete destruction of transformers is not acceptable in practice. The degree of deterioration that can be permitted is determined largely by safety and service continuity conditions and also by the probability of occurrence of abnormal operating conditions. [2]

As a result, there is just an increasing probability that a transformer may fail rather than a clearly defined moment at which it should be replaced.

The aging of transformer insulation system reduces both its mechanical and dielectric withstand strength. A transformer experiences faults that cause large radial and compressive forces over the course of its service life. With system growth, the transformer's operating stresses rise along with the load. In an aged transformer, typically the conductor insulation is weakened to the point where it can no longer sustain mechanical stresses of a fault. In other words, the insulation becomes so fragile that it may cause major damage from fault conditions or even typical vibration. Then dielectric failure of turn to turn insulation occurs, or loosening of winding clamping pressure takes place, which reduces the transformer's ability to withstand future short circuit forces. [3]

Life Estimation Based on Thermal Modeling

A transformer is built with enough mechanical and dielectric strength, along with a safety margin, to withstand the maximum operational stresses. Throughout the transformer's service life, thermal stresses will deteriorate the insulation and lower the safety margin until the transformer can no longer withstand the stresses caused by external events, making it more vulnerable to failure. However, operational experience has shown that thermal stresses are not only the cause of transformer failure. But thermal stress is still considered to be the most critical factor in determining the useful life of a transformer. [4]

Effect of temperature on the life of transformer having Class-A insulation was identified in 1930, as shown in Figure 2, which depicts a curve showing the probable life of Class-A insulation in terms of the time required for the insulation to become practically useless in oil for different temperatures.

The equation of the straight line shown in Figure 2 is given by

$$Y = 7.15 * 10^4 e^{-0.088x}$$

where, Y= time in years, X = temperature in °C.

The actual life of the insulation was determined from the solid line curve within the temperature range of 30 to 120°C. Montsinger's rule states that the life of insulation is halved for every 10°C temperature rise. However, as insulation quality has improved significantly since 1930, this criterion is no longer applicable. But on the other hand, the factor of safety in transformer design is much lower now, which means that the transformer insulation is stressed to much higher level now even under normal operating conditions. [5]

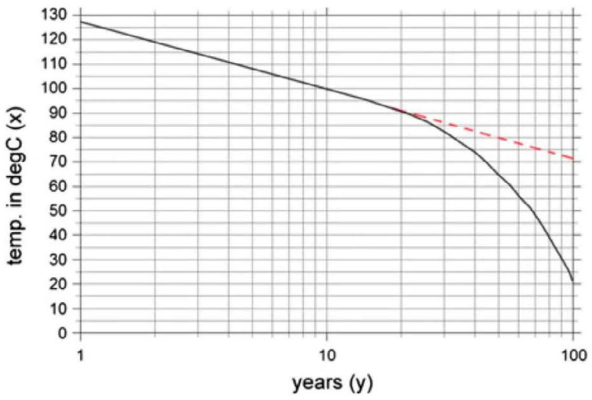

Figure 2:- Effect of temperature on the life of Class-A insulation

The outcome of various insulation deterioration tests, as published in 1947 [4], are displayed in Figure 3. In this study, the underlying consideration was that the reciprocal of the time to reach the point of failure is equal to a reaction rate constant as given below.

$$\frac{f_0'(p)}{t} = K_0 = Ae^{-\frac{B}{T}}$$

Where, A and B are constants, T= absolute temperature, Ko = reaction rate constant, and P could be a particular value of an insulation property, e.g., 20 % of the original tensile strength of paper as the limiting value. Then considering the value of ; the time to reach the limiting point could be determined. [6]

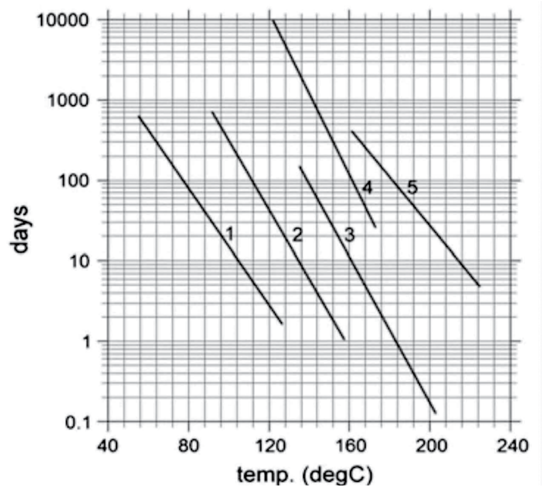

Figure 3 :- Variation of life with temperature for different types of insulation

Aging Acceleration Factor

Although aging of transformer insulation is a time-dependent function of temperature, moisture content, and oxygen content, IEEE guide [7] considers insulation temperature as the controlling parameter, with the premise that the moisture and oxygen contributions to insulation deterioration is minimized with the help of modern oil preservation systems. In aging studies, it is normal to consider the aging effects produced by the highest or hottest-spot temperature, as the part of insulation which operates at the highest temperature will usually undergo the greatest deterioration.

Figure 4 shows the curve that relates per unit transformer insulation life to winding hottest-spot temperature as per IEEE guide [7] considering temperature as the principal variable affecting thermal life. Figure 4 shows that aging is decreased below normal for temperatures below 110°C and accelerated above normal for temperatures above a reference temperature of 110°C. The curve's equation is as follows:

$$Per\ unit\ life = 9.80 * 10^{-18} e^{\frac{1500}{\theta_H + 273}}$$

An aging acceleration factor (FAA) for a specific load and temperature or for a changing load and temperature profile over a 24-hour period can be computed using Figure 4. The transformer's equivalent aging may be computed using the FAA equation as follows [7]:

$$F_{AA} = e^{\left(\frac{1500}{110+273} - \frac{1500}{\theta_H + 273}\right)}$$

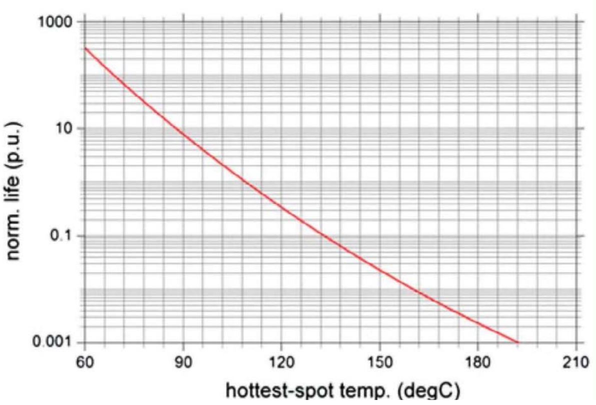

Figure 4:- Transformer insulation life versus hottest-spot temperature

For winding hottest-spot temperatures greater than the reference temperature 110 °C, FAA will be greater than 1 and will be less than 1 for temperatures below 110 °C. A curve of FAA versus hottest-spot temperature for a 65°C rise insulation system is shown in Figure 5.

The following equation gives the equivalent life at the reference temperature that will be consumed in a given time period for the given temperature cycle [7]:

$$F_{EQA} = \frac{\sum_{n=1}^{N} F_{AA,n} \Delta t_n}{\sum_{n=1}^{N} \Delta t_n}$$

where, is the equivalent aging factor for the total time period, n is index of the time interval t, N is total number of time intervals, is the time interval, and is aging acceleration factor for the temperature which exists during the time interval.

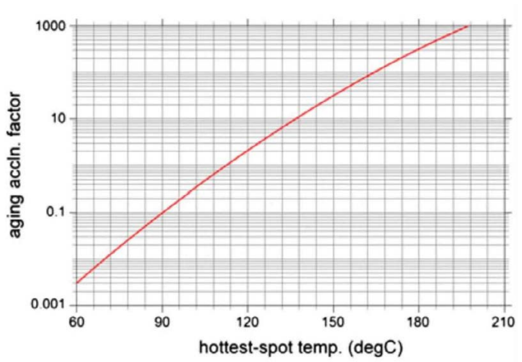

Figure 5:- Aging acceleration factor versus hottest-spot temperature

Loss of insulation life in the time period is computed as the equivalent life consumed divided by the definition of total normal insulation life. Usually, the total time period used is 24 h. The equation is given as follows [7]:

$$\%\,Loss\ of\ life = \frac{F_{EQA} * t * 100}{Normal\ insulation\ life}$$

The IEEE guide [7] provides benchmark values of normal insulation life for a well-dried, oxygen-free system. For example, if the degree of polymerization value is reduced to 200, the normal insulation life is 1,50,000 hours, or 17.12 years, for a 65°C average winding temperature rise insulation system at the reference temperature of 110°C.

Hot-Spot Factor

The hottest-spot temperature () could be computed according to IEC standard [6] as follows [8]:

where, K is the time-dependent relative load per unit, x = oil exponent, y = winding exponent, r = loss ratio, = ambient temperature, = Hot-spot to top-oil gradient, and = top-of-tank oil rise. Details of these parameters are available in [8].

$$\theta_H = \theta_a + \Delta\theta_{or}\left(\frac{1 + rK^2}{1 + r}\right)^x + Hg_r K^y$$

The hottest-spot temperature rise can also be estimated using a hot-spot factor, H . The value of H varies over a wide range depending upon the transformer design [8]. The CIGRE working group 12.09 showed that the value of H lies between 1 and 3 [9]. The daily loss of life of transformer is computed from the hottest-spot temperature which is obtained by varying hot-spot factor from 1.3 to 2.1. The result are shown in figure 6. Cooler winding temperature indicator on/off setting of 75/50 degree C and 95/70 degree C are both simulated. The daily loss-of-life increases linearly as the hot-spot factor increases, as can be seen from each of the 4 cases: summer loading under 75/50 degree C, summer loading under 95/70 degree C, winter load under 75/50 degree C and winter load under 95/70 degree C. Figure 6 shows the variation of daily loss of life with hot-spot factor. [10]

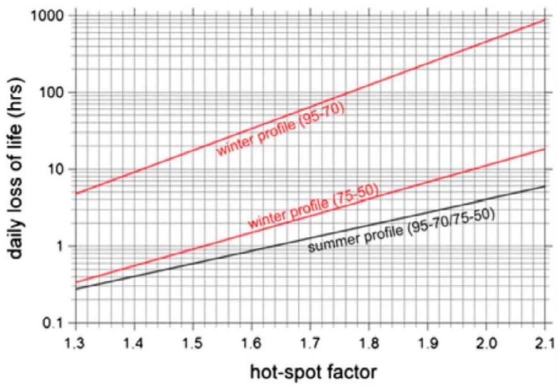

Figure 6:- Variation of daily loss of life with hot-spot factor

Conclusion

The relationships between various parameters responsible for ageing of transformer have been studied in detail. It should be noted here that the uncertainty involved in the computation of loss of life based on the above-mentioned methodology is high. Moreover, as the deterioration of transformer insulation is caused by many factors that influence the cumulative effect of temperature over time, it is very difficult to predict with any great degree of accuracy the useful life of the insulation in a transformer, particularly under widely varying service conditions. [4]

Due to the lack of examples of end-of-life failures, the limited failure records and the age censored transformer population, any traditional statistical analysis of the failures cannot be used to predict the end-of-life and future transformer reliability. Even a complete knowledge of thermal end-of-life for a particular transformer would only give a statistical risk of failure at a particular age since actual failures are observed to have a large random element probably related to system stress. [10]

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An Overview of Hydropower Sector Lending in Nepal's Banking Industry

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Background:

Nepal is rich in natural resources, including mountains, lakes, rivers, medicinal herbs, forests, and diverse ecosystems. Its geography transitions rapidly from the northern Himalayan region through the central hills to the southern plains of the Terai. Among these resources, Nepal possesses abundant freshwater assets, counting more than 6,000 rivers and streams with a total length of approximately 45,000 km. The hydropower potential of these rivers has been estimated to be about 83,000 Mega Watt (MW) in total, out of which roughly 43,000 MW is considered economically and technically viable.

The hydropower sector has undergone a remarkable transformation over the last two decades. Nepal has successfully shifted from chronic electricity shortages and prolonged load shedding to a seasonal electricity surplus and active cross-border electricity exports. As of the end of Falgun 2082 (mid-March 2026), the installed electricity generation capacity connected to the national grid reached 4,105 MW. This grid mix comprises 3,798 MW from hydropower, 142 MW from solar energy, 106.24 MW from alternative energy sources, 53.4 MW from thermal plants, and 6 MW from sugar factories. Consequently, electricity access has reached 99.1% of the population. An additional 666 MW is expected to be added by the end of FY 2082/83, pushing total generation capacity further upward by 4,626 MW.

Nepal's hydropower journey began with the commissioning of the Pharping Hydropower Plant in 1911 A.D. For several decades, however, development remained slow due to limited investment, inadequate technical capacity, and weak infrastructure. Following the economic liberalization policies of the 1990s and the enactment of the Electricity Act, private sector participation accelerated significantly. Independent Power Producers (IPPs) emerged as major contributors, supported by Power Purchase Agreements (PPAs) with the Nepal Electricity Authority (NEA).

Over nearly seven decades of planned development, Nepal has made significant progress across economic, social, and infrastructural dimensions. The Government of Nepal has adopted a 25-year Long-Term Vision (2019–2043), which aims to achieve an installed electricity generation capacity of 40,000 MW and provide 100% household electricity access. Additionally, the government has introduced remittance management programs to encourage inflows through the formal banking system, promoting the investment of these funds into productive sectors such as hydropower, agribusiness, and tourism.

A significant increase in hydropower generation is projected to drive a corresponding rise in domestic electricity consumption across all economic sectors, while gradually expanding electricity exports. This rapid expansion over the past decade has substantially increased the exposure and participation of Banks and Financial Institutions (BFIs), infrastructure development banks, insurance companies, and institutional investors. Consequently, hydropower lending has become one of the largest project financing portfolios in Nepal's banking sector.

Despite its enormous potential, hydropower financing faces numerous risks. These include construction delays, geological uncertainties, hydrological variability, transmission bottlenecks, policy inconsistencies, environmental concerns, foreign exchange risks, and escalating climate-related events. Mitigating these challenges requires prudent credit appraisal, effective project monitoring, diversified financing mechanisms, and supportive government policies.

BFIs have played a pivotal role in this growth. Because hydropower projects require substantial capital investment and entail long gestation periods, bank financing remains indispensable. Today, hydropower lending stands firmly as one of the largest infrastructure financing portfolios within Nepal's banking industry.

Regulatory Provisions Under NRB Unified Directives:

Nepal Rastra Bank (NRB) has introduced targeted regulatory mechanisms to accommodate the long gestation periods and unique financial structures of energy projects. The major provisions are summarized below:

- Interest Capitalization during Moratorium: NRB allows the capitalization of interest accrued during the moratorium period for projects in critical energy infrastructure, including hydropower and transmission lines.

- Partial Capitalization for Grid Delays: Hydropower projects that have completed construction and initiated electricity production, but cannot achieve full commercial operations due to the unavailability of transmission lines, can obtain partial interest capitalization for the portion of interest not covered by actual net revenues.

- Base Rate Premium Cap: For loans provided to hydropower projects, BFIs are restricted to adding a maximum premium of 1% on their base rate for a period of 5 years from the start of cross-border electricity exports. For reservoir-type hydropower projects, this facility is extended until loan maturity.

- Single Obligor Limit (SOL): To facilitate large-scale project financing, BFIs can disburse funded and non-funded loans to the energy sector (including hydropower, renewable energy, transmission lines, and cable cars) up to 50% of their core capital under the single obligor limit framework.

- Reserve Transfer Flexibility: Upon 60% physical construction completion of a hydropower project, the amount provisioned under the Interest Capitalized Term Loan (ICTL) can be deducted from the Interest Capitalized Reserve (ICR) and safely transferred to retained earnings.

Priority Sector Lending Framework:

Through its macroprudential policies, the NRB mandates directed-sector lending to ensure financial resources are channeled into productive sectors that drive real economic growth, create employment, and reduce the ballooning trade deficit via import substitution.

NRB explicitly classifies energy sector lending under the "Priority Sector" umbrella. BFIs must achieve specified cumulative lending targets within this combined sector based on their total outstanding loans and advances, calculated on a rolling six-month average:

Table 1: NRB Priority Sector Lending Targets (By Poush End 2082)

BFI Class	Eligible Combined Sectors	Minimum Target (% of Total Loan Portfolio)
Class 'A' (Commercial Banks)	Tourism, SMEs, Energy, IT, Export Industries	20%
Class 'B' (Development Banks)	Agriculture, Tourism, SMEs, Energy, IT, Export Industries	20%
Class 'C' (Finance Companies)	Agriculture, Tourism, SMEs, Energy, IT, Export Industries	15%

NRB strictly monitors these deployment figures on a quarterly basis. BFIs failing to meet these directed minimum thresholds face stringent financial penalties. Through this framework, the central bank aims to curb speculative lending—which drives unproductive asset bubbles—and prioritize sustainable capital generation.

Current Energy Lending Status:

Banking is the most transparent, competitive, and highly regulated industry in Nepal. The current ecosystem comprises 55 NRB-licensed institutions eligible to finance the energy sector, incorporating 20 Class 'A' commercial banks, 17 Class 'B' development banks, 17 Class 'C' finance companies, and one dedicated infrastructure bank (NIFRA).

As Nepal transitions further into a decentralized, federal structure of governance, local energy demands are shifting. However, sector-specific concentrations remain highly focused on infrastructure.

Table 2: Sector-wise Lending Status by BFIs

Sector	Amount (NPR in million)	Share (%)
Construction	260,951.18	4.43
Electricity, Gas and Water	494,766.00	8.40
Metal Products, Machinery & Electronic Equipment & Assemblage	77,002.37	1.31
Transport, Communication and Public Utilities	87,026.64	1.48
Wholesaler & Retailer	1,036,217.50	17.60
Finance, Insurance and Real Estate	445,075.43	7.56
Tourism Service	274,815.57	4.67
Other Services	229,712.94	3.90
Consumption Loans	1,293,582.19	21.97
Local Government	1,229.16	0.02
Others	321,772.19	5.47
Total Loan Portfolio	**5,887,603.54**	**100**

As of Baisakh 2083 (Table -2), BFIs have provided credit facilities totaling NPR 494,766 million to the Electricity, Gas, and Water sector. This accounts for 8.40 percent of the total loan portfolio of NPR 5,887,603.54 million. This sector is preceded by Consumption Loans (21.97 percent) and the Wholesale & Retail sector (17.60 percent).

Environmental and Social Risk Management (ESRM) Considerations:

Because infrastructure projects carry massive environmental and footprints, BFIs must strictly evaluate projects under the NRB's Guideline on Environmental and Social Risk Management (ESRM) for Banks and Financial Institutions, 2022. Credit approval is fundamentally contingent on evaluating the following parameters:

Table 3: Key ESRM Parameters for Hydropower Credit Appraisal

Aspects	Environmental and Social Parameters
Construction related issues	▪ Wastewater discharges – Effluents from worker camp sanitary wastewater ▪ Storm water runoff – Total suspended solids (TSS) ▪ Rock extraction/ tunneling discharges ▪ Solid waste – rock waste and topsoil storage ▪ Biodiversity – aquatic and terrestrial ecology surveys, vegetation reinstatement. As relevant, aquatic ecology should be assessed upstream and downstream of effluent discharges during construction. ▪ Air quality/ air emissions – PM at project boundary, black smoke from construction equipment, visible dust at construction sites. ▪ Noise and vibrations at nearest receptor (include pre-blasting surveys of community infrastructure)
Hydrology/ Morphology	▪ Streamflow upstream and downstream (key selected points) ▪ Water consumption (downstream) ▪ Stored water volume (reservoirs) ▪ Flow, velocity, depth
Water quality	▪ Temperature upstream/ downstream (all types of hydropower) ▪ Disolved oxygen/ TSS, water clarity, phosphates, nitrates in reservoir and downstream
Sediment transport	▪ TSS (upstream and downstream), sediment transport and deposition (RoR and storage), stream morphology, structural risk to in-stream structures
Emissions	▪ CO_2, Hydrogen sulfide and methane in reservoir and downstream of dam (storage reservoirs)
Resettlement related	▪ Acquisition of land, compensation of affected land and properties
Indigenous people (IP) and vulnerable people/ community	▪ Impact on IPs land and religious places, culture, tradition, local economy, employment
Acquatic ecology	▪ Fish and invertebrate species/ population size (upstream, downstream and in reservoirs ▪ Habitat preference by indicator species, considering different life cycle stages and natural history
Terrestrial ecology	▪ Forestration of upstream/ reservoir riparian areas ▪ Forest types and major plant species including Non Timber forest products ▪ Wildlife (species, distribution, numbers)
Land use	▪ Vegetation cover/ land use change in watershed
Community health	▪ Water based vectors
Community safety	▪ Dam structural safety – Construction and post construction surveys ▪ Downstream population use of riparian resources

Challenges in Hydropower Sector Lending:

Despite strong regulatory support and vast natural potential, financing hydropower projects in Nepal introduces unique systemic bottlenecks that threaten the credit quality of BFI portfolios:

1. Hydrological Risks and Climate Variability: Nepal's hydropower generation is heavily dominated by Run-of-River (RoR) plants. While total installed capacity is rising, electricity generation drops sharply during the winter/dry season due to receding water levels across major river basins. Climate change has exacerbated this via erratic monsoon patterns and increased glacial melt, threatening both low-flow generation and exposing projects to severe damage from Glacial Lake Outburst Floods (GLOFs) and landslides.

2. Transmission Line Bottlenecks ("Evacuation Risk"): The pace of transmission line construction by the state-owned NEA lags severely behind private sector generation. Multiple projects face forced outages or cannot run at full capacity because the grid infrastructure is absent or inadequate to "evacuate" the power. This directly impairs the revenue generation of the project, turning otherwise viable bank assets into high-stress accounts.

3. Asset-Liability Mismatch for BFIs: Hydropower projects require long-term capital deployment with typical repayment periods stretching between 15 to 20 years. Conversely, the liability profile of Nepalese BFIs consists primarily of short-term fixed deposits (usually 1 to 2 years). This severe asset-liability mismatch exposes the banking sector to liquidity shocks when credit cycles tighten.

4. Contractor Inefficiencies and Cost Overruns: Delays in local bureaucracy, land acquisition disputes, and inadequate technical capacity among domestic contractors frequently lead to extended construction periods. Extended gestation periods cause severe cost overruns through compounding Interest During Construction (IDC), distorting initial debt-to-equity ratios and delaying debt-service schedules.

5. Foreign Exchange (FX) Risk in Large Projects: Megaprojects require foreign direct investment (FDI) and international debt financing denominated in USD. However, revenues from PPAs are earned in Nepalese Rupees (NPR). In the absence of mature, affordable long-term hedging instruments in Nepal, exchange rate fluctuations pose an existential risk to debt service.

Way Forward:

To sustain lending momentum and safeguard the financial health of the banking industry, a coordinated approach among the central bank, commercial lenders, developers, and state agencies is vital:

- Diversifying the Grid Mix via Policy Incentives: To counter dry-season generation dips, NRB and the Ministry of Energy should collaborate to provide enhanced credit incentives for Peaking Run-of-River (PRoR) and multi-purpose storage-type projects. Accelerating floating solar and wind additions will further stabilize the seasonal grid profile.

- Deepening the Capital Markets & Consortia: BFIs should transition away from traditional balance-sheet lending toward long-term corporate energy bonds, specialized green bonds, and blended finance mechanisms. Expanding the underwriting capacity of the Hydroelectricity Investment and Development Company (HIDCL) and NIFRA can spread risks across a broader base through multi-tiered consortiums.

- Infrastructure Lead Times Synchronization:

The government must prioritize public-private partnership (PPP) models for transmission line development. Aligning the construction timelines of NEA transmission corridors directly with the commissioning dates of private IPPs will eliminate structural evacuation losses.

- Adopting Advanced Climate Risk Modeling**:** Standard financial analysis must give way to advanced hydrological and climate stress-testing during the credit appraisal phase. BFIs should integrate remote sensing data and predictive climate modeling into their ESRM frameworks to insulate their portfolios against catastrophic environmental events.

- Operationalizing Hedging Frameworks**:** For foreign-denominated financing, the central bank and the Ministry of Finance need to operationalize viable, subsidized foreign exchange hedging funds. This will protect international developers and local underwriting banks from currency depreciation while attracting global climate finances into Nepal's energy market.

(Opinions and views expressed in the article are personnel)

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Installation of hydraulic turbine-generator in under construction Tanahu Hydropower Project.

अनिवार्य अवकाश प्राप्त कर्मचारीहरूको विवरण

२०८२ माघ १ गते देखि २०८३ असाढ मसान्तसम्म

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१	१३४७१३	३	मिटर रिडर	सन्त बहादुर मगर	२०८२.१०.०१	अनिवार्य	सामान्य प्रशासन महाशाखा	
२	१६७५५२	२	हेल्पर	रविन्द्र प्रसाद पराजुली	२०८२.१०.०१	अनिवार्य	रत्ननगर टाँडी वितरण केन्द्र	
३	१६८०८८	६	सहायक प्रशासकीय अधिकृत	लोकमान स्वाँर	२०८२.१०.०३	अनिवार्य	धनगढी वितरण केन्द्र	
४	१९११४८	६	सहायक इन्जिनियर	सुशिल कुमार श्रेष्ठ	२०८२.१०.०३	अनिवार्य	महाराजगंज वितरण केन्द्र	
५	१३४२२९	४	फोरमेन	नवराज गौतम	२०८२.१०.०४	अनिवार्य	बागमती प्रादेशिक कार्यालय, काठमाडौं	
६	१४७२८४	३	मिटर रिडर	राज कुमार थापा	२०८२.१०.०४	अनिवार्य	काठमाडौं ग्रिड महाशाखा	
७	१४२३५९	१०	सह-निर्देशक	भरत शम्सेर भट्टराई	२०८२.१०.०६	अनिवार्य	वित्तिय लेखापारीक्षण महाशाखा	
८	१६४३३०	४	फोरमेन	रामचन्द्र शाह सोनार	२०८२.१०.०६	अनिवार्य	कञ्चनपुर वितरण केन्द्र	
९	१५९५४१	६	सहायक इन्जिनियर	हस्त बहादुर देवकोटा	२०८२.१०.०८	अनिवार्य	मर्स्याङ्दी कोरीडोर २२० के.भी. प्र.ला.आयोजना	
१०	१४९३०३	१२	उप-कार्यकारी निर्देशक	तारा प्रसाद प्रधान	२०८२.१०.१०	अनिवार्य	आयोजना व्यवस्थापन निर्देशनालय	
११	१९३२८९	६	सहायक लेखा अधिकृत	सुवर्णेश्वर श्रेष्ठ	२०८२.१०.१०	अनिवार्य		
१२	१७५३६८	४	फोरमेन	केशवराज रेग्मी	२०८२.१०.१३	अनिवार्य	तनहुँ वितरण केन्द्र	
१३	१३४७०१	५	लेखापाल	निर्मला कोइराला	२०८२.१०.१५	अनिवार्य	लगनखेल वितरण केन्द्र	
१४	११५९५०	५	सुपरभाइजर	रण बहादुर सिंह	२०८२.१०.१५	अनिवार्य	चमेलिया जलविधुत केन्द्र	
१५	१६४४१५	४	गार्ड कमाण्डर	मिल बहादुर राना	२०८२.१०.१६	अनिवार्य	चतरा जलविद्युत केन्द्र	
१६	१९७४४६	४	फोरमेन	परमेश्वर प्रसाद राउत	२०८२.१०.१७	अनिवार्य	इनरुवा वितरण केन्द्र	
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१८	१५३८५८	४	फोरमेन	कपिलदेव पण्डित कुम्हार	२०८२.१०.२४	अनिवार्य	गौर वितरण केन्द्र	
१९	१९६३४२	४	फोरमेन	वेदनाथ सापकोटा	२०८२.१०.२६	अनिवार्य	भक्तपुर वितरण केन्द्र	
२०	१४१९७४	६	सहायक लेखा अधिकृत	पूर्ण बहादुर कुँवर	२०८२.१०.२७	अनिवार्य	कंक्रिट पोल प्लान्ट लम्की	
२१	१९२८७१	५	सुपरभाइजर	विनोद कुमार दत्त	२०८२.१०.२८	अनिवार्य		
२२	१८३३६५	६	सहायक प्रशासकीय अधिकृत	ताम्र बहादुर पण्डीत क्षेत्री	२०८२.१०.२९	अनिवार्य	वितरण तथा ग्राहक सेवा निर्देशनालय	
२३	१८३९९४	६	सहायक प्रशासकीय अधिकृत	प्रकाश कुमार बस्नेत	२०८२.११.०२	अनिवार्य	हेटौंडा-परवानीपुर-पोखरीया १३२ के.भी.प्र.ला. आयोजना	
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२५	१४४७९०	५	मि.रि.सु.भा.	रामध्वज लामिछाने	२०८२.११.०५	अनिवार्य	बालाजु वितरण केन्द्र	
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२७	१२७२२३	३	मिटर रिडर	देवी बहादुर वस्नेत	२०८२.११.०७	अनिवार्य	चतरा जलविद्युत केन्द्र	
२८	१५१३१३	१०	सह-निर्देशक	तोमलाल सुवेदी	२०८२.११.०८	अनिवार्य	लगानी विश्लेषण महाशाखा	
२९	१९७८२४	९	उप-प्रबन्धक	कमर आलम खा	२०८२.११.१०	अनिवार्य	गुलरिया वितरण केन्द्र	
३०	१४६५०६	६	सहायक इन्जिनियर	हेमन्त प्रसाद चौधरी	२०८२.११.१०	अनिवार्य	बुटवल ग्रिड महाशाखा	

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
३१	१८६३४१	४	फोरमेन	सुरेश बस्नेत	२०८२.११.१०	अनिवार्य	दुहबी ग्रिड महाशाखा	
३२	१८८५०७	६	सहायक प्रशासकीय अधिकृत	सहदेव भट्ट	२०८२.११.११	अनिवार्य	बुईपा ओखलढुङ्गा ३३ के.भी.प्र.ला. आयोजना	
३३	१३९१७२	५	वरिष्ठ गार्ड कमाण्डर	ख्याम बहादुर खड्का	२०८२.११.१४	अनिवार्य	आयोजना विकास विभाग	
३४	१७४४५८	९	उप-प्रबन्धक	गजेन्द्र कुमार चौधरी	२०८२.११.२१	अनिवार्य	बागमती प्रादेशिक कार्यालय, काठमाडौं	
३५	१८०१६३	३	मिटर रिडर	कृष्ण बहादुर सुवेदी	२०८२.११.२२	अनिवार्य	चतरा जलविद्युत केन्द्र	
३६	१६६५१२	२	हेल्पर	बृजकिशोर महतो धानुक	२०८२.११.२३	अनिवार्य	बीरगंज वितरण केन्द्र	
३७	१५४५५७	६	सहायक लेखा अधिकृत	उदय प्रकाश गुरागाँइ	२०८२.११.२४	अनिवार्य	कोशि कोरिडोर २२० के.भि. प्रशारण लाइन आयोजना	
३८	१६३३०६	८	सहायक प्रबन्धक	गोपाल प्रसाद रौनियार	२०८२.११.२८	अनिवार्य	काठमाडौं उपत्यका पश्चिम वितरण प्रणाली सुदृढीकरण आयोजना	
३९	१२४३३७	५	मि.रि.सु.भा.	दमयन्ती सिंह क्षेत्री	२०८२.१२.०२	अनिवार्य	भैरहवा वितरण केन्द्र	
४०	१९९७१६	४	फोरमेन	मिन बहादुर अधिकारी	२०८२.१२.०३	अनिवार्य	पोखरा वितरण केन्द्र	
४१	१४९४६९	८	सहायक निर्देशक	नारायण राज विष्ट	२०८२.१२.१०	अनिवार्य	वित्तिय लेखापारीक्षण महाशाखा	
४२	१८१७७२	११	निर्देशक	नसिवमान प्रधान	२०८२.१२.११	अनिवार्य	आयोजना विकास विभाग	
४३	१७१३४२	४	फोरमेन	हरि बहादुर श्रेष्ठ	२०८२.१२.११	अनिवार्य	कीर्तिपुर वितरण केन्द्र	
४४	१८५८३३	३	इलेक्ट्रिसियन	राजन कुमार राजवंशी	२०८२.१२.११	अनिवार्य	दमक वितरण केन्द्र	
४५	१९३९३९	४	फोरमेन	उद्धव प्रसाद पौडेल	२०८२.१२.१२	अनिवार्य	कुलेश्वर वितरण केन्द्र	
४६	१२५७७३	६	सहायक प्रशासकीय अधिकृत	बद्रि कुमार प्याकुरेल	२०८२.१२.१३	अनिवार्य	माथिल्लो त्रिशुली ३ ए जलविद्यत केन्द्र	
४७	१६१७५५	६	सहायक लेखा अधिकृत	देवेन्द्रमुर्ति पन्त	२०८२.१२.१६	अनिवार्य	कुलेखानी दोश्रो जलविद्युत केन्द्र	
४८	१७०६९१	२	कार्यालय सहयोगी	दुर्गा प्रसाद दाहाल	२०८२.१२.१६	अनिवार्य	इलाम (पुवाखोला) जलविद्युत केन्द्र	
४९	१८६६२७	६	सहायक प्रशासकीय अधिकृत	स्नेहलता सिंह राठौर	२०८२.१२.१७	अनिवार्य	लगनखेल वितरण केन्द्र	
५०	११६६९२	१२	उप-कार्यकारी निर्देशक	बेल प्रसाद शर्मा	२०८२.१२.२१	अनिवार्य	कानून विभाग	
५१	१६१२८३	५	सुपरभाईजर	बाल चन्द्र थापा	२०८२.१२.२५	अनिवार्य	काठमाडौं ग्रिड महाशाखा	
५२	१२६९२०	८	सहायक प्रबन्धक	राम दिनेश राय यादव	२०८२.१२.२९	अनिवार्य	चन्द्रपुर-सुकदेवचौक १३२ के.भी.प्रशारण लाइन आयोजना	
५३	१९२५३१	३	इलेक्ट्रिसियन	चन्द्र प्रसाद आचार्य	२०८२.१२.२९	अनिवार्य	कुलेखानी तेश्रो जलविद्युत केन्द्र	
५४	१६८४३०	३	इलेक्ट्रिसियन	ईश्वरी मिजार	२०८२.१२.३०	अनिवार्य	कुलेखानी प्रथम जलविद्युत केन्द्र	
५५	१३४८३७	१०	प्रबन्धक	लक्ष्मी नारायण मुखिया	२०८३.०१.०१	अनिवार्य	कुसाहा कटैया १३२ के.भी.प्र.ला.आ.	
५६	१७६६८८	६	सहायक इन्जिनियर	गोविन्द प्रसाद घिमिरे	२०८३.०१.०१	अनिवार्य	काठमाडौं ग्रिड महाशाखा	
५७	१८४२६१	५	सि.हे.इ.अ.	ज्ञान बहादुर तामाङ्ग	२०८३.०१.०१	अनिवार्य	सामान्य सेवा विभाग	
५८	१५३३९९	५	सि.हे.इ.अ.	राजन ठकुरी	२०८३.०१.०१	अनिवार्य	हैटौंडा ग्रिड महाशाखा	
५९	१८६०२५	५	सुपरभाईजर	राधा गुरुङ्ग	२०८३.०१.०१	अनिवार्य	बुटवल ग्रिड महाशाखा	
६०	१८३०४३	३	इलेक्ट्रिसियन	गोरख बहादुर रावल	२०८३.०१.०१	अनिवार्य	बाजुरा वितरण केन्द्र	
६१	१५९०६७	३	इलेक्ट्रिसियन	त्रिवेणी राउत	२०८३.०१.०१	अनिवार्य	सिमरा वितरण केन्द्र	
६२	१६५४४६	२	कार्यालय सहयोगी	सानु बाबु थापा	२०८३.०१.०१	अनिवार्य	काभ्रे वितरण केन्द्र	
६३	११११८८	२	हेल्पर	राजेन्द्र महतो धानुक	२०८३.०१.०१	अनिवार्य	बीरगंज वितरण केन्द्र	
६४	१६६६३७	२	हेल्पर	कुमार चौधरी	२०८३.०१.०१	अनिवार्य	अनारमनी वितरण केन्द्र	
६५	१४७५४०	४	फोरमेन	कृष्ण बहादुर भुजेल	२०८३.०१.०२	अनिवार्य	पोखरा वितरण केन्द्र	
६६	१४६१५७	७	लेखा अधिकृत	देवु प्रसाद दाहाल	२०८३.०१.०४	अनिवार्य	तामाकोशी जलविद्युत कम्पनी लि.	

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
६७	१७०८४४	६	सहायक इन्जिनियर	विरेन्द्र प्रकाश जोशी	२०८३.०१.०५	अनिवार्य	काठमाडौं ग्रिड महाशाखा	
६८	१९२९१७	५	लखापाल/स्टोरकिपर	कृष्ण कुमार श्रेष्ठ	२०८३.०१.०५	अनिवार्य	देविघाट जलविद्युत केन्द्र	
६९	१९५४०२	४	फोरमेन	समसुल हक मिया	२०८३.०१.०५	अनिवार्य	बीरगंज वितरण केन्द्र	
७०	१५३८२१	३	मिटर रिडर	तिर्थ बहादुर महत	२०८३.०१.०६	अनिवार्य	जुम्ला वितरण केन्द्र	
७१	१६११५५	३	मिटर रिडर	पदम बहादुर दनुवार	२०८३.०१.०७	अनिवार्य	लहान वितरण केन्द्र	
७२	१३३१०७	४	फोरमेन	कृष्ण प्रसाद शर्मा	२०८३.०१.०८	अनिवार्य	मेलम्ची वितरण केन्द्र	
७३	१२३३१४	७	लेखा अधिकृत	गेवेन्द्र शर्मा लम्साल	२०८३.०१.१२	अनिवार्य	गण्डकी प्रादेशिक कार्यालय, पोखरा	
७४	१३०९९३	६	सहायक कम्प्यूटर अधिकृत	शिव कुमारी पराजुली	२०८३.०१.१३	अनिवार्य	पोखरा वितरण केन्द्र	
७५	१५५४६७	६	सहायक इन्जिनियर	पदम सिंह विष्ट	२०८३.०१.१५	अनिवार्य	अत्तरिया ग्रिड महाशाखा	
७६	११९८६१	३	मिटर रिडर	रामबाबु चौधरी	२०८३.०१.१५	अनिवार्य	मलंगवा वितरण केन्द्र	
७७	१३४५७३	४	फोरमेन	धनुराज तामाङ्ग	२०८३.०१.१७	अनिवार्य	रामेछाप वितरण केन्द्र	
७८	१७७१२५	६	सहायक इन्जिनियर	तुलसी भक्त कोजु	२०८३.०१.२०	अनिवार्य	काभ्रे वितरण केन्द्र	
७९	१८३६५२	५	सुपरभाइजर	भुलीराम थापा	२०८३.०१.२०	अनिवार्य	समान्य सेवा विभाग	
८०	१८५४२२	३	इलेक्ट्रिसियन	कुन्ता पौडेल लुईटेल	२०८३.०१.२०	अनिवार्य	ठिमी वितरण केन्द्र	
८१	१२४४०४	३	इलेक्ट्रिसियन	राम चन्द्र राय	२०८३.०१.२१	अनिवार्य	मलंगवा वितरण केन्द्र	
८२	१९५३६४	२	हेल्पर	गोकर्ण अधिकारी	२०८३.०१.२१	अनिवार्य	ठिमी वितरण केन्द्र	
८३	१३२६६२	८	सहायक प्रबन्धक	मकुन्द राज पराजुली	२०८३.०१.२२	अनिवार्य	काठमाडौं ग्रिड महाशाखा	
८४	१४५७७४	७	प्रशासकीय अधिकृत	यम बहादुर श्रेष्ठ	२०८३.०१.२२	अनिवार्य	हेटौंडा भरतपुर बर्दघाट २२० के.भी.,प्र.ला.आयोजना	
८५	११५७८९	५	सुपरभाइजर	इश्वर प्रसाद चौधरी	२०८३.०१.२५	अनिवार्य	बर्दघाट वितरण केन्द्र	
८६	११३८५४	५	सुपरभाइजर	रामचन्द्र गिरी	२०८३.०१.२५	अनिवार्य	भरतपुर वितरण केन्द्र	
८७	१६४९७९	४	फोरमेन	हरी बहादुर अस्लामी मगर	२०८३.०१.२६	अनिवार्य	नयाँमिल वितरण केन्द्र	
८८	१२८७३१	११	निर्देशक	बलराम सिलवाल	२०८३.०१.२८	अनिवार्य	जनसाधन विभाग	
८९	१२०३०७	१०	प्रबन्धक	दिपेन्द्र राज द्विवेदी	२०८३.०१.२९	अनिवार्य	संस्थागत योजना महाशाखा	
९०	१९१९०५	६	सहायक लेखा अधिकृत	बसन्ती देवी श्रेष्ठ	२०८३.०१.३०	अनिवार्य	आन्तरिक लेखा परिक्षण विभाग	
९१	१७०१४५	४	फोरमेन	बेद बहादुर श्रेष्ठ	२०८३.०२.०१	अनिवार्य	पाँचखाल वितरण केन्द्र	
९२	१२२०७३	३	मिटर रिडर	अम्बर बहादुर राई	२०८३.०२.०२	अनिवार्य	भौगर्भिक परीक्षण विभाग	
९३	१२१८४६	५	सुपरभाइजर	खिलानाथ धमला	२०८३.०२.०४	अनिवार्य	दमक वितरण केन्द्र	
९४	१८२९५५	४	फोरमेन	कमल किशोर मण्डल	२०८३.०२.०६	अनिवार्य	सखुवा वितरण केन्द्र	
९५	१२१२२२	५	लेखापाल	बच्चुराम पण्डित क्षेत्री	२०८३.०२.०७	अनिवार्य	रत्नपार्क वितरण केन्द्र	
९६	१२६५२७	२	हेल्पर	गुरुदत्त भट्टराई	२०८३.०२.०७	अनिवार्य	कालिगण्डकी रिडी १३२ के.भी.प्रशारण लाइन आयोजना	
९७	१६४२२१	४	फोरमेन	रंगलाल राजवंशी	२०८३.०२.०८	अनिवार्य	दुहबी ग्रिड महाशाखा	
९८	१८१५९४	६	सहायक प्रशासकीय अधिकृत	उदय चन्द्र साह	२०८३.०२.१२	अनिवार्य	जनकपुर वितरण केन्द्र	
९९	१७८९८५	१०	प्रबन्धक	राजिव कुमार सिंह	२०८३.०२.१५	अनिवार्य	सामुदायिक ग्रामिण विद्युतिकरण विभाग	
१००	१९६८८४	५	मि.रि.सु.भा.	इश्वर भक्त श्रेष्ठ	२०८३.०२.१५	अनिवार्य	पोखरा वितरण केन्द्र	
१०१	१४३५८४	४	फोरमेन	पारस साह कानु	२०८३.०२.१५	अनिवार्य	कलैया विरतण केन्द्र	
१०२	१४२५१०	४	फोरमेन	सुरेश कुमार शिवाकोटी	२०८३.०२.१८	अनिवार्य	अनारमनी वितरण केन्द्र	
१०३	१४६८७७	५	सुपरभाईजर	बेग बहादुर तामाङ	२०८३.०२.२०	अनिवार्य	सिन्धुली वितरण केन्द्र	

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
१०४	१२५६५९	८	सहायक निर्देशक	राजेन्द्र संजेल	२०८३.०२.२२	अनिवार्य	केन्द्रीय लेखा महाशाखा	
१०५	१९७३३०	५	मि.रि.सु.भा.	रंजित प्रसाद कर्ण	२०८३.०२.२३	अनिवार्य	मधेश प्रादेशिक कार्यालय, जनकपुर	
१०६	१७७८९८	४	सि.मि.रि.	दिपक प्रसाद अधिकारी	२०८३.०२.२४	अनिवार्य	अछाम वितरण केन्द्र	
१०७	१६८२३८	६	सहायक लेखा अधिकृत	राज कुमार कटुवाल	२०८३.०२.२९	अनिवार्य	किर्तिपुर वितरण केन्द्र	
१०८	१२११०९	६	सहायक इन्जिनियर	वीर बहादुर हेन्जन तामाङ	२०८३.०३.०१	अनिवार्य	ढल्केबर ग्रिड महाशाखा	
१०९	१३१७१७	३	मिटर रिडर	अविराज शाही	२०८३.०३.०१	अनिवार्य	कालिकोट वितरण केन्द्र	
११०	११३६६४	६	सहायक लेखा अधिकृत	रमेश के.सी.	२०८३.०३.०२	अनिवार्य	रत्नपार्क वितरण केन्द्र	
१११	१४१६६२	५	सुपरभाइजर	हिक्मत बहादुर ठकुराठी	२०८३.०३.०२	अनिवार्य	महेन्द्रनगर वितरण केन्द्र	
११२	१६०९०५	६	सहायक इन्जिनियर	अनिल कुमार उपाध्याय अधिकारी	२०८३.०३.०३	अनिवार्य	वानेश्वर वितरण केन्द्र	
११३	१७८१०५	९	उप-प्रबन्धक	माधव प्रसाद यादव	२०८३.०३.०४	अनिवार्य	उदयपुर वितरण केन्द्र	
११४	१९१४४१	६	सहायक प्रशासकीय अधिकृत	मञ्जु श्रेष्ठ	२०८३.०३.०४	अनिवार्य	संस्थागत वित्तिय विभाग	
११५	१५०९०५	५	मि.रि.सु.भा.	दाताराम घिमिरे	२०८३.०३.०४	अनिवार्य	भद्रपुर वितरण केन्द्र	
११६	१६५९६५	४	फोरमेन	भिमसेन थापा मगर	२०८३.०३.०४	अनिवार्य	वानेश्वर वितरण केन्द्र	
११७	११८७९५	२	हेल्पर	बृज किशोर साह	२०८३.०३.०४	अनिवार्य	सखुवा वितरण केन्द्र	
११८	१४२६६५	७	कम्प्युटर अधिकृत	राजेन्द्र क्षेत्री	२०८३.०३.०७	अनिवार्य	परासी वितरण केन्द्र	
११९	१६२४८०	३	इलेक्ट्रिसियन	रेशम बहादुर थापा मगर	२०८३.०३.०९	अनिवार्य	हेटौडा ग्रिड महाशाखा	
१२०	१७५०८६	८	सहायक निर्देशक	इन्दिरा श्रेष्ठ	२०८३.०३.१०	अनिवार्य	सोलु कोरिडोर १३२ के.भी. प्र.ला.आयो जना	
१२१	१४६६९१	६	सहायक प्रशासकीय अधिकृत	मनहरी बस्नेत	२०८३.०३.११	अनिवार्य	उत्पादन विकास तथा सहायता विभाग	
१२२	१३७२६९०	४	फोरमेन	राजिव थापामगर	२०८३.०३.१२	अनिवार्य	हेटौडा वितरण केन्द्र	
१२३	१६९५३५	३	इलेक्ट्रिसियन	तुले ऐडी	२०८३.०३.१४	अनिवार्य	कालिकोट वितरण केन्द्र	
१२४	१७८४३९	७	प्रशासकीय अधिकृत	होम बहादुर अधिकारी	२०८३.०३.१४	अनिवार्य	मध्य मस्याङ्दी जलविद्युत केन्द्र	
१२५	१७१८३३	८	सहायक निर्देशक	कुवेर बहादुर पुडासैनी	२०८३.०३.१५	अनिवार्य	मोदी जलविद्युत कम्पनी लिमिटेड	
१२६	१८०१९०	६	सहायक इन्जिनियर	गणेश बहादुर राजभाट	२०८३.०३.१५	अनिवार्य	पोखरा ग्रिड महाशाखा	
१२७	११९५२४	५	लेखापाल	कृष्ण प्रसाद आचार्य	२०८३.०३.१५	अनिवार्य	जोरपाटी वितरण केन्द्र	
१२८	१५११९९	३	इलेक्ट्रिसियन	जय प्रसाद शर्मा	२०८३.०३.१५	अनिवार्य	म्याग्दी वितरण केन्द्र	
१२९	११८८८९	५	सुपरभाइजर	मोहन बहादुर गुरुङ	२०८३.०३.१६	अनिवार्य	मर्स्याङ्दी कोरिडोर २२० के.भी. प्रशारण लाइन आयोजना	
१३०	११६६९०	४	फोरमेन	केन्द्र बहादुर गुरुङ	२०८३.०३.१६	अनिवार्य	सामान्य सेवा विभाग	
१३१	१३८९७८	५	सुपरभाइजर	मनमोहन यादव	२०८३.०३.१७	अनिवार्य	परासी वितरण केन्द्र	
१३२	१९२१९५	६	सहायक इन्जिनियर	टंकमणी तामाङ	२०८३.०३.१८	अनिवार्य	धरान वितरण केन्द्र	
१३३	१९८३८२	२	कार्यालय सहयोगी	आइतमाया पोडेनी	२०८३.०३.१८	अनिवार्य	वानेश्वर वितरण केन्द्र	
१३४	१७१७०३	५	सुपरभाइजर	गणेश बहादुर बोहरा	२०८३.०३.२२	अनिवार्य	माथिल्लो त्रिशुली घए जलविद्युत केन्द्र	
१३५	१२२१३३	१२	उप-कार्यकारी निर्देशक	तुलाराम गिरी	२०८३.०३.२५	अनिवार्य	अर्थ निर्देशनालय	
१३६	१९१२३९	४	सहायक लेखापाल	महालक्ष्मी के.सी.	२०८३.०३.२५	अनिवार्य	लगनखेल विरतण केन्द्र	
१३७	१५८१३८	४	फोरमेन	जित बहादुर कार्की	२०८३.०३.२५	अनिवार्य	चतरा जलविद्युत केन्द्र	
१३८	१४३५२५	३	इलेक्ट्रिसियन	सिंह बहादुर वल	२०८३.०३.२५	अनिवार्य	हेटौडा वितरण केन्द्र	
१३९	१२११५२	४	फोरमेन	हरि प्रसाद प्याकुरेल	२०८३.०३.२६	अनिवार्य	त्रिशुली जल विद्युत केन्द्र	
१४०	१२०६५३	५	सि.हे.ई.अ.	ठग बहादुर कार्की	२०८३.०३.२७	अनिवार्य	अनारमनी वितरण केन्द्र	

नेपाल विद्युत प्राधिकरण

राजीनामा स्वीकृत भएका कर्मचारीहरूको विवरण

२०८२ माघ १ गते देखि २०८३ असाढ मसान्तसम्म

सि नं	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
१	१६०२२८	३	इलेक्ट्रिसियन	अशोक आचार्य	२०८२.१०.०६	राजीनामा		
२	१६२४४५	४	फोरमेन	चन्द्र शेखर सिंह	२०८२.११.१२	राजीनामा	त्रिशुली जलविद्युत केन्द्र	
३	१११३१०	४	सहायक लेखापाल	बल बोहोर	२०८२.११.२६	राजीनामा	नुवाकोट वितरण केन्द्र	
४	१९९६६८	३	मिटर रिडर	वन्दना जोशी	२०८२.१२.०१	राजीनामा	कुलेश्वर वितरण केन्द्र	
५	१८५२५५	१	जुनियर हेल्पर	कालु सिंह बिष्ट	२०८३.०२.०४	राजीनामा	बैतडी वितरण केन्द्र	
६	१४७३२३	६	सहायक ईन्जिनियर	रमेश मास्के	२०८३.०३.१८	राजीनामा	मर्स्याङ्दी कोरिडोर २२० के.भी. प्रशारण लाइन आयोजना	

नेपाल विद्युत प्राधिकरण

स्वेच्छिक अवकाश लिएका कर्मचारीहरूको विवरण

२०८२ माघ १ गते देखि २०८३ असाढ मसान्तसम्म

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
१	१८०७६६	७	लेखा अधिकृत	रामेश्वर प्रसाद पौडेल	२०८२.१०.१४	स्वेच्छिक	सामान्य सेवा विभाग	
२	१९७८२०	५	सि.हे.इ.अ.	सुरेन्द्र के.सी.	२०८२.१०.१५	स्वेच्छिक	समान्य प्रशासन महाशाखा	
३	१२८२४९	८	सहायक प्रबन्धक	सिताराम सिग्देल	२०८२.११.१०	स्वेच्छिक	विद्युत व्यापार विभाग	
४	१२१२९९	७	कम्प्युटर अधिकृत	कपिल देव पन्त	२०८२.११.२७	स्वेच्छिक	वितरण प्रणाली सुदृढीकरण तथा विस्तार आयोजना	
५	१५५२०२	६	सहायक लेखा अधिकृत	गोपाल पन्त	२०८२.१२.०१	स्वेच्छिक	रंगेली वितरण केन्द्र	
६	१९३८७५	६	सहायक लेखा अधिकृत	छविलाल पन्थी	२०८२.१२.०१	स्वेच्छिक	नयाँ बुटवल-लमही ४०० के.भी.प्रसारण लाइन आयोजना	
७	१२९१९९	६	सहायक इन्जिनियर	विनोद कुमार श्रेष्ठ	२०८२.१२.३०	स्वेच्छिक	बालाजु वितरण केन्द्र	
८	१८९०४३	६	सहायक प्रशासकीय अधिकृत	सरस्वती राजवंशी	२०८३.०१.०९	स्वेच्छिक	विद्युत प्रणाली व्यवस्थापन विभाग	
९	१११३१८	५	सुपरभाइजर	रिपुधन राई	२०८३.०१.११	स्वेच्छिक	भौगर्भिक परीक्षण विभाग	
१०	१६३५७३	७	प्रशासकीय अधिकृत	सिताराम थापा	२०८३.०१.१८	स्वेच्छिक	उत्पादन विकास तथा सहायता विभाग	
११	१३२५२८	८	सहायक प्रबन्धक	भिम राज कडरिया	२०८३.०१.२३	स्वेच्छिक	तनहुँ हाइड्रोपावर लिमिटेड	
१२	१५९००३	७	कम्प्युटर अधिकृत	शारदा भट्टराई	२०८३.०२.०१	स्वेच्छिक	उपलब्धी शाखा	
१३	१८०३१४	८	सहायक प्रबन्धक	मदन राज चापागाँई	२०८३.०२.११	स्वेच्छिक	जनसाधन विभाग	
१४	१३२८९२	५	लेखापाल	कविराज पराजुली	२०८३.०२.२९	स्वेच्छिक	बानेश्वर वितरण केन्द्र	
१५	१२२५३०	५	लेखापाल	राजु महर्जन	२०८३.०३.०१	स्वेच्छिक	लगनखेल विरतण केन्द्र	
१६	१६४९७४	२	कार्यालय सहयोगी	आइतलाल वलामी	२०८३.०३.०१	स्वेच्छिक	कार्यकारी निर्देशकको सचिवालय	

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
१७	१६०४८८	५	मि.रि.सु.भा.	सरिता घिमिरे	२०८३.०३.०१	स्वेच्छिक	रत्नपार्क वितरण केन्द्र	
१८	१५६७०६	५	सि.हे.ई.अ.	श्याम प्रसाद रुपाखेती	२०८३.०३.०७	स्वेच्छिक	मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजना	
१९	१५२७४४	७	इन्जिनियर	विपिन कुमार कायस्थ	२०८३.०३.०८	स्वेच्छिक	इनरुवा वितरण केन्द्र	
२०	१९७७२९	५	सि.हे.ई.अ.	सानु डंगोल	२०८३.०३.०९	स्वेच्छिक	महाराजगंज वितरण केन्द्र	
२१	११२०९०	५	सुपरभाइजर	राम महर्जन	२०८३.०३.१०	स्वेच्छिक	लगनखेल विरतण केन्द्र	
२२	१२२६४२	४	फोरमेन	लवराज गिरी	२०८३.०३.१०	स्वेच्छिक	लगनखेल विरतण केन्द्र	
२३	१५१५७९	३	मिटर रिडर	रामकाजी थापा मगर	२०८३.०३.११	स्वेच्छिक	बागमती प्रादेशिक कार्यालय, काठमाडौं	
२४	१३५१२९	८	सहायक निर्देशक	दुर्गा प्रसाद घिमिरे	२०८३.०३.१५	स्वेच्छिक	योजना अनुगमन तथा सूचना प्रविधि निर्देशनालय	
२५	१४३१०९	४	फोरमेन	रामशरण सिंह	२०८३.०३.१६	स्वेच्छिक	जलेश्वर विरतण केन्द्र	
२६	१७१९२४	३	मिटर रिडर	देवेन्द्र झा	२०८३.०३.१७	स्वेच्छिक	जलेश्वर विरतण केन्द्र	
२७	१४७६६१	५	सुपरभाईजर	श्रीराम खड्का	२०८३.०३.१७	स्वेच्छिक	लगनखेल विरतण केन्द्र	
२८	१७१५०८	४	फोरमेन	अनिल कुमार लाल कर्ण	२०८३.०३.१७	स्वेच्छिक	जलेश्वर विरतण केन्द्र	

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मृत्यु भई अवकाश भएका कर्मचारीहरूको विवरण

२०८२ माघ १ गते देखि २०८३ असार मसान्तसम्म

सि नं.	क.स.नं.	तह	पद	नाम थर	अवकाश मिति	अवकाशको किसिम	कार्यरत कार्यालय	कैफियत
१	१८५५०४	५	सुपरभाइजर	कुलराज थापा मगर	२०८३.०१.०३	मृत्यु	बुटवल ग्रिड महाशाखा	

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आर्थिक सहायता लिने कर्मचारीहरूको विवरण

२०८२ माघ १ गते देखि २०८३ असार मसान्तसम्म

सि.नं.	विवरण	आर्थिक सहायता लिने कर्मचारीहरूको विवरण	जम्मा रकम रू
१	काजक्रिया सहायता	कार्यविधि, २०७९ अनुसार १५० जना कर्मचारीको परिवारलाई २० हजार साथै १ जना कर्मचारी स्वयंको मृत्यु भएकोले ३० हजार रुपैयाका दरले जम्मा १५१ जनालाई काजक्रिया सहायता उपलब्ध गराइएको ।	३०,३०,०००.००
२	दैवी प्रकोप सहायता	कार्यविधि, २०७९ अनुसार ३ जनाको ४० हजारका दरले दैवि प्रकोप सहायता उपलब्ध गराइएको ।	१,२०,०००.००
३	कडा रोग सहायता	कार्यविधि, २०७९ अनुसार २ जनाको ५० हजारका दरले कडारोग सहायता उपलब्ध गराइएको ।	१,००,०००.००
		जम्मा	३२,५०,०००.००

दुर्घटनामा परी घाइते तथा अंगभंग भएमा पेश गर्नुपर्ने कागजातहरू :

१. **चालकको नाम, ठेगाना, सवारी इजाजत पत्र नवीकरण सहितको प्रतिलिपि**
२. **सम्बन्धित कार्यालयका प्रमुखबाट दिइएको कार्यदेश पत्र ।**
३. **दुर्घटना प्रतिवेदन (कार्यालयको तर्फबाट)**
४. **दुर्घटनाको प्रहरी प्रतिवेदन (स्थलगत मुचुल्का सहित)**
५. **दुर्घटना भएको साधनको नम्बर र किसिम (भाडा, सहकारी, संस्थान आदि)**
६. **सवारी साधन बीमा गर्दाको चालु बीमालेखको प्रतिलिपि ।**
७. **दुर्घटनाको किसिम (दुर्घटना आफ्नो कारणले वा तेस्रो पक्ष) ।**
८. **उपचार खर्चका सक्कल बिल तथा** Prescription **र शीर्षक वाइज खर्चको विवरणहरू ।**

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२०८३ असार महिनाको दरबन्दी विवरण

पद	सेवा	स्वीकृत स्थायी दरबन्दी	मौजुदा कर्मचारी	मौजुदा कर्मचारी	
			स्थायी	म्यादी/करार	जम्मा
कार्यकारी निर्देशक		१	१	०	१
उप कार्यकारी निर्देशक "अधिकृत स्तर (तह ६ देखी ११ सम्म)"	(प्राविधिक/प्रशासन)	९	८	०	८
	प्राविधिक	१७५८	१३५३	०	१३५३
	प्रशासन	८८३	७६७	१	७६८
	जम्मा	२६४१	२१२०	१	२१२१
सहायक स्तर (तह १ देखी ५ सम्म)	प्राविधिक	६०१९	४०९९	११२	४२११
	प्रशासन	२७६३	२२२३	९५	२३१८
	जम्मा	८७८२	६३२२	२०७	६५२९
	कूल जम्मा	११४३३	८४५१	२०८	८६५९

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दरबारमार्ग, काठमाडौं ।

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आन्तरिक : २००२, २००३

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