Terms of Reference for a Strategic Environmental Assessment for the Myanmar Hydropower Sector

Vision

Sustainable hydropower development based on integrated water, land and ecosystem planning, balancing a range of natural resources uses and priorities to achieve economic development, environmental sustainability and social equity.

1. Background

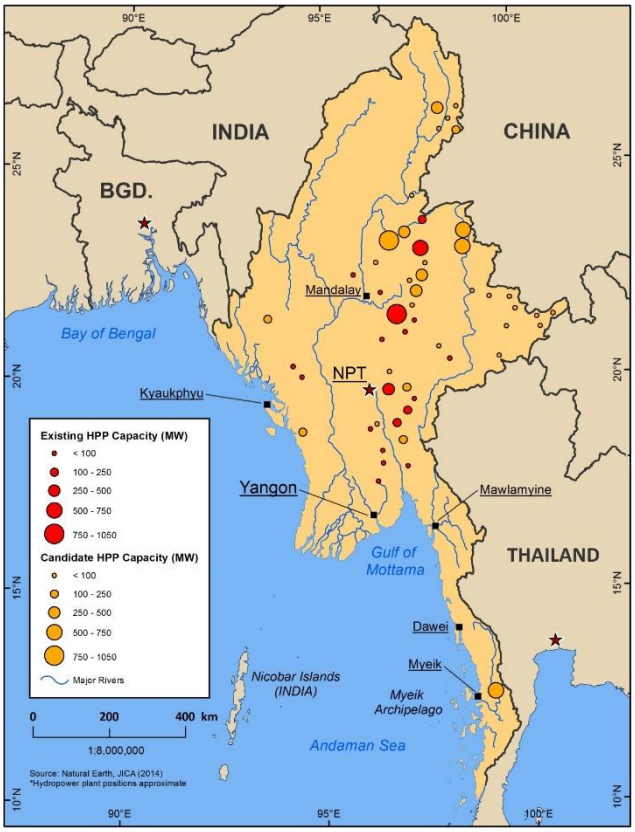
The Myanmar electricity supply system is grounded on hydropower and gas- and coal-fired thermal power plants, supplying 71.0%, 26.5% and 2.5% of grid supply respectively in 2012/13 (MoEP, 2015). The hydropower industry is in its relative infancy in terms of current installed capacity compared to potential installed capacity. Around 3,151 MW of hydropower capacity is operational, versus an estimated 45,632 MW of potential country-wide capacity (MoEP, 2015). The Myanmar hydropower sector is substantially underdeveloped compared to many neighbouring countries such as India, China and Laos.

National river systems largely retain natural flows, with the existence of few major dams. A number of Myanmar's major river systems are predominantly located within the country (e.g. Ayeyarwady = 95%, Chindwin = 100%), with only some upper reaches located in neighbouring countries where water resource development has had relatively little impact on the total basin flows.

Given the limited development of hydropower in Myanmar to date, combined with the recent opening up of the country to foreign investment and current high level of interest in this sector, coupled with rising national power demand, hydropower development is set to ramp up quickly over the next 5-20 years.

Limited policy, procedures and plans exist in Myanmar to drive sustainable hydropower development by integrating water, land, ecosystem and social management objectives, and there is recent strong opposition to some large proposed hydropower projects in the country. Therefore the time is appropriate to develop integrated policy and plans to guide the hydropower sector, a key pillar of national planning and economic development. In particular, policy and plans are required to guide the rapid expansion of medium/large hydropower projects in a coordinated whole-of-basin manner to achieve sustainable river use that balances hydropower generation with the protection of river ecosystems and the maintenance of ecosystem services whilst putting in place clear benefit sharing mechanisms with local communities.

Figure 1: Existing and Proposed HPP in Myanmar (MW)



Source: IUCN, 2015.

2. Strategic Environmental Assessment

Hydropower development in Myanmar over the next two decades has the potential to create significant national and sectoral impacts. The development of multiple hydropower projects within a watershed can severely degrade the riverine ecosystem and cause significant adverse impacts on river resource users, primarily by altering river flows (daily and seasonal) and segmenting rivers with dams that are impassable (by native fish and navigation). These impacts are long term and usually only reversible with the removal of the dams. The judicious use and protection of natural resources for multiple purposes over the long term, balancing the economic benefits of hydropower generation with ecosystem protection and services (e.g. flood control) and existing natural resource use (e.g. fisheries), is required to provide sustainable benefits to existing and new resource users.

A Strategic Environmental Assessment (SEA) provides the best tool to plan balanced hydropower development in a watershed or nationally as an SEA considers the cumulative impact of multiple projects across a broad area, particularly on significant environmental and social values early in the planning process. An effective SEA will lead to optimising project siting and configuration, the single most effective environmental and social impact avoidance measure available, particularly in Myanmar where comparatively few major water resource developments have been installed. Project proposals that emerge from the SEA process will have greater legitimacy and be more likely to gain public acceptance. These projects, as a result of reduced conflicts, are expected to have lower planning costs, a smoother approval process, and be more likely to be supported by international financial institutions, donors, and leading power companies.

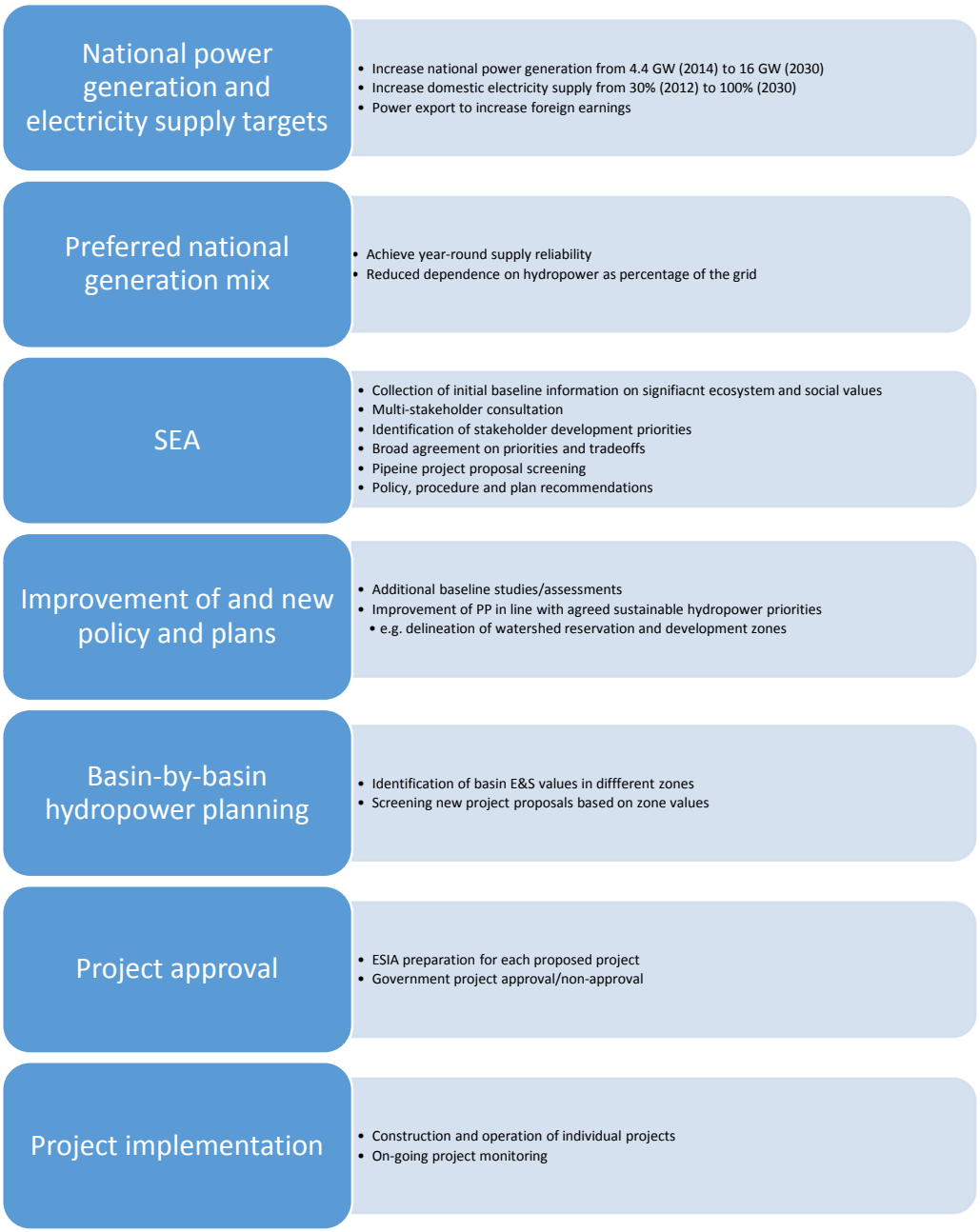
The SEA and sustainable hydropower development policies and plans that emerge from this process will move hydropower development from a top down economic and technical approach to an approach based on negotiating and sharing benefits and gaining public acceptance. The process will enable major E&S impacts to be avoided and provide the mechanism for society to agree on trade-offs related to other potentially significant impacts at the earliest possible planning stage, adding an environmental and social sustainability agenda to traditional considerations.

A major benefit of whole-of-watershed planning to the hydropower industry is that it can provide a "license to operate" by achieving a trade-off between development and conservation. Significant impact issues such as fish migration that cannot be solved by individual projects can be solved on a watershed or national basis (e.g. by conserving a notable river section whilst developing a lower value section). Solving such issues can remove major impediments to development bank support for hydropower projects by achieving compliance with international environmental and social standards and safeguards. Additionally, costly project investigation and feasibility planning can be directed towards those projects with a higher likelihood of obtaining public support/acceptance and government approval, reducing the likelihood of major hydropower projects being delayed or derailed by environmental and social issues (e.g. Myitsone HPP and Upper Thanlwin (Mong Ton) HPP late in the planning process.

Without an SEA and related integrated policies, procedures and plans, individual projects will be approved with insufficient consideration of cumulative impacts, most likely resulting in hydropower development on all major rivers, fragmenting and over-exploiting these resources principally for the economic benefit derived from power generation at the expense of impacts on aquatic ecosystems, water use, livelihoods impacts and related factors. This could also lead to a reduction in the anticipated or planned capacity than might have been achieved with comprehensive E&S planning.

The role of the SEA in Myanmar's overall power and hydropower planning is illustrated in Figure 2, showing the higher level energy targets of the country with the strategic policies, plans and project level initiatives.

Figure 2: Proposed Power and Hydropower Planning Process Incorporating SEA



The SEA will form Phase 1 of a three phase program for sustainable hydropower development:

Phase 1 SEA preparation
(i) pipeline project proposal screening
(ii) long-term pathway setting

Phase 2 Additional baseline surveys and assessments
Preparation of hydropower development policy, procedures and plans

Phase 3 Implementation of hydropower policy, procedures and plans

SEA Aim and Objectives

The aim of the Myanmar Hydropower SEA is to identify a balanced, equitable and sustainable development pathway for hydropower in Myanmar over the next 20 years and beyond, and achieve broad consensus on this, based on environmental, social and economic considerations, to achieve long-term economic development and sustainable use and protection of natural resources and ecosystems. The SEA will assess proposed/permitted hydropower projects with an installed capacity of 20 MW and above, based on the assumption that this scale of project creates notable impacts on rivers and natural resource use. The SEA aims to lead to integrated policy, procedures and plans that will guide and promote sustainable hydropower development.

The objectives of the SEA are to:

- understand and analyze the current state of hydropower development in Myanmar – related government policy and plans, existing projects, and the likely business-as-usual (BAU) hydropower development pathway;
- ensure hydropower meets growth targets with the least environmental and social impact and greatest benefit by helping avoid delays and increased costs;
- provide adequate environmental and social baseline information to inform consultation/dialogue with decision makers and other stakeholders and assist with the development of government policy and plans;
- involve decision makers and key stakeholders in establishing development priorities and influencing them to agree on a common set of priorities to achieve sustainable hydropower development;
- screen pipeline hydropower project proposals based on significant river and watershed values to provide E&S risk profiles by rating river stretches / sub-basins on significant existing E&S values that may be compromised by HPP development;
- describe the E&S impacts of hydropower projects to date and into the future;
- frame a preferred sustainable hydropower development pathway that optimizes environmental, social and economic outcomes in line with decision makers' and stakeholders' priorities; and
- recommend appropriate policy and plans (and supporting studies) that make trade-offs to achieve sustainable hydropower development, ecosystem protection and local natural resource use, accounting for institutional and policy constraints to mainstreaming environmental and social considerations into hydropower planning and development.

The screening of pipeline projects should ideally occur after the completion of the SEA and the preparation of related policy and plans. However, it is required as the initial step to provide a basin-wide context to the rapidly expanding list of project proposals in Myanmar.

The key expected outcomes of the SEA are: (i) a more informed and improved dialogue between stakeholders; (ii) a greater understanding by decision makers and other stakeholders of the range of stakeholder values and priorities that need to be taken into account in formulating the sustainable hydropower development pathway; (iii) an E&S rating of pipeline project proposals; (iv) a shared development pathway that accounts for stakeholder priorities; (v) clear recommendations on policies, procedures and plans required to plan hydropower, trading off different values and outcomes; and (vi) clear recommendations on additional baseline data gathering required to fill key information gaps. The SEA will also include a clear indication of the preferable river stretches or sub-watersheds for medium/large scale hydropower and those to retain in their existing state, enabling new projects to be sited to avoid significant adverse environmental and/or social impacts.

This SEA is principally an *ex ante* ("before the fact") assessment designed to influence policy and plans before the business-as-usual case plays out, although it will account for the impacts of existing projects

and screen pipeline project proposals as well[1]. It will be prepared with limited data[2] on riverine ecosystems, livelihoods and other baseline conditions, but this initial important step in the coordinated planning of major hydropower projects at national/basin/watershed level cannot wait until detailed information is available given the rate at which hydropower projects are currently being proposed, planned and developed. For example, baseline riverine ecosystem data is likely to be collected over numerous years, well after the SEA has been completed.

3. Resource Use, Major Impact Issues and Stakeholders

Myanmar's rivers, groundwater, and watersheds are a shared natural resource used by multiple interests ranging from private households to large businesses and government, for many different purposes. River uses / ecosystem services include hydropower generation, water supply for irrigation and domestic consumption, fishing and aquaculture, transportation, effluent disposal, sand/gravel extraction and recreation. Watersheds and rivers also sustain important biodiversity values (e.g. unique, limited range, migratory, endangered or critically endangered species). Watershed natural resource use in Myanmar spans the normal array of uses found in large catchments, including ecosystem protection/services, agriculture, forestry, tourism, historical site preservation, urban development, mining and recreation.

Operational hydropower projects in Myanmar range in size from micro to large (<1MW up to 790 MW installed capacity). The use of the Ayeyarwady-Chindwin river basin, occupying 58% of Myanmar's land mass, provides a useful snapshot of major river and water uses in the country. No hydropower projects have been developed on the lower reach of the Ayeyarwady river. The Ayeyarwady river is navigable for around 1,500 km, forming a major route for local and long distance river transport. Fishing and aquaculture are common activities along the length of the river, as are recreational activities.

Depending upon the project type and location, major environmental and social impact issues of hydropower projects may variously include those listed in Table 1. Major adverse impacts generally relate to longer term impacts that are larger in scale and more difficult to manage, and largely related to project site selection. Many construction phase impacts are usually not classed as major impacts as they occur over the short to medium term and are manageable using conventional measures.

Table 1: Major Potential Environmental and Social Impacts of Hydropower Projects (this is an illustrative, non-exhaustive table)

Factor	Potential Impact	Feature Affected and Cause
Environmental	River hydrology changes	Permanent downstream river flow modification, such as daily flow changes from peaking power releases, and seasonal changes from storage projects
	River geomorphology changes / degradation	Reduction in downstream sediment load due to pond/reservoir trapping and increased downstream river bank and bed erosion ("sediment hungry waters") Occasional release of large volumes of sediment when periodically flushing the desanding basin/pond/reservoir

[1] Several studies/masterplans have been completed from the feasibility angle: a) "Power System Planning 2011-2030: Existing Power Systems and Suggestions" by China Three Gorges Corporation & Hydro China Kunming Engineering Corporation, April 2014. b) "The Project for Formulation of the National Electricity Master Plan" by JICA, NEWJEC Inc., The Kansai Electric Power Co. Inc., December 2014.

[2] The World Bank supported Ayeyarwady Integrated River Basin Management Project (AIRBM), in conjunction with the National Water Resources Committee is undertaking a State of the Basin process for the Ayeyarwady River Basin. The Water, Land and Ecosystems (WLE) Initiative of the Consultative Group for International Agricultural Research (CGIAR) is supporting a number of research initiatives. In both cases new data is being generated that can contribute to the SEA process.

	Water quality changes / deterioration	Educed water quality from the detention of water in storage project reservoirs, often at depth. e.g. changes in temperature, dissolved oxygen content and nutrient levels. Occasional release of sediment from the desanding basin/pond/reservoir.
	Aquatic ecosystem / biodiversity degradation / loss	Aquatic ecosystem degradation / loss of aquatic biodiversity from river flow changes, alteration of water quality, creation of impassable obstacles for fish migration.
	Terrestrial ecosystem / biodiversity degradation/loss	Direct loss of biodiversity on project facility and ancillary sites, primarily in the reservoir area but also from such aspects as spoil disposal. Potential loss of connectivity to terrestrial fauna due to reservoir impoundment. Indirect loss from induced harvesting (e.g. from improved access into a forest area created by a project road or the reservoir waterbody).
Socio-economic	Land acquisition and resettlement, loss of agricultural/forestry land	Acquisition of private land and assets, and physical displacement / resettlement of households to another site Conversion of existing productive land uses (e.g. agriculture, forestry) to hydropower production (from reservoir flooding, regular downstream inundation), with an associated loss of production.
	Loss of or reduction in communal natural resources supporting livelihoods or cultural / religious practices	Reduction in or removal of fishing, aquaculture, water supply for irrigation and domestic consumption, forest and, grassland resources, etc. Disruption of the natural river flow regime that may be required for religious, cultural, or recreational purposes.
	Loss of cultural heritage sites	Primarily from reservoir inundation, but also from removal on any other project site.
	Access / transport restrictions	Curtailing river transport and cross-river road transport.
	Community safety	Safety risks associated with (i) the sudden release of a large volume flow (generation flow and/or spill flow), and (ii) structural failures /dam break resulting in the sudden release of a large volume of stored water (although a highly unlikely event).
	Impacts on indigenous peoples	Potential differential impacts on indigenous peoples livelihoods and physical displacement.
Cumulative impact	Cumulative basin impacts	The combined effect of multiple water resource and other developments in a defined area such as the watershed/basin.

Major project impacts are usually long-term, larger in scale and more difficult to manage. Common construction impacts that are short term and manageable are seen as relatively secondary for these reasons.

Stakeholders in hydropower development and related natural resource use range from individuals to Government Ministries/departments, commercial businesses, non-government organisations (NGOs) and other interested parties, while hydropower interests include developers, international finance institutions (IFIs), contractors and suppliers. Table 2 provides a list of some of the key decision makers and stakeholders that should be consulted during SEA preparation.

Table 2: Stakeholders in River and Watershed Management and Hydropower Development

Stakeholder Group	Stakeholder
Government Ministries/Departments/ Committees	Ministry of Electric Power (Department of Hydropower Implementation, Department of Electric Power Planning) Ministry of Energy Ministry of Agriculture and Irrigation Ministry of Livestock, Fishery and Rural Development Ministry of National Planning and Economic Development Ministry of Environmental Conservation and Forestry Ministry of Social Welfare, Relief and Resettlement Ministry of Transport Ministry of Construction Department of Meteorology and Hydrology Directorate of Water Resources and Improvement of River Systems National Water Resources Committee
Universities & research organisations	University of Yangon Mandalay University Yangon Technological University
Local communities	Communities affected by and likely to be affected by existing medium to large scale hydropower project
Local NGOs	Renewable Energy Association of Myanmar (REAM), KESAN, Myanmar Centre for Responsible Business, FREDA (numerous to be added)
International NGOs	Flora and Fauna International, The Nature Conservancy, Wildlife Conservation Society, WWF, IUCN, International Rivers, Stockholm Environment Institute, Water Land and Ecosystems, International Water Management Institute; Oxfam, among others
International finance institutions/bilaterals	IFC, World Bank, ADB, JICA, Norway, Australia, Netherlands, ANZ, Bangkok Bank, among others
Consultant Firms	National Engineering and Planning Services (NEPS), Supreme, among others
Hydropower developers & representative bodies	SN POWER, EDF, K-Water, Andritz Hydro, Tata, ShweTaung, IGE, members of the Hydropower Developers' Working Group, International Hydropower Association, MMCOLD, among others.

4. Government Objectives for the Power Sector

The Government of Myanmar aims to rapidly increase power generation and electrification across the country over the next 10-20 years to provide sustainable economic development and reduce poverty through the provision of affordable and reliable energy. It also aims to increase energy exports to increase foreign exchange earnings after meeting national demand. The Government is restructuring the energy and power sector, moving it from an inefficient state-controlled monopoly to a competitive, market-driven system. This involves: breaking up the sector's large vertically integrated utilities; facilitating implementation of a larger number of private energy and power projects; and introducing market-based reforms into the sector. State-owned generation and distribution assets are to be sold as separate business entities to the private sector to minimize the cost of energy and electricity by matching supply and demand under market-based conditions.

Key sector targets include increasing national generation capacity by 500-1,000 MW per year over the next 10 years to reach 16,665 MW of installed capacity, and to increase the electrification rate from 30% of the population to 75% by 2021/2022, and to 100% by 2030. The Government strategy for new electric power generation plants to be constructed by 2031 is based on an energy mix of 38% (8,896 MW) hydropower, 20% (4,758 MW) natural gas, 33% (7,940 MW) coal and 9% (2,000 MW) renewable

sources (other than hydropower). This generation mix will reduce the country's reliance on hydropower, thereby improving supply reliability during the summer months.

5. SEA Methodology

An essentially sequential methodology shall be followed to prepare the SEA, as outlined below, although this is open to modification and the addition of tasks to improve the assessment process as the SEA develops and new information is obtained.

5.1 Appointment of an Advisory Group

An Advisory Group (AG) consisting of representatives from the government of Myanmar (MOEP and MOECAF), development banks (IFC/WB, ADB, JICA, etc), donor countries (Norway, Australia, etc), and Myanmar CSOs/research institutes/academia will be established to provide long-term guidance and continuity to the development of sustainable hydropower in Myanmar. The AG will provide a united voice to achieve the desired outcomes, commencing with overseeing SEA preparation.

5.2 Confirmation of SEA Purpose and Methodology

During contract negotiation with the preferred firm, the purpose and context of the SEA will be confirmed by the AG. The selected consultants shall present any suggested improvements to the methodology set out in this ToR to the AG for review and approval as appropriate.

5.3 Collection of Initial Baseline Information

Integrating the SEA process into the policy and plans development process requires an in-depth understanding of the decision making process in the target sector and country. Information required by decision makers shall be identified, covering the political, institutional and governance context underlying decision-making processes.

Available key baseline information will be collected to adequately inform initial stakeholder discussions. The level of detail of baseline information will be limited to the best available information at the time, to enable an informed discussion by decision makers and key stakeholders on the main impact issues. Further baseline information will be collected as the SEA progresses and as needed. A significant limitation that the SEA will have to contend with is the limited availability of information on some baseline conditions (e.g. distribution of fish species), therefore these gaps will be identified and post-SEA studies will be proposed to be undertaken by relevant parties to provide detail on key subjects.[3]

Spatial Data
The following essential baseline spatial data is required to provide a firm starting point for discussions on multiple river and watershed management and related priorities, to be obtained as existing GIS layers or entered as new layers into a project GIS:

- Administrative boundaries*;
- Contour mapping, river/drainage, major watershed boundaries, etc*;
- Population distribution*;
- Hydropower projects equal to/above 20 MW - existing, under construction, approved, issued with a survey license/under feasibility study, and conceptual (see list in Appendix A);
- Natural forest cover* – existing and change over time;

[3] Data collected by the project will be provided to the government for its own repository of information.

- Protected areas* – existing and proposed (including heritage sites and precincts), boundaries, purposes, values;
- Key aquatic species distribution/range – migratory, limited range, endemic, exotic and invasive, critically endangered / endangered (e.g. Mekong river dolphin, Mekong shark);
- River transportation extent;
- Any other notable high conservation value, significant or sensitive sites or well known/widely recognized key ecosystem services; and
- Conflict areas.

  * indicates likely existing GIS data available from government agencies and other organisations such as the Myanmar Information Management Unit (a UN service).[4]

Note: IFC shall commence baseline spatial data collection, principally GIS-based data, using in-house capability prior to the commencement of the SEA to ensure that the best available data is obtained in a timely manner. The collected information shall be provided to the SEA consultant team, including thematic maps developed for a key watershed to illustrate the required output of the SEA for each major Myanmar watershed.

Expert Groups
Expert technical groups will be set up to facilitate discussions on: available data sources on baseline conditions; potential hydropower impacts; determination of the significance of baseline values; and review of the SEA methodology, assessment process and findings. Expert Groups will be formed for key issues such as "fish" or "aquatic ecology", "river use", "terrestrial ecology", "protected areas", "flood prone zones", "hydrology", "ethnic or indigenous peoples distribution" and "conflict areas". Expert group meetings will be convened by the Advisory Group, with at least one Advisory Group member and an SEA technical consultant present in each meeting. The expert groups will be an effective way of exploring each issue in detail by consulting with experts in different fields.

Baseline Description
Summary descriptions of the distribution of the various GIS features listed above will be prepared to provide an overview of these features, with this information obtained from secondary sources.

Existing Policies, Plans, Programs and Decision Making
All Myanmar development policies, plans and programs for sectors relating to sustainable hydropower development, including water resources (e.g. irrigation, water supply, flood mitigation), river transportation, protected area management, forestry, agriculture and land management, urban development, mining, archaeological and cultural sites, tourism, legal and customary resource rights, and other issues related to sustainable natural resource use shall be obtained and analysed. A short summary shall be prepared focusing on how each policy relates to water, land and ecosystem resource management and social protection.

The existing decision making process for hydropower project approval will be described, identifying the key agencies at national and provincial level as applicable, processes and main assessment criteria. The policies and guidelines of key international finance institutions that relate to hydropower development, natural resource and ecosystem protection and management, as well as social protection, shall also be summarised, including IFC, WB, ADB and JICA standards and guidelines.

5.4 Stakeholder Analysis and Engagement Planning

SEA is an integrative process that requires the participation of key stakeholders. The opinions, perspectives and priorities of a broad range stakeholders shall be sought to scope the SEA, informing

[4] IFC is in discussion with the WBG Geo Mapping Centre to provide support and use in Myanmar as well as with the WLE Healthy Rivers Initiative.

stakeholders about the priorities of other stakeholders, and seeking to influence them about the need to establish a shared vision for equitable and sustainable hydropower development. The SEA process will build on the open dialogue led by IFC, MOECAF and MOEP in January, October, and December 2015 on sustainable hydropower to stimulate discussions among decision-makers and affected/concerned stakeholders. If key stakeholders eventually endorse SEA recommendations they are likely to support the resulting policy, plans and projects that emerge from this process.

The broad range of stakeholders will be identified through discussions with known decision makers and stakeholders. Stakeholders to be consulted shall include those listed in Table 2 among others. Consultation shall include discussions with some communities affected by existing large dams/hydropower projects in Myanmar to understand potential legacy issues and environmental and social impacts that are likely to occur under the BAU case (but not seeking to resolve these issues). This process will be run throughout SEA preparation, with new stakeholders added as they become known.

A simple analysis will be undertaken to identify and cluster interested and affected stakeholders (likely to be affected by hydropower policy and plans) by (i) their degree of influence over decision making, and (ii) their relevancy to the SEA, based on (a) the significance of expected impact on their interest/s, and/or (b) their capacity to provide relevant information to the assessment process.

The SEA consultation process shall be outlined in a Stakeholder Engagement Plan that will guide this task. Consultation shall include, but not be limited to:

- discussions with individual stakeholders;
- workshops with multiple key stakeholders; and
- on-site discussions with stakeholders during field investigations.

The knowledge of stakeholders, particularly on existing and proposed developments and baseline ecological and social conditions, will be tapped into, with the different priorities of various stakeholders identified. By focusing the SEA on the sustainable development priorities of decision makers and key stakeholders, the SEA findings cannot be dismissed as being irrelevant at a later date. The SEA will initially focus on the most widely shared priorities, however as the debate picks up speed it will also address less widely shared concerns (e.g. access rights of individuals to natural resources).

It is expected that each of the six major river basins will be visited during SEA preparation to consult with key regional stakeholders and view issues on the ground. The number of visits to each basin will be determined during SEA preparation, but for the purpose of budgeting it should be assumed that tentatively six visits will occur in the Ayeywaddy-Thanlwin basin, four in the Thanlwin basin and three each in the other four major basins. In addition, numerous visits to will be required to agencies in Nay Pyi Taw, Yangon, Mandalay and other major centers to meet stakeholders. It should also be assumed that two initial workshops will be held with stakeholders to discuss issues and priorities (in Yangon and Mandalay) and similarly two workshops will be held to present the SEA findings.[5] Meetings will also occur with the Hydropower Developers' Working Group.

Note: stakeholder consultation will not be slanted towards hydropower development interests or any other single/narrow interest. It will be inclusive of all relevant views, both major and minor, so that balanced and equitable priorities and a broad range of issues are identified.

5.5 Identification of Sustainable Development Priorities

[5] Collaboration will involve the World Bank's AIRBM project to draw on the team knowledge and materials developed to avoid replication and add value. Where relevant, this process will also draw on other research programs.

The sustainable development priorities of government agencies and other stakeholders will be identified by obtaining their views on achieving balanced and sustainable hydropower development, and sound environmental and social outcomes. Existing policies and plans and good international industry practice shall also be considered.

Key issues and desired policy objectives under the main themes of environmental, social and economic priorities will be identified, and differing individual views will be discussed. Consultation will involve direct discussions with stakeholders, stakeholder workshops where baseline information, basin development concepts and the views of different groups are presented, and field discussions with stakeholders.

The consultants, working closely with the Advisory Group and Expert Groups, will seek to improve stakeholder understanding of the range of development priorities of stakeholders and to gain broad agreement on sustainable development priorities by:

- preparing an overview of key sustainable development priorities of decision makers / stakeholders so that these can be debated; and
- meeting relevant decision makers and stakeholders to present and discuss the different priorities.

Influencing decision makers and potentially affected or interested stakeholders starts with understanding the issues of concern and development priorities. The SEA team shall meet with relevant decision makers to identify policies and plans priorities and/or their major environment or sustainable development concerns. The team shall prepare a short overview of key environment or sustainable development priorities of decision makers so that these can be debated with relevant stakeholders**.**

The identified environment or sustainable development priorities of decision makers shall be discussed with the affected/interested parties to determine if these reflect needs and concerns of the wider community. Consultation may suggest new priorities or propose amendments to the priorities proposed by decision makers. Priorities shall be checked against related existing policies and plans to see where they align and differ.

A final overview of identified environmental / sustainable development priorities shall be presented to decision makers to seek their endorsement. The SEA will focus on both (i) shared priorities of stakeholders and (ii) good sustainable development outcomes. If the decision-making actors do not agree that certain issues are important, the SEA will note that certain issues of community concern did not receive wide support among decision makers, and discuss these 'minority concerns'.

Documented outcomes of consultation will be shared with consulted stakeholders, providing them with the opportunity to reconsider and amend the proposed policies and plans. Throughout this engagement process, the individual interests of various stakeholders in different sustainable development priorities shall be recorded. Later, interested people may be invited to participate in the assessment of implications of the proposed policies and plans regarding their concerns.

5.6 Screening of Pipeline Project Proposals

Pipeline project proposals (at feasibility planning stage but yet to be approved by GoM) will be screened based on their potential impact on significant river and watershed values (Note: operational and under construction projects will not be screened, but instead collectively considered to be existing projects. Screening of proposals will be undertaken by (i) rating the overall E&S value of each discrete sub-basins/river stretch that may be compromised by HPP development, and (ii) considering the main features of each project that may produce significant E&S impacts.

A limited number of significant river and watershed environmental and social values that may be compromised by HPP development (e.g. aquatic biodiversity, ecosystem service value, protected area location) will be rated and used to determine an overall value classification for each discrete sub-basin/river stretch. For example, the rating given to a sub-basin may be one of three (3) classes: "low" – ideal for development; "medium"; and "high" - at least one associated environmental or social issue is significant and may be difficult to overcome.

This rating will be overlayed with an understanding of the main features of each project that have the potential to compromise the identified significant values. For example, the interbasin transfer of water, storage generation, and the size of the reservoir are significant project features that would be considered, with the limitations of each project described and rated.[6]

Screening will be based on available spatial data and identified sustainable development priorities. The input of the Expert Groups will be essential in determining high value / no-go areas. Further refinement of project screening may occur at a later date once more detailed information becomes available.

5.7 Prediction of Business-as-Usual Hydropower Development

The BAU hydropower development pathway is largely market driven, with projects developed as quickly as government approval is provided and developers are able to secure financing and construct them. This pathway involves the approval of individual projects based on their specific environmental and social impacts, and does not consider a strategic basin-wide approach for the sustainable use of significant natural resources such as river flow regimes and ecosystems. A broad understanding of this development pathway is required to create discussion and debate among stakeholders in order to identify a preferred development pathway that avoids many of the BAU environmental and social impacts. The likely development scenario over the medium to long term is necessary so as not to underestimate the impact outcomes of hydropower development.

The BAU case will be predicted by taking into account all existing, under construction, approved and currently proposed hydropower projects with a capacity of 20 MW or greater, and other existing, under construction and proposed medium to large scale water resource projects, as well as likely hydropower project development (best estimate) over the next 20 years (Table 3). This scenario will decide which currently proposed projects are most likely to be built under the existing policy and planning regime, taking into account hydropower development over the past 10-20 years in neighboring countries that were in a similar situation to Myanmar (e.g. Lao PDR, Bhutan, India). Discussions with the Department of Hydropower Implementation, Ministry of Agriculture and Irrigation and other key agencies will be critical in framing the BAU case.

Table 3: Development Pathways – Business-as-Usual and Sustainable Development

Business-as-Usual Projects	Sustainable Development Projects
• Operational • Under construction • Survey licensed • Proposed for detailed feasibility study • Likely in the immediate future – based on existing Myanmar policy and plans and hydropower development under similar policy and plans in nearby countries over the past decade	• Operational • Under construction • Likely in the long term under strategic policy and plans focused on balanced and sustainable hydropower development

[6] "No-go zones" need to be discussed and considered based on the E&S rating profiles.

The BAU case (use Appendix A as the starting point) will be discussed separately for each basin and sub-basin, describing the current and proposed extent of water resource development. The key impact-related features of major water resource projects will be described to assist in forming a picture of the main likely environmental and social impacts within each basin.

5.8 Rapid Impact Assessment of Business-as-Usual Hydropower Development

A rapid overview assessment of the BAU case in 20 years time (2035) will be undertaken to provide an indication of likely environmental and social sustainability and economic effects, an essential input when considering a more sustainable hydropower development pathway. Only major impacts and benefits under these three themes will be predicted to maintain the strategic focus of the SEA, although likely secondary impacts shall be listed.

The main features of project types and important local conditions that act as drivers of key impacts will be identified and discussed. These generic drivers shall include, but not necessarily be limited to: downstream flow changes; length of dewatered river section downstream; fish/aquatic mammal species and endemism; presence of a fish ladder; reservoir water retention time; direct loss of / new access created through notable habitat; reservoir surface area; number of people expected to be displaced (total and per MW); presence of indigenous peoples, and cultural property affected. Each project will be categorized according to its type/drivers. The main impact zones of each project will be mapped (for example, dewatered river stretches and stretches subject to diurnal flow variations), clearly indicating where the impacts currently occur for existing and under construction projects versus the potential impacts if likely BAU projects are constructed. This mapping, overlaid onto baseline layers, shall provide a clear picture of where opportunities exist to avoid sensitive sites and significant and unsustainable environmental and/or social impacts.

The detailed quantification of impacts is not required for this overview, but rather the main issues and approximate magnitude of the impacts on basin natural resources, ecosystems, people and economic development shall be described to highlight the base case. At a minimum BAU impacts on river hydrology (seasonal and daily flows), aquatic ecology, river transport, fishing, protected areas and related social impacts on local people (including indigenous peoples), as well as the economic benefit to the country and other benefits such as irrigation, will be assessed. Sensitive sites/areas will be identified based on secondary information, consultation with Expert Groups, and agency and NGO discussions, including areas currently under conflict. The inspection of key sensitive sites will be undertaken by the relevant team specialist/s to check current conditions and more fully understand the issue/s.

5.9 Framing the Sustainable Hydropower Development Pathway

A vision for balanced and sustainable hydropower development will be prepared by the consultants based on the priorities of decision makers and stakeholders, and the achievement of good environmental and social outcomes. The vision will clearly state the desired natural resource, ecosystem, social and economic development outcomes.

5.10 Sustainable Development Recommendations

A written report shall be prepared by the consultants that presents the entire analysis, presenting clear recommendations on policies and plans to achieve agreed sustainable hydropower development over the medium to long term, and providing justification for the recommendations. Gaps in the existing decision making process and policies and plans in terms of creating the stated sustainable development

pathway will be identified. Recommended actions shall be presented in an action plan that is likely to include further consultation, identified knowledge gaps, baseline surveys and detailed assessments needed to finalize policy, plans, programs, implementation arrangements and a monitoring framework. For example, the SEA may identify potential sub-basins with notable values to preserve by excluding hydropower development, requiring detailed assessment to select the optimum areas.

6. Team Specialists

The team shall consist of core and supporting specialists across a range of fields to provide the level of baseline information collection, informed discussion, impact analysis and direction setting necessary to understand the BAU hydropower development pathway and the likely environmental, social and economic impacts of this course, to elicit and analyze stakeholder priorities to set a sustainable development pathway, and to make informed sustainable development recommendations. The core team shall include specialists with experience in Myanmar. Firms wishing to undertake this work are strongly recommended to form consortia that includes Myanmar organizations and individuals (including academics).

The core team should include the following key professionals as a minimum, but the consultants should propose any additional specialists that it believes are needed to complete the scope of work to a high standard:

- Team Leader / Environmental specialist;
- Aquatic ecologist;
- Social/livelihoods specialist;
- Hydropower engineer;
- Geomorphologist;
- Economist; and
- Myanmar Specialist Consultants (policy, environment, social)*.

Supporting specialists should include:

- GIS specialist*;
- Stakeholder consultation specialists*; and
- Interpreters*.

* - denotes recommended Myanmar national positions.

The team will be assisted by the Advisory Group that will provide on-going input on available baseline data, sustainable development objectives, consultation and relationship building, priority setting, and the review of draft reports.

7. Program

An indicative 12 month program is planned, using the following draft program as a general guide that can be improved upon.

Table 3: SEA Program

EIA Tasks and Milestones	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Confirmation of SEA purpose & methodology												
2. Initial baseline data collection												
3. Stakeholder consultation												
Milestone 1: First draft of GIS baseline layers												
4. Stakeholder analysis & engagement planning												
5. Identification of sustainable development priorities												
Milestone 2: Stakeholder Engagement Plan and identified devel. priorities												
6. Project proposal screening & ranking												
Milestone 3: Project Proposal Ranking												
7. Prediction of the BAU hydropower development case												
8. Rapid assessment of the BAU case												
Milestone 4: Summary & assessment of BAU hydropower development case												
9. Framing the sustainable hydropower development pathway												
10. Sustainable development recommendations												
Milestone 5: Draft SEA												
11. Review & comment on Draft SEA by Advisory Group												
12. Revision of Draft SEA based on Advisor Group comments												
13. Review & comment on Draft SEA by Government												
Milestone 6: Final SEA												

The program has to allow sufficient time for consultation with and feedback to stakeholders.

8. Inputs and Cost

The consultants are required to provide the total costs to undertake the work, together with a breakdown of:

(i) the person-days input of each professional;
(ii) the daily rate of each professional;
(iii) details of major expenses; and
(iv) details of any expenses that will be charged by unit rate.

9. Outputs

The milestone and final outputs of the SEA shall include:

- milestone data and reports, including: (i) Stakeholder Engagement Plan; and (ii) summary of BAU hydropower development case;
- a GIS database with layers indicating: (i) the location of hydropower projects (operational, under construction, approved, proposed); (ii) known significant environmental and social values by watershed and river stretch; and (iii) the predicted BAU and sustainable development cases for hydropower development; that can be built on over time to plan basin development and protection, and track major developments and changes to natural resource conditions;
- a detailed Draft SEA report and Final SEA report describing the BAU case and likely resulting impacts, describing sustainable development priorities and setting the sustainable development pathway, and providing clear recommendations for policy and plan improvement/development, supporting studies and additional consultation (as required); and

- general agreement among the majority of decision makers and key stakeholders on the recommended sustainable hydropower development pathway.

The consultant team shall provide monthly progress reports and follow-up conference calls to the Advisory Group, summarizing the progress of each current task against the agreed program and any issues that have arisen that may affect the timely completion of the work.

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Appendix A: Myanmar Power Sector

1. Myanmar Power Demand

Electrification is an emerging issue for Myanmar as the demand for electricity is projected to rapidly increase with economic growth, urbanization and industrialization. Only about one-third of the population currently has access to electricity, but electrification of the entire country is a goal of the Government by 2030. Power demand is predicted to increase by between 486-775% over the 18 year period between 2012 and 2030 (Table A.1).

Table A.1: Myanmar Power Demand Forecast

Year	High Case (MW)			Low Case (MW)		
	Non-Indust.	Industry	Total	Non-indust.	Industry	Total
2012	1,265	609	**1,874**	1,265	609	**1,874**
2020	3,060	1,472	**4,531**	2,390	1,472	**3,862**
2030	9,819	4,723	**14,542**	5,631	3,468	**9,100**

Source: Department of Hydropower Implementation (2015).

2. Myanmar Power Generation

Total installed hydropower capacity is reported as 3,151 MW (67.7% of total grid supply) by the Ministry of Electric Power in 2015, although these figures are slightly different from those provided by the Department of Hydropower Implementation (Table A.2).

Table A.2: Current Myanmar Generation Mix

Item	Grid System (MW)	Isolated (MW)	Total (MW)	Percentage (%)
Hydropower	3,011	33	3,044	66.46
Gas	1,325	-	1,325	28.92
Coal	120	-	120	2.62
Diesel	-	87	87	1.90
Biomass	-	5	5	0.10
Total	**4,456**	**125**	**4,581**	**100.00**

Source: Department of Hydropower Implementation (2015).

3. Myanmar Hydropower Generation

MOEP operates 20 hydropower plants with a total installed capacity of 2,780 MW (GoM, 2014). The oldest hydropower plant was constructed in 1960 (Baluchang 168 MW), two plants were constructed in 1985 and 1989, three plants between 1992-1998, eight more between 2000-2010, and six between 2010-2012. Upgrades are proposed to Thahtay (111 MW), Upper Yeywa (280 MW) and Upper Keng Tawng (51 MW) over time. In addition, Middle Paunglaung (100 MW) and Deedoke (66 MW) have signed an MOU to conduct detailed project investigation and prepare a Feasibility Study.

A summary of the current development stage of all hydropower projects (existing and proposed) is provided in Table A.3. Existing and proposed hydropower projects in Myanmar with a capacity of 12 MW or greater are listed in Table A.4, but this is a work in progress. Project details have been taken from a number of sources, with some projects and river locations referred to by different names as indicated.

Table A.3: Current Development Stage of Myanmar Hydropower Projects (2015)

Development Stage	Projects	Installed Capacity (MW)
Existing Power Plant	25	3,151
Implementation	5	1,495
JVA	5	12,799
MOA	14	16,490
MOU	19	10,047
Planning/Proposal	4	1,650
Total	**72**	**45,632**

Source: Ministry of Electric Power.

Table A.4: Myanmar Hydropower Projects - 12 MW and Greater (2015)

Project	River	Installed Capacity (MW)	Project Type[1]	Year Commission.	Stage of Construction (2015)
Operational					
Shweli-1	Shweli	600		2009	-
Dapein-1	Dapein	240		2011	-
Thaukyekhat-2	Thaukyekhat	120		2014	-
Baluchaung-1	Baluchaung	28		1992	-
Baluchaung-2 (Lawpita-2)	Baluchaung	168		1960/1974	-
Baluchaung-3	Baluchaung	52		2015	-
Nancho	Nancho	40		2014	-
Chipwi Ngi	Chipwi	99		2013	
Thaphanseik	Mu	30		2002	-
Sedawgyi	Chaungmagyi	25		1989	-
Yeywa	Myitnge (Dokhtawady)	790		2010	-
Kinda	Panlaung	56		1985	-
Zawgyi-1	Zawgyi	18		1995	-
Zawgyi-2	Zawgyi	12		2000	-
Keng Tawng	Namtein	54		2009	-
Upper Paunglaung	Paunglaung	140		2015	-
Paunglaung	Paunglaung	280		2005	-
Kabaung	Kabaung	30		2008	-
Kun	Kun	60		2012	-
Yenwe	Yenwe	25		2007	-
Shwegyin	Shwegyin	75		2011	-
Zaungtu	Bago	20		2000	-
Mone	Mone	75		2004	-
Kyee Ohn Kyee Wa	Mone	74		2012	-
Phyu		40		2015	-
Under Construction					
Shweli-3	Shweli	1,050		-	10% completed
Upper Yeywa	Myitnge	280		-	24% completed
Thahtay	Thahtay	111		-	42% completed
Upper Keng Tawng	Namtein	51		-	30% completed
Contract/JVA Signed					
Myitsone	Ayeyarwaddy	6,000			
Chipwi	Maykha	3,600			
Laza	Malihka	1,900			
Chipwe Nge	Chipwe	99			
Upper Thanlwin	Thanlwin	1,400			
Contract/MOA Signed					
Wutsok	Maykha	1,800			
Kaunglanhpu	Maykha	2,700			

Renan	Maykha	1,200			
Hpizaw	Maykha	2,000			
Gawlan	Nawchankha	120			
Hkankwan	Nawchankha	140		-	-
Lawngdin	Nawchankha	600		-	-
Tongxinqiao	Nawchankha	340		-	-
Hutgyi	Thanlwin	1,200			expected 2019
Shweli-2	Shweli	520		-	
Ywathit	Thanlwin	4,000			
Nao Pha	Thanlwin	1,200		-	-
Mantong	Thanlwin	225		-	-
Nam Tabak	Nam Tabak	285			delayed
Contract/MOU Signed					
Dapein-2		140			
Upper Thanlwin (Mong Ton)	Thanlwin	7,110			
Keng Tong	Nam Iwe	128			
Wan Da Ping	Nam Iwe	33			
Suo Iwe	Nam Iwe	160			
Keng Yang	Nam Iwe	40			
He Kou	Nam Iwe	100			
Nam Hka	Nam Iwe	210			
Manipur	Manipur	380			
Middle Yweya	Myitnge (Dokhtawaddy)	700			
Deedoke	Myitnge (Dokhtawaddy)	66			
Nam Li	Nam Li Hka	165			
Tum Bang	Tum Bang Hka	130			
Middle Paunglaung	Paunglaung	100			
Hpak Nam	Nam Pawn	105			
Hpi Hseng	Nam Pawn	45			
Upper Nam Pawn	Nam Pawn	150			
Lower Nam Pawn	Nam Pawn	105			
Upper Ham Kham	Nam Pawn	180			

1 – run-of-river; storage; pump storage.
Source: various.

Hydropower plants which would normally operate as peaking plants, generating for part of each day, are operating as base load power plants due to the shortage of power supply across 24 hour of each day. Power generation during summer months is limited by low river inflows. For example, firm generation capacity was limited to 986 MW (35% of installed capacity) during the 2013 summer.

The Director of the Department of Hydropower Implementation has indicated that there are potentially 302 hydropower projects in the country with a total theoretical installed capacity of 46,330 MW (Table A.5), however only 3,151 MW is connected to the national grid as of March 2015.

Table A.5: Potential Hydropower Projects

Size (MW)	Number of Projects	Potential Installed Capacity (MW)
<10	210	231
10-50	32	806
>50	60	45,293
Total	**302**	**46,331**

Source: Director of the Department of Hydropower Implementation.

MOEP is progressively adding new hydropower generation capacity. Out of 11 new hydropower plants with a total installed capacity of 2,132 MW designed to generate 7,865 MWh/a of electrical energy,

seven plants are proposed to be constructed by the government. MOEP is investigating another four hydropower projects with an aggregate installed capacity of 379 MW. MOEP is implementing 43 hydropower projects with an aggregate installed capacity of 42,226 MW on a Joint Venture/BOT basis. In addition, MOEP has investigated 92 locations with an aggregate potential installed capacity of 46,099 MW.

Seventeen projects at feasibility stage are being considered for development by international companies, consisting of nine projects proposed by companies from the Peoples' Republic of China, two projects each by Indian, Korean and Thai companies and several others.

Myanmar's policy on foreign investment is mostly by joint venture, based on an agreement between government and public or private companies, with the requirements of 10-15% free share and 10-15% free electricity.

According to studies by the United Nations and other sources, the hydropower potential of Myanmar is estimated to be as much as 40,000 MW. By 2002, 35 hydropower stations (including 15 medium-scale projects) had been completed with a total capacity of 390 MW, which is just 1 percent of the potential. The government signed an agreement with China Power Investment Corporation in 2007 for the construction of seven large dams along the Ayeyarwady, Maykha, and Malikha rivers in Kachin state. The largest one, the Myitsone dam, will be located at the confluence of the Maykha and Malikha rivers, which then become the Ayeyarwady river and will be 152 m high with an installed capacity of 6,000 MW.