Annex-II Small-Scale Hydropower Subtask A5 "Sustainable Small-Scale Hydropower in Local Communities"

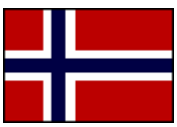
IEA Hydro Technical Report

Appendices

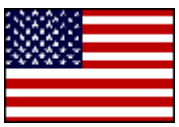
March 2017

IEA Hydro: Annex II

JAPAN



NORWAY



USA

Appendix A1

Current Status of Small-Scale Hydropower in the Countries Studied

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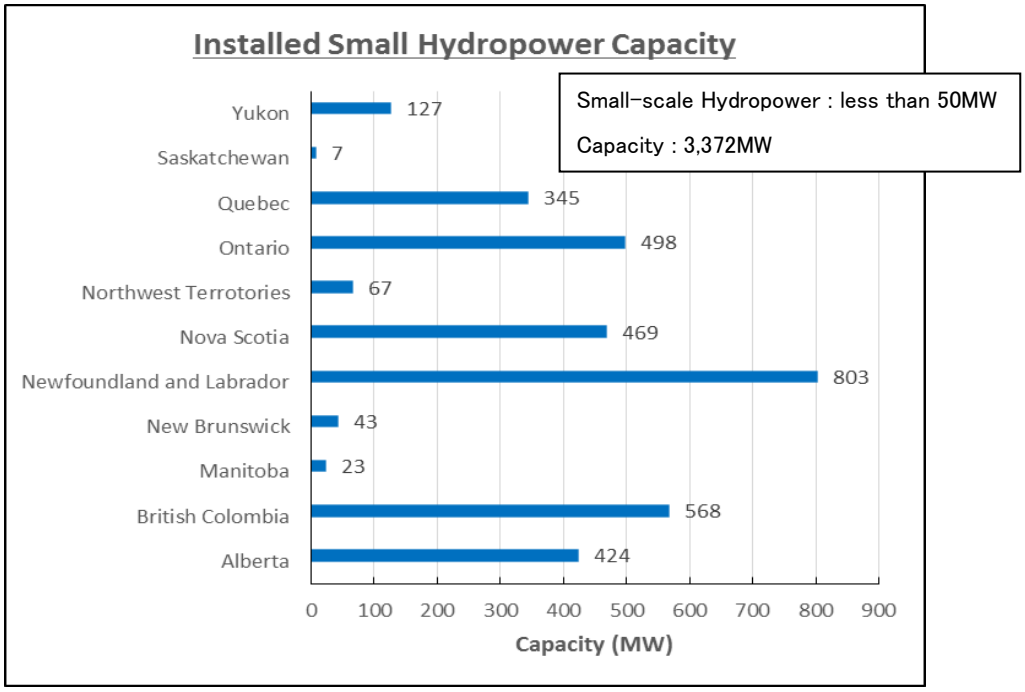
Current status of small-scale hydropower (Canada)

1. Outline of Small-scale Hydropower

Current development of small scale hydropower generation (less than 50MW) in Canada is outlined as follows:

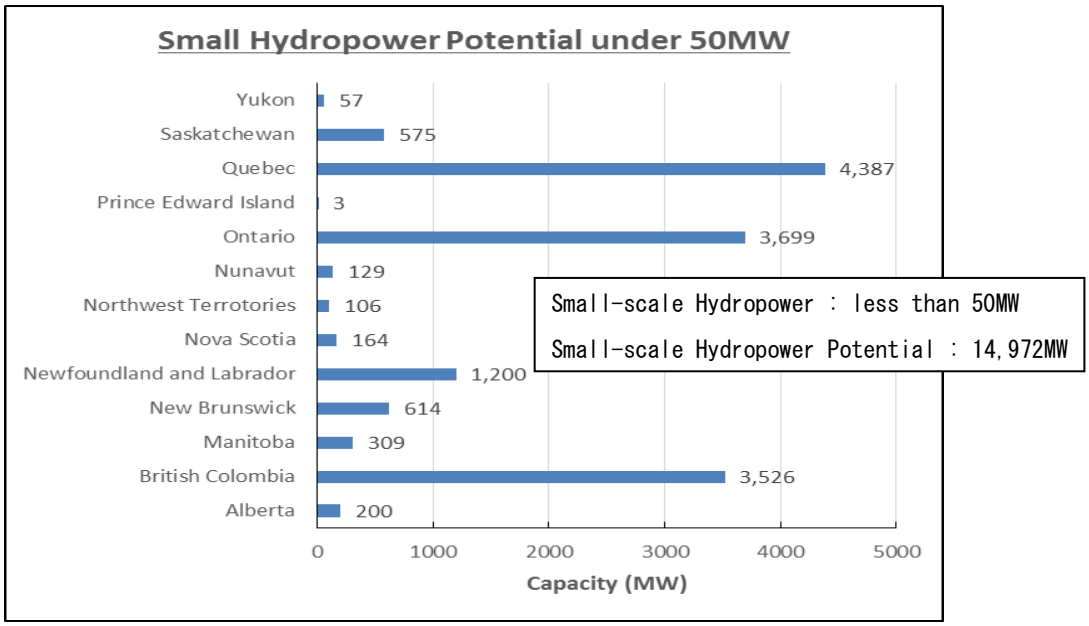
【Existing(Developed Potential)】



(Source) Statistics Canada catalogue 57-206-XIB

Fig.1 Installed Small-scale Hydropower Plants

【Small Hydro Potential】



(Source) Statistics Canada catalogue 57-206-XIB

Fig.2 Small Hydropower Potential under 50MW

2. Business Structure of Small-scale Hydropower

2.1 Liberalization of the Electricity Market

(Source) The Federation of Electric Power Companies of Japan

https://www.fepc.or.jp/library/kaigai/kaigai_jigyo/canada/detail/1231587_4788.html

Electric power utilities in Canada have been actively exporting and importing electric power to and from the United States for a long time. Given such a background, upon request from the United States which had already implemented power market liberalization, Canada has promoted the liberalization of power wholesale market by offering power transmission services using indiscriminately opened transmission lines.

As of the end of 2015, 8 provinces out of 10 (Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Colombia except for Newfoundland and Prince Edward) have implemented the liberalization of power wholesale market (by opening the power transmission lines).

With regard to the separation of power generation and transmission sectors (unbundling), most of the large-scale province-owned utilities have either separated their generation, transmission and distribution divisions into business units or adopted a separate accounting system.

As of the end of 2015, total liberalization of the power retail market has been introduced only in two provinces, Alberta and Ontario. Partial liberalization whereby only large-scale industrial consumers have an open access to the power grid is in place in the three provinces of New Brunswick, British Colombia and Quebec.

The electricity tariff in Canada varies greatly from province to province, whereas it is relatively low in provinces having rich and low-cost hydropower resources such as Quebec, Manitoba, and British Columbia.

2.2 Power producer

(Note)The following information are obtained from "Japan Electric Information Center, 2013"(Japanese version), and Web site of Association of Major Power Customers of BC(AMPC).

In Canada the Constitution, because it is the jurisdiction of the state mainly the electricity business regulation, electric utilities are operated in the state unit.

It consists state electric utilities, private electric utilities, local government electric utilities, industrial private power companies in Canada. The independent power producers are also operated in Ontario State and Alberta State who are advanced deregulation.

Electric Utilities in British Columbia :

Electric utilities in BC include:

- Publicly-owned Crown Corporations;
- Regulated private utilities;
- Municipally-owned entities; and
- Investor-owned entities.

(1)BC Hydro and Power Authority

BC Hydro and Power Authority (BC Hydro) is a crown corporation and reports to the BC Ministry of Energy, Mines and Natural Gas.

BC Hydro operates electricity generation, transmission and distribution facilities and provides electrical services throughout the province of BC. Its facilities include 31 hydroelectric facilities and three thermal generating plants, totaling 12,000 megawatts (MW) of installed generating capacity. BC Hydro delivers electricity to its customers via a network of over 18,500 km of transmission lines and 57,648 km of distribution lines. Their transmission network connects with transmission systems in Alberta and Washington State improving system reliability and providing electricity trade opportunities.

(2)FortisBC

FortisBC is a regulated private utility and provides electrical service to homes and businesses in the south central interior of BC. They have approximately 111,300 customers servicing the areas of Kelowna, Osoyoos, Trail, Castlegar, Princeton and Rossland. Through the wholesale supply of power to municipal distributors in the communities of Summerland, Penticton, Kelowna, Grand Forks and Nelson, FortisBC serves approximately 48,500 customers.

(3)Municipal Utilities

BC also has several municipal utilities that provide electric services.

Nelson Hydro operates generation, transmission and distribution facilities in and around the City of Nelson. The City of New Westminster, City of Grand Forks, City of Kelowna, City of Penticton and the District of Summerland operate distribution systems and purchase electricity from BC Hydro or FortisBC.

(4)Investor-Owned Utilities

Investor-owned utilities in BC include; Corix Multi Utility Services, Hemlock Valley Electrical Services Ltd. and Silversmith Power & Light Corporation.

3. Regulation/Facilitation Measures

3.1 Water Rights

(Source) Micro-Hydropower Systems, A Buyer's Guide/Natural Resources Canada

All water in British Columbia is owned by the Crown on behalf of the residents of the province. Authority to divert and use surface water is obtained by a licence or approval in accordance with the statutory requirements of the Water Act and the Water Protection Act.

Water licences for hydropower projects are generally issued for three categories: residential, commercial and general. The residential category applies to projects that have a capacity of 25 kW or less (in British Columbia), where the power is used to meet the household requirement of the licensee. The commercial category applies where the power is sold to immediate family members, employees or tenants of the licensee and

the project capacity does not exceed 499 kW, or where the project supplies power to an industrial facility in which the licensee has an interest of more than 50 percent.

The general category applies to projects where the capacity exceeds the licensee's household and commercial needs and includes projects that sell energy to the provincial/territorial power grid. Annual water rental fees for hydro projects depend on the category of the power use (residential, commercial or general), the capacity of the system and the actual annual energy output of the system.

3.2 Environmental Flow

(Source)Instream flow thresholds for fish and fish habitat as guidelines for reviewing proposed water uses SYNOPSIS/British Columbia Instream Flow Guidelines for Fish

Instream flows are directly related to natural water availability (e.g., rainfall, snow melt, groundwater) and human water use. The legal right to extract and use water is governed by conditions set out in water licences. Authority for granting and administering water licences rests with the provincial government and its water resources agencies (currently Land and Water BC, Inc.), but conditions in the water licence must comply with a variety of legislation, regulations, and policies.

At present, water licence applications are reviewed by staff in Land and Water BC and may be referred to other resource management agencies (federal and provincial) for comment. (Other licensees, applicants, or landowners, whose rights may be affected if the licence is granted, may also be notified.) If a review indicates that the fisheries resource is likely to be negatively affected by the proposed water use the application may be rejected. There is no formal procedure for determining which applications are referred, the extent of the review during the referral, or how instream flows for fish are ultimately determined. Thus, water allocation decisions may vary among licence applications, streams, and regions, with the consequence that fisheries resources may not be protected to the same level in all streams.

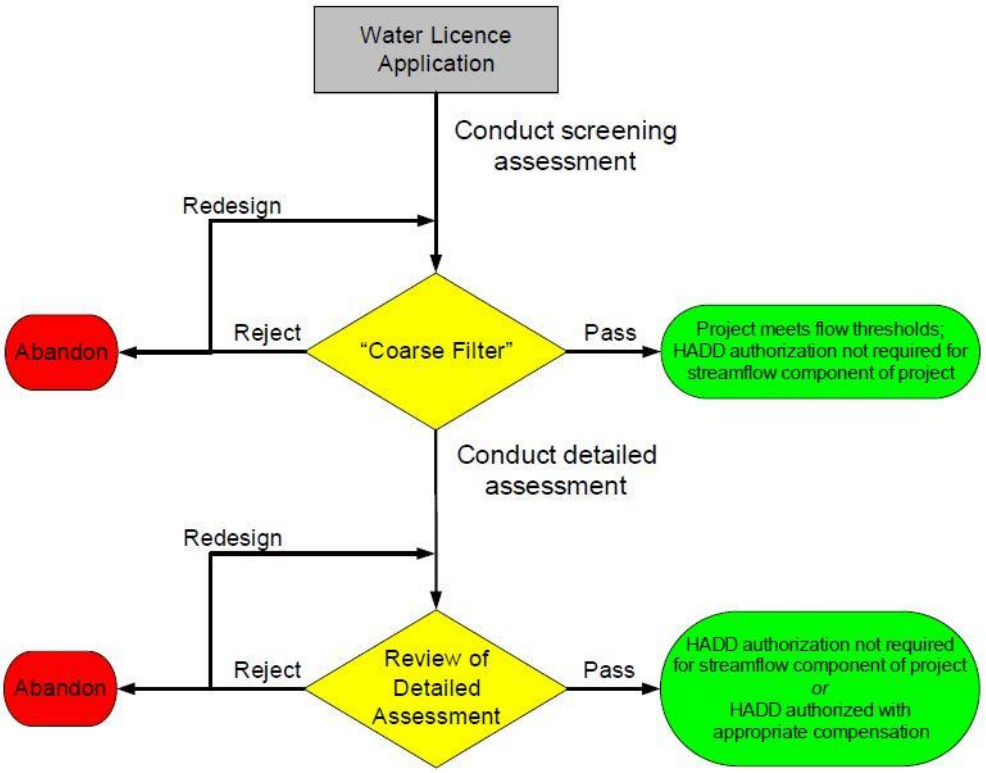


Fig.3 General decision schematic for a two-tiered review process

The "coarse filter" is first applied to a proposed water use. If the coarse filter indicates that fish-flow issues are not a concern the application would be approved subject to review of other fisheries concerns (e.g., intake screening, footprint issues, etc.). If the coarse filter indicated a potential fish-flow concern then the applicant has three options: abandon the project, redesign it to meet the flow thresholds (e.g., alter diversion rates or timing) or collect and present additional information to demonstrate that fish-flow concerns are adequately addressed within the proposed flow regime.

3.3 Support Schemes(Feed-in Tariff, etc.)

(Source) World Small Hydropower Development Report 2013/ICSHP

In Canada, incentives to develop clean, renewable or green power typically take one or more of the following forms: tax incentives, requests for proposal, standard offer programmes, net-metering and/or feed-in tariffs. The application and availability of these programs varies from province to province, and the schemes are subject to frequent amendments and adjustments.

(1) Federal Incentives

(Source) http://www.nrcan.gc.ca/ecoaction/14145

1)ecoENERGY for Renewable Power

The Government of Canada has invested nearly $5 billion in the ecoENERGY initiatives to help Canadians use energy more efficiently, boost renewable energy supplies and develop cleaner energy technologies.

The ecoENERGY for Renewable Power program was launched in April 2007 to encourage the generation of electricity from renewable energy sources such as wind, low-impact hydro, biomass, photovoltaic and geothermal energy. Although no new contribution agreements have been signed after March 31, 2011, projects with contribution agreements receive a one cent per kilowatt-hour (kWh) incentive for eligible production during their first ten years of operation. The program itself will end on March 31, 2021.

As of March 31, 2011, 104 projects qualified for funding under the program representing investments of about $1.4 billion over 14 years and almost 4500 megawatts of renewable power capacity.

2) Accelerated Capital Cost Allowance (ACCA)

A 50% accelerated CCA is provided under Class 43.2 of Schedule II to the Income Tax Regulations for specified clean energy generation equipment. Eligible equipment includes solar thermal, solar air and solar photovoltaic equipment while project size restrictions have been eliminated.

Class 43.2 was introduced in 2005 and is currently available for assets acquired on or after February 23, 2005 and before 2012. For assets acquired before February 23, 2005, accelerated CCA is provided under Class 43.1 is 30%.

(2) Provincial Incentives (British Columbia)

British Columbia has the following incentives for Small-Hydro Projects:

1) Sales Tax Incentives for Material and equipment used to conserve energy

Provincial sales Tax (PST) exemption for material and equipment used to conserve energy or produce electricity from renewable source. Expiry dates vary.

Eligible materials and equipments include:

- insulation;
- “energy Star Qualified” windows, doors, skylights and residential appliances;
- energy efficient residential furnaces, boilers, heat pumps and gas-fired water heaters (minimum ratings apply);
- energy efficient commercial boilers;
- alternative energy sources (e.g., ocean, wind, solar and micro-hydro power generating equipment);
- natural gas and propane conversion kits;
- hybrid electric and HCGN bus conversions; and
- aerodynamic and anti-idling devices for trucks and tractor-trailers (gross vehicle weight minimums may apply)

2) Net Metering

Customers earn credits by transferring excess electricity generated primarily for their own use from clean energy (e.g., hydro, wind, solar, pohotovoltaic, geothermal, tidal, wave and bio-mass) to the electrical grid.

Generating units must have a rating capacity of 50kWor less and use a “BC Clean” energy source.

3) Standing Offer Program

BC Hydro implemented a Standing Offer Program to encourage the development of small and clean energy projects throughout British Columbia. The program is a process to purchase energy from small projects with a nameplate capacity greater than 0.05 megawatts but not more than 10 megawatts.

Ontario Electric Support Program:

1) Feed-in tariff (FIT) programmes

These programmes provide guaranteed grid access and stable prices under long-term contracts (up to 40 years for hydro, for example) for electricity generated from renewable sources. Ontario's FIT Programme is North America's first comprehensive guaranteed pricing structure for renewable electricity production and is offered for projects under 50 MW.

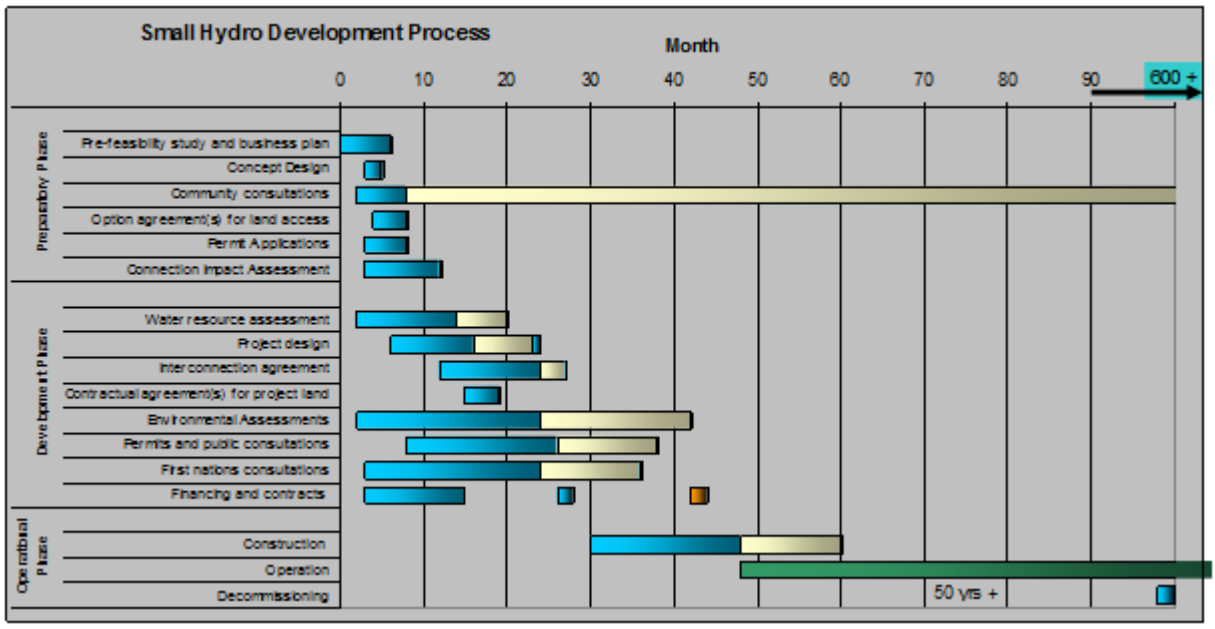
3.4 Others

(1) Licensing Procedures for Small-scale Hydroelectric Power Development

(Source)Annex II, Subtask A3:Small Scale Hydro-Public Policy & Experience

The average timeline for licensing small hydroelectric projects in Canada is approximately 40 months (see Table 1). However, licensing procedures and timelines in Canada do vary between provinces and territories.

Table 1 Canadian Average Timelines for the Small Hydro Development Process



In the province of British Columbia the Ministry of Agriculture and Lands, and Ministry of Environment are responsible for allocating Crown land and water for the benefit of

British Columbians. They play an important roles in environmental assessment, land tenure and protection and the management of the environment. Applications for a waterpower project will be processed through "one window" with the water licence and Crown land tenure applications adjudicated concurrently. The major legislations that relate to the development and operation of hydropower facilities enacted by the government of British Columbia are the Environmental Assessment Act, Water Act, Land Act, Ministry of Environment Act, Municipal Act, Public Utilities Act, Utilities Commission Act, Hydro and Power Authority Act and the Transmission Corporation Act.

(2) First Nations Consultation

(Source) Hydroelectric Power Generation Development Inquiry February 28, 2011/Alberta Utilities Commission

Consultation with potentially affected First Nations is one of the primary considerations during the preliminary portion of a prospective hydro development. The constitutional duty to consult rests with both the provincial and federal governments, with a goal to avoid or mitigate potential adverse impacts on Aboriginal rights and claims.

During the course of the inquiry, various First Nations provided their views on the consultation obligations of the Crown in relation to potential hydro developments. These views were presented in written format as well as through presentations and remarks made during the roundtable discussions.

【The Government of Canada's Approach to Implementation of the Inherent Right and the Negotiation of Aboriginal Self-Government】

(Source) http://www.aadnc-aandc.gc.ca/eng/1100100031843/1100100031844

The Inherent Right of Self-Government is a Section 35 Right:

The Government of Canada recognizes the inherent right of self-government as an existing Aboriginal right under section 35 of the Constitution Act, 1982. It recognizes, as well, that the inherent right may find expression in treaties, and in the context of the Crown's relationship with treaty First Nations. Recognition of the inherent right is based on the view that the Aboriginal peoples of Canada have the right to govern themselves in relation to matters that are internal to their communities, integral to their unique cultures, identities, traditions, languages and institutions, and with respect to their special relationship to their land and their resources.

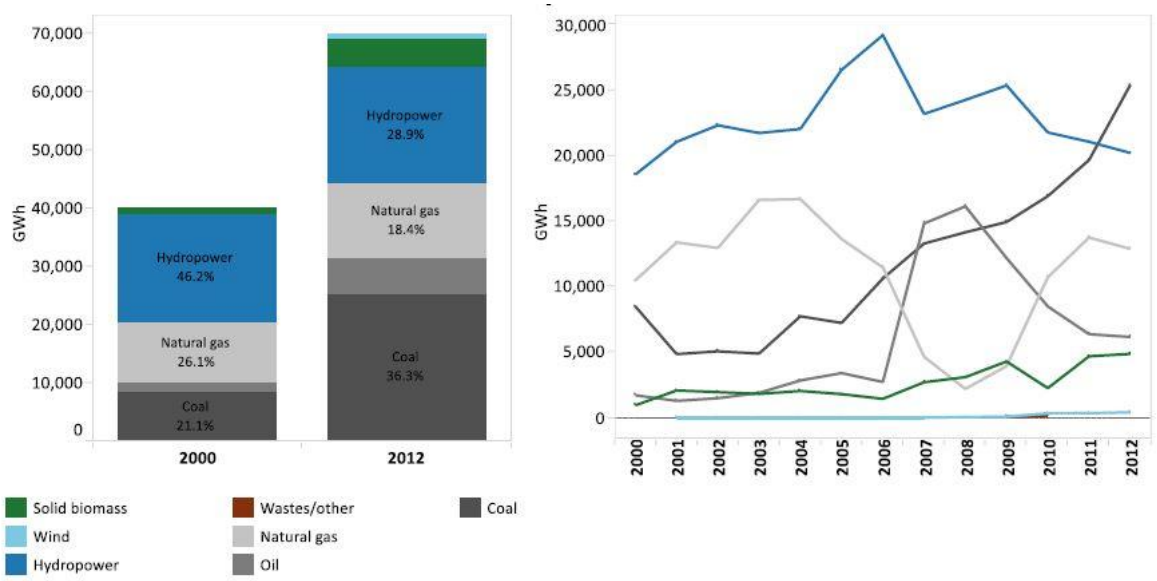
The Government acknowledges that the inherent right of self-government may be enforceable through the courts and that there are different views about the nature, scope and content of the inherent right. However, litigation over the inherent right would be lengthy, costly and would tend to foster conflict. In any case, the courts are likely to provide general guidance to the parties involved, leaving it to them to work out detailed arrangements.

For these reasons, the Government is convinced that litigation should be a last resort.

Negotiations among governments and Aboriginal peoples are clearly preferable as the most practical and effective way to implement the inherent right of self-government.

Current status of small-scale hydropower (Chile)

1. Outline of Small-scale Hydropower



		Electricity generation	Share of renewables
2000	Total	40,078.0 GWh	
	Of which renewables	19,457.0 GWh	48.5%
2012	Total	69,751.0 GWh	
	Of which renewables	25,421.0 GWh	36.4%

		Electricity generation	Share in total renewables
2012	Wind	409.0 GWh	1.6%
	Solid biomass	4,854.0 GWh	19.1%
	Hydropower	20,158.0 GWh	79.3%

Fig. 1 Electricity Generation by Source

(Source) IRENA/Renewable Energy Policy Brief, Chile, June 2015

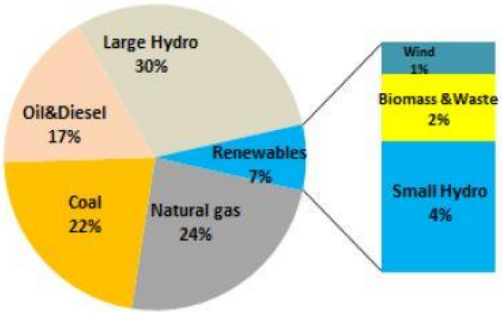


Fig. 2 Electricity Generation by Source, 2012

(Source) BNEF, CNE and own elaboration

Table 1 Current State of Small Hydro (As of August 2014)

(Source)Renewable Energy Center of Chile's Ministry of Energy(RNC) Statistics

In Operation (MW)	Under Construction (MW)	With Environmental Approval Issued (MW)	Under Environmental Review (MW)
342	34	290	185

The hydropower ranges commonly used in Chile are: pico hydro: 200W～5kW; micro hydro: 5.1～100kW; mini hydro: 101～2,000kW; small hydro (small hydropower): 2.1～20MW. In Chile, hydroelectric generators smaller than 20MW are considered "Non-conventional Renewable Energy".

Chile is endowed with a total hydropower potential of about 60,000MW. The Chilean Association for Small and Medium Hydroelectric Plants (APEMEC) reports, in its May 2012 bulletin, a mini-hydropower potential between 7,000MW and 17,000MW was estimated by the Energy Ministry (Fig. 3). This theoretical potential is located in the central and southern region of Chile.

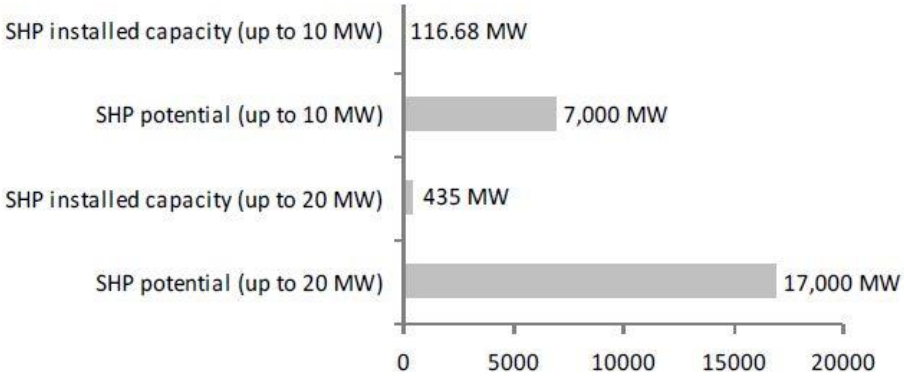
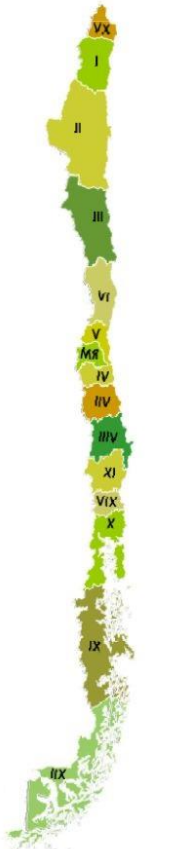
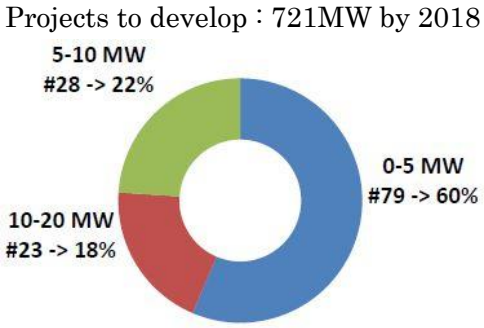


Fig. 3 Small hydropower capacities in Chile

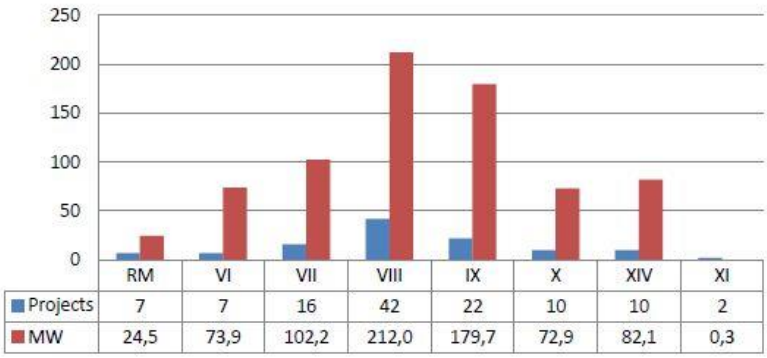
(Source)World Small Hydropower Development Report 2013 (UNIDO, ICSHP)



Chile Region



Distributed by size (MW)



	RM	VI	VII	VIII	IX	X	XIV	XI
Projects	7	7	16	42	22	10	10	2
MW	24,5	73,9	102,2	212,0	179,7	72,9	82,1	0,3

Projects by Region

Fig. 4 Projects to develop

(Source) A historical and current Energy Market and Small Hydro in Chile, 2015(Ministry of Energy)

2. Business Structure of Small-scale Hydropower

2.1 Electric Power Supply System

The electric power utilities in Chile began liberalizing the power trade market in 1982 ahead of other countries in the world. In a series of structural reforms, the state-owned electric power utility was divided and privatized, while a wholesale power market was introduced and the role of supervising bureaus and regulatory authorities were specifically designated, thus the basis of the current power market system was established. The electricity tariff, power market, bidding procedure, etc are regulated by the relevant laws, and the transparency of the system is ensured. Since the liberalization, a number of European and American capitals have been invested in power generation and transmission businesses. The power distribution sector can be entered by obtaining an operating permission (concession) in certain service areas, while Economic Load Dispatching Center (CDEC) in each power grid plays an integral role in managing the power system operation and trade market. The scope of liberalization has not been extended to retail power market.

Fig.5 shows the country's electric power supply system.

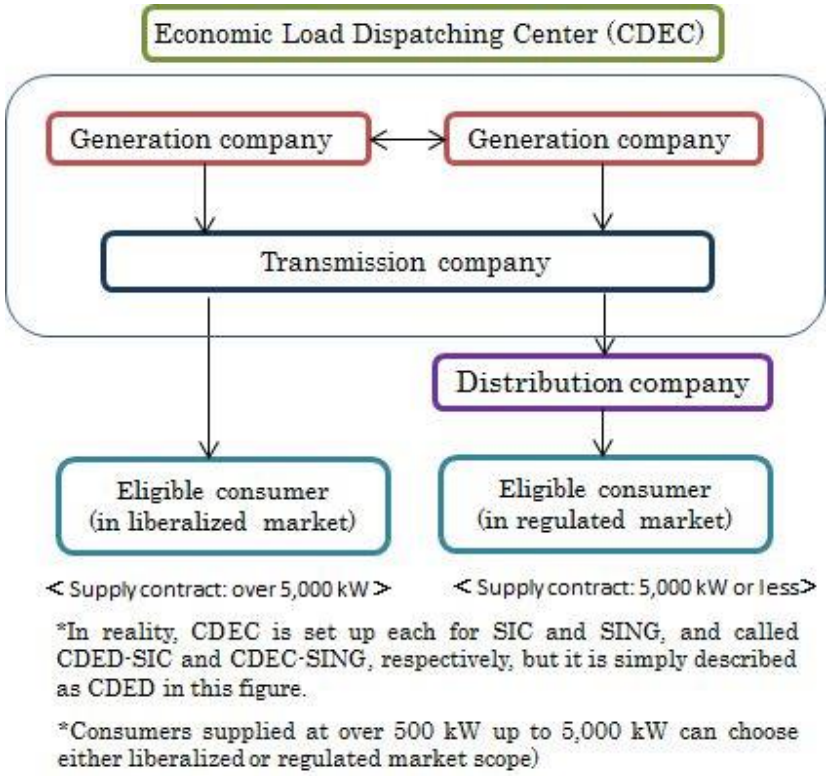


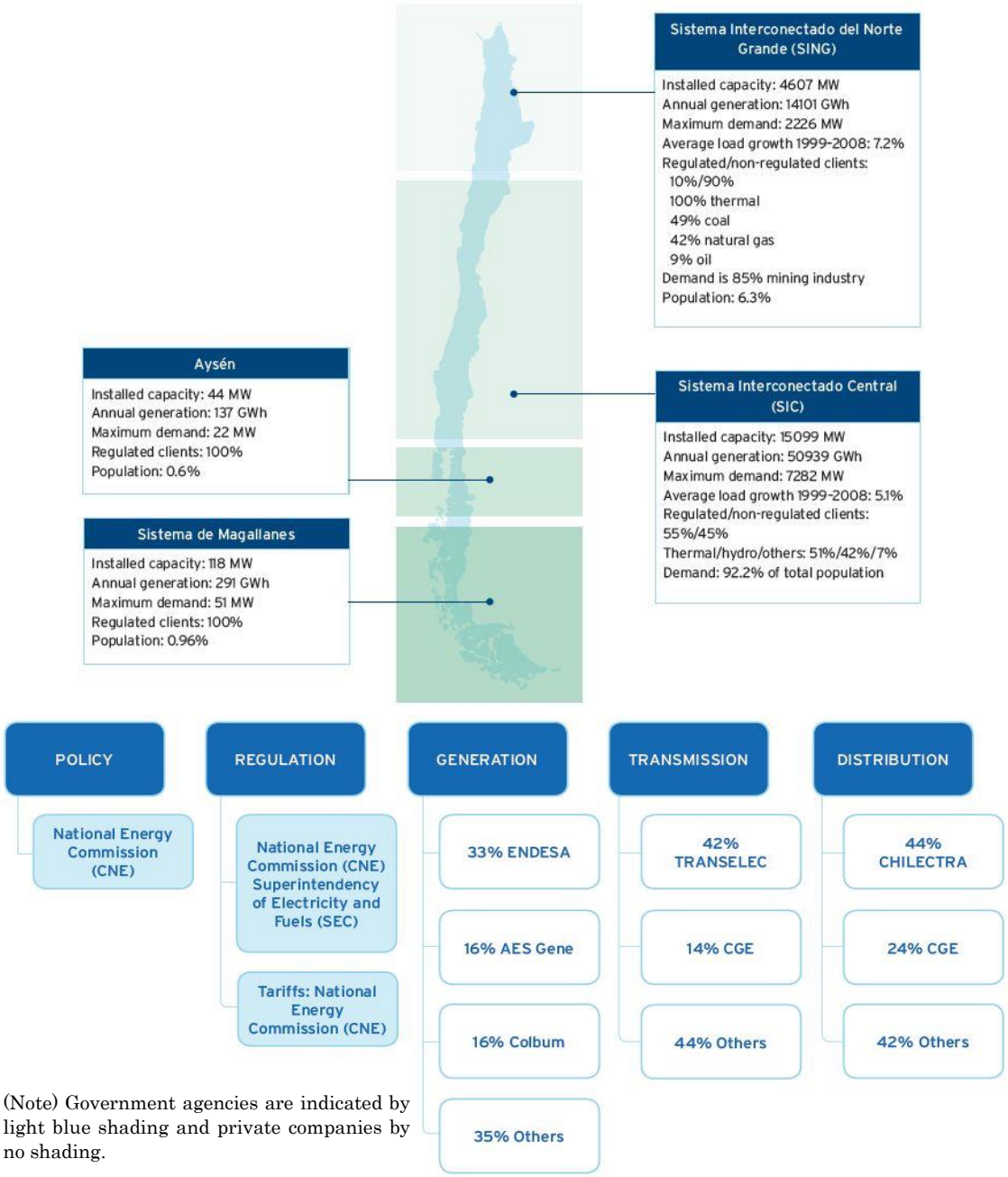
Fig.5: Electric Power Supply System in Chile

(Source: *Overseas Electricity Report 2016-6*, Japan Electric Power Information Center, Inc.)

2.2 Overview of Electricity System

Chile has a privatized electricity market, in which generation, transmission and distribution are all financed by private investment. Generation and commercialization

activities are competitive markets, while the transmission and distribution segments of the market are subject to a regulatory framework that establishes investment requirements, sets process for access, and ensure third-party access. The sector is divided into four district power systems, which are not connected with each other, as shown in Fig. 6.



(Note) Government agencies are indicated by light blue shading and private companies by no shading.

Fig. 6 Structure of the electricity sector

(Source)Vagllasindi and Besant-Jones. 2009. Power Market Structure : Revisiting Policy Options

(MaRS Market Insights/Market Information Report : Chile July 2015)

National Energy Commission (CNE):

The CNE is charged with proposing policies and strategies to support the energy market, regulating electricity tariffs, developing and implementing technology standards,

and supervising electricity dispatch and operational criteria.

ENDESA:

ENDESA is an electricity generating company subsidiary of Enersis which has a presence in five countries in Latin America: Argentina, Brazil, Colombia, Chile and Peru. It has 46 electricity plants and an installed capacity of 12,332.8MW. ENDESA is Chile's principal generating company and one of the largest companies in the country, with a total capacity of 4,476.7MW representing close to 38% of the country's installed capacity. It has total of 20 installations, most of them on the Central Grid (SIC) and others on the Northem Grid (SING), the main electricity systems in Chile.

AES Gene:

AES is one of the world's largest global power companies, with 2004 revenues of $9.5 billion. With operations in 26 countries on five continents, AES provides power to people in more counries around the world than any other company. Through 123 generation facilities and 14 regulated utilities, AES has the capacity to generate 44,000megawatts of electricity and provide power to 100 million people worldwide.

Colbum:

Colbum is the third largest electricity generation company in Chile, concentrating its operations in the Sistema Interconectado Central (SIC). Its installed capacity is approximately 15% of Chile total, some 1,480MW, with 75% coming to Hydroelectric plants, including the Colbum-Machicura plant with 490MW.

3. Regulation/Facilitation Measures

3.1 Water Rights

(Sources: *Study on Irrigation Water and Water Rights in Chile*, International Collaboration for Agriculture and Forestry (Vol.28 (2005) No.3), *Water Rights/Trade Systems in Japan and the World*, Intellectual Value Creation, September 2010)

The water rights system in Chile has the following features:

① The water rights are independent from land ownership, and can be freely traded or transferred pursuant to the ownership rights provided by the relevant civil law.

② The acquisition of water rights does not obligate immediate use of water, nor designate any priority in purposes of use.

③ The water rights are given by the nation, but in case there are competitors for the same source of water, the ownership is decided through a bidding process.

④ In addition to consumers' rights such as using water for agricultural or everyday use, the rights for non-consumers such as hydropower generation are also approved.

⑤ In the event of disputes, the state government has limited jurisdiction while such disputes are resolved in a commercial or legal process.

The water law enacted in 1981 was amended in 2005 in order to correct the monopoly of water rights by hydropower generation utilities. The main amendments are as follows:

- A "water rights non-use surcharge" is to be introduced, whereby non-use of water rights as of 2011, the license fees on water rights are doubled, and if the non-use status continues thereafter, in 2016, the fees will be doubled those imposed in 2011.
- "Valid reasons" need to be submitted to apply for water rights.
- Upon application for water rights, the notification period to third parties is to be extended from two to six months to avoid causing loss to the interest of other stakeholders.
- It is to be required to ensure river discharge for ecological maintenance.

3.2 Environmental Impact Assessment

The Chilean Environmental Protection Ministry is responsible for environmental protection. The Environmental Impact Assessment (EIA) and the Declaration of Environmental Impacts are carried out and financed by the investor. The environment assessment procedure has guidelines on the following aspects:

- Policy and Procedures for carrying out, obtaining review and approval of environmental assessments;
- Guidelines for the preparation and review of Environmental Reports (EIA and DIA);
- Guidelines for public consultation;
- Guidelines for sensitive and critical areas (historical, archaeological and original people sites);
- Chilean environmental legislation and the National Environmental Quality Standards.

All small hydropower development projects with capacities higher than 3 MW and/or water flow higher than 2 m^3/s follow the legal framework for EIA, which forms an integral part of the feasibility study. Smaller projects only have to prepare an Environmental Impact Declaration Report, much shorter than an EIA.

3.3 Support Scheme

(Source) Renewable Energy Policy Brief, Chile, June 2015

(1) There are no fiscal incentives for renewable electricity in Chile. However, a carbon tax was enacted in September 2014 (Law 20780 of Tax Reform). The yearly tax of US$5/tonne CO2 applies to emissions from power plants of 50MW or more (except biomass) starting in 2017 (to be paid in 2018).

(2) There have been at least US$ 208million of support to renewables in Chile since 2001.

Since 2005 the *Invest Chile Project* partially subsidizes pre-feasibility and pre-investment studies (support capped at US$160,000 per project). Initial public subsidies for feasibility studies were complemented in 2008 with EUR 3 million subsidies from a German government-owned private bank (KfW), as part of an EUR85 million loan to finance low-interest credits for renewable energy projects in Chile. The Invest Chile Project was continued in 2012 by the *Support for Non-Conventional Renewable Energy Development Programme*, with a US$ 85 million budget. The 2014-2018 Energy Programme aims at strengthening support schemes for pre-investment in renewable electricity generation.

3.4 Others

(1) Renewable Obligation/Non-conventional renewable energy law (Law 20.257)

Non-Conventional Renewable Energy Law (NCRE Law), enacted on 1 April 2008, aims to fulfill future energy requirements by developing non-conventional renewable energy sources, such as geothermal, wind, solar, tidal, biomass and small hydroelectric plants.

The law requires electricity providing companies, withdrawing electricity to supply their contract commitments, to demonstrate that a certain percentage of their total energy committed was injected in the system by non-conventional energy sources. The energy can be produced by their own plants, or by contracting from third-parties.

This quota came into force at the start of 2010, and until 2014 will require 5% of electricity to come from non-conventional renewable energy sources. Starting from 2015, the obligation will be increased by 0.5% annually, reaching 10% in 2024.

The obligation will last for 25 years (2010-2034). Hydro is considered as a non-conventional source if the capacity is below 20 MW. However, for a plant producing between 20 and 40 MW, a portion of the energy can be considered non-conventional based on a decreasing function, with the non-conventional energy content of a 40 MW plant equal to zero.

On 14 October 2013, the law was reformed and mandates that electric utilities with more than 200MW operational capacity should generate 20% of electricity from renewable sources by 2025.

(2) Barriers to small hydropower development

(Source)World Small Hydropower Development Report 2013(ICSHP)

The main administrative barriers to small hydropower development in Chile are:

- Long lead times (about one to two years);
- Too many state organizations involved in authorizations and insufficient coordination among them.

The main technical barriers to small hydropower development in Chile are:

- Difficulties and high costs for small hydropower connection to the secondary

(medium voltage) grids because of lack of transportation capacity on existing lines, thus hindering the transport to the main grid lines;

- Small/mini hydropower schemes are generally projected in remote areas near the Andes Mountains, without grids nearby.

The main political barrier is the lack of a clear energy development program for the country.

Current status of small-scale hydropower (Germany)

1. Outline of Small-scale Hydropower

Current development of small scale hydropower generation (less than 10,000 kW) in Germany is outlined as follows:

【Existing (Developed Hydro Potential)】

Year	Number of power plants		Gross installed capacity (MW)		Average capacity (MW)		Gross electricity generation (GWh/year)	
	～1MW	1～10MW	～1MW	1～10MW	～1MW	1～10MW	～1MW	1～10MW
2007	7,186	317	503	1,202	0.07	3.79	3,188	4,805
2008	7,192	317	513	1,202	0.07	3.79	3,197	4,806
2009	7,195	317	514	1,208	0.07	3.81	3,199	4,844
2010	7,199	317	515	1,208	0.07	3.81	3,215	4,883
2011	7,199	317	515	1,208	0.07	3.81	3,316	5,036
2012			713	1,067			2,543	4,662

Data：ESHA_Stream map_HYDI Database

【Hydro Potential】

Category	～1MW			1MW～10MW			Total		
	Plant No.	Total Capacity (MW)	Generation (GWh)	Plant No.	Total Capacity (MW)	Generation (GWh)	Plant No.	Total Capacity (MW)	Generation (GWh)
Hydro Potential								1,584	9,190

Data：ESHA_Stream map_HYDI Database

2. Business Structure of Small-scale Hydropower

2.1 Liberalization of the electricity sector

According to the EU requirements on liberalization, Germany's domestic electricity market was fully liberalized in 1998 (Energy Industry Act). Prior to liberalization, a defined supply area was typically served by a single supplier (e.g. local utility) operating in near-monopolistic market conditions.

The key elements of liberalization are;

- Neutralization of the networks make sure that the network operators are neutral facilitators between generation and supply, through;
  - ownership unbundling between the transmission network and large plants in order to prevent privileging the own assets,
  - organizational unbundling between the distribution network and the supply in order to allow new suppliers nondiscriminatory access to the customers.
- Implementation of a public regulatory agency in order to control the network charges and to design specific markets
- Setting up a power exchange in order to allow competition between existing power plants on the basis of marginal costs

Fig.1 shows the unbundled value chain of the electricity sector.

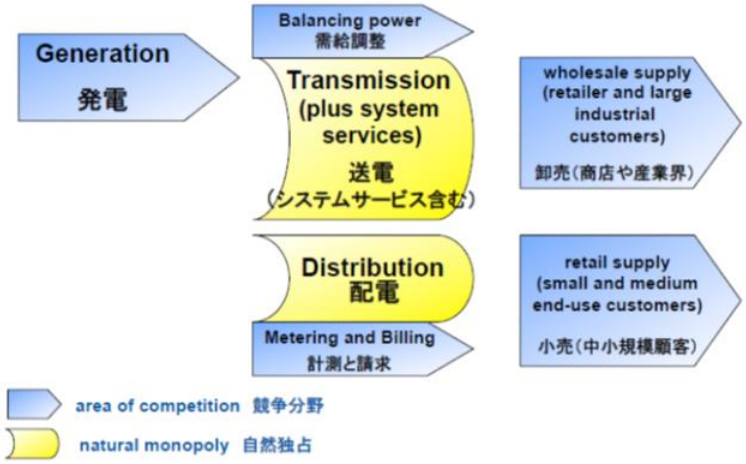


Fig. 1 The unbundled value chain of the electricity sector

(Source)Electricity Market Liberalization and the German Energiewende/

Prof. Uwe Leprich, Institute for Future Energy Systems(IZES)

2.2 Power Producer

The German electricity market is dominated by four large suppliers that between them had a 67 percent share of the conventional power market in Germany and Austria in 2013. The "big four" – RWE, EnBW, E.ON and Vattenfall – are involved in primary power production, distribution and sales. Despite many smaller power providers in the market often offering cheaper consumer prices than the big four, German households are reluctant to switch providers and the major utilities retain a dominant market position. But they have faced challenges as Germany shifts away from their core business – the centralised production and distribution of power from fossil fuels and nuclear energy – to a low-carbon economy based on power generation from renewables, a sector in which they continue to lag behind.

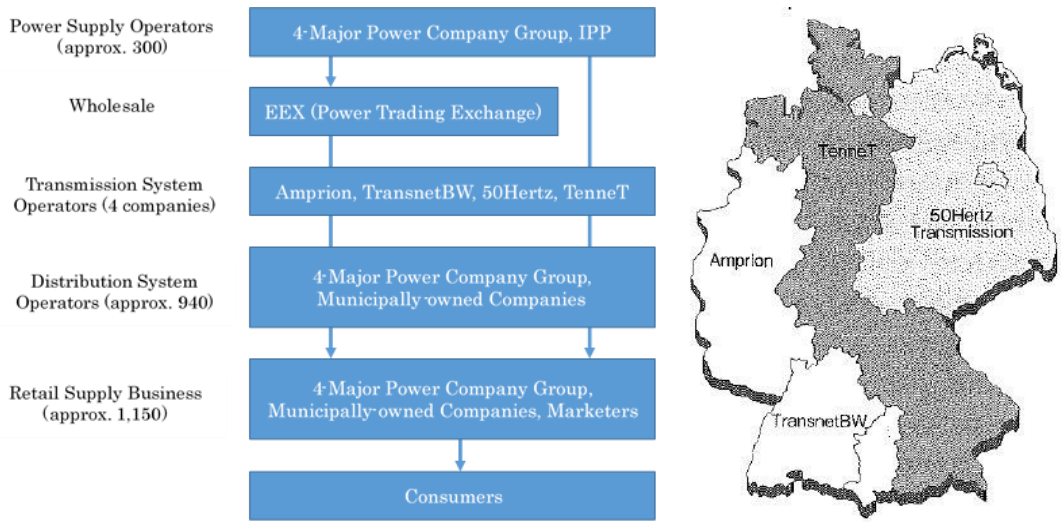


Fig. 1 Structure of Power Supply System

(Source: Japan Electric Power Information Center, 2014)

2.3 Transmission System Operators(TSOs)

In Germany, the operators of the high-voltage grids, i.e. the 220 and 380 kV grids, are designated as Transmission System Operators. The Transmission System Operators are responsible for the secure transmission of energy, whereby they constantly monitor the balance between the demand for and provision of power and intervene in the market if necessary. In addition, they are responsible for the maintenance of the grid and its expansion as needed. In Germany, there are four Transmission System Operators, each of which is responsible for their control area.

2.4 Power Distribution Companies

The distribution grid is operated by a large number of regional and municipal operators (888, as of January 2014). There are 1,679,000 km of distribution grid in Germany, which transmits power at three different levels of voltage:

- High voltage grid (approx. 77,000 km) transmits power at 60 kV to 220 kV and is used for the primary distribution of the electricity to transformer substations in population centres or large, energy-intensive companies in the industrial sector.
- Medium voltage (approx. 479,000 km) transmits power at 6 kV to 60 kV to smaller regional substations and larger consumers such as factories or hospitals.
- Low voltage grid (approx. 1,123,000 km) transmits power at 230 V or 400 V to private households and other smaller private consumers.

2.5 Retail Supply Business Companies

There are the retail electricity companies managed by local government, retail subsidiaries of the 4-Major Power Company Group that were separated and independent from the distribution companies carried out originally, and independent business companies. As a whole, 1,030 companies are engaging in the retail business. (As of April 2010)

2.6 Others

In Germany, decided to phase out nuclear power, the German government has been promoting the development of renewable energy technologies. As of the end of 2014, German has the world-wide installed capacity of renewable energy, remarkably wind power 38.2GW and solar power 38.2GW

Especially Munich set the goal of generating enough renewable energy to supply electricity to the entire municipality of Munich (7.5 billion kWh/year) by 2025. Stadtwerke München GmbH SWM formulated “Renewable Energies Expansion Campaign” to achieve the target, and set a budget of about €9 billion in renewable facilities, like wind power, hydropower solar/heat, biomass and geothermal plants.

3 Regulation/Facilitation Measures

3.1 Water Rights

- Ancient water rights exist with no time limit.
- New licenses are granted for revitalization and/or any water head change or water flow increase. The duration of new license is minimum 20 years up to a maximum of 30 years.
- They are granted with high restrictions because of WFD. No support from RES so far.
- There are no water use fees.
- Concession fees differ from Federal State to Federal State, e.g. 10,000 € for 150 kW concession in the state of Hesse.

3.2 Environmental Flow(Residual Flow)

Generally the residual flow is regulated to be 30%of mean low water flow.

3.3 Support Scheme

(1) Feed-in Tariff (EEG feed-in tariff)

In Germany, small Renewable Energy Sources Electricity (RES-E) plants up to 500 kW which put into operation before 01 January 2016 are promoted by feed-in tariff as set out in the Renewable Energy Act (EEG) 2014. Plant operators may switch on a monthly basis between feed-in tariffs and a market premium or may benefit proportionately from the feed-in tariffs or the market premium.

Moreover, independently from the size of the RES-E plant, each plant can be eligible under the feed-in tariff in exceptional cases.

(a)Eligibility:

Plant operators shall meet the following requirements in order to receive the feed-in tariff：

- Installed capacity of maximum 500 kW for plants put into operation before 01 January 2016. As of 01 January 2016, feed-in tariffs will only be granted for power plants with an installed capacity of up to 100 kW.
- Feed-in tariffs are granted only for electricity actually taken over by the grid operator. The electricity may not be consumed in the direct surrounding of the power plant and needs to be transmitted through the grid.

Hydropower Plants:

Both new plants and modernized existing plants are eligible. The following conditions apply:

- Maximum capacity of 500 kW
- Requirements of the Federal Water Act.

  Existing plants are eligible only if the modernisation complies with the requirements of the Federal Water Act.

(b)Amount

Capacity (MW)	≦0.5	≦2.0	≦5.0	≦10.0	≦20.0	≦50.0	＞50.0
Tariff (€ct/kWh)	12.52	8.25	6.31	5.54	5.34	4.28	3.50

(c)Eligibility period

The tariff payment period is usually 20 years plus the year in which the system or plant was put into operation.

(d)Degression

The degression rate is 0.5% every year.

(2) Loan (KfW Financing Initiative Energiewende)

The KfW Financing Initiative Energiewende gives low interest loans for investments in installations for electricity production from renewable energy sources in accordance with the EEG. It is a long-term loan with an interest period of up to 20 years including a repayment-free start-up period of maximum 3 years. The plant operator or investor signs a contract with a regular bank (Hausbank) specifying the terms of contract. If not agreed differently between the contracting parties, the KfW Rules for investment loans apply.

3.4 Others

(1) Barriers to small hydropower development

- No positive impact seen so far on the Renewable Energy Framework Directive(RES) but negative impact from WFD.
- Social acceptance of SHP is rather high, but strong influence of ecologically powerful administration and NGOs as well as strong influence of fishery and angler clubs which blame SHP to harm fish live.
- The WFD directive will be transferred into German law until 2015. The following mitigation measures regarding environmental impacts are currently focused on:
  (i) upstream/downstream fish ladders,
  (ii) smaller distance between bars of rake cleaners(15mm) and,
  (iii) river bed management/naturalization of water flow

Current status of small-scale hydropower (Japan)

1. Outline of small-scale hydropower

Current development of middle-and small-scale (30MW capacity or below) hydropower in Japan is outlined in the following table:

Capacity (kW)	Under development			Existing		Development ratio	
	No.	Total (kW)	Total output generated (MWh)	No.	Total (kW)	No. (%)	Capacity (%)
Under 1,000	1,708	364,937	1,891,207	535	211,597	24	37
1,000～under 10,000	2,134	6,606,831	26,693,649	875	3,310,773	29	33
10,000～30,000	212	3,356,312	12,539,804	374	6,285,600	64	65
30,001～under 50,000	22	848,512	2,835,072	85	3,261,000	79	79
50,000～100,000	14	879,100	2,353,400	66	4,305,390	83	83
100,000 or above	3	378,000	1,109,000	26	4,904,600	90	93
Total	**4,093**	**12,433,692**	**47,422,132**	**1,961**	**22,279,560**	**32**	**64**
Average		**3,038**	**11,586**		**11,361**		

Source: Hydropower potential (March 31, 2012)
Hydropower potential survey of untapped energy (March, 2009)

The types of operators of existing hydropower facilities (30MW capacity or below) are categorized as follows:

Category	～1MW			1MW～10MW			10MW～30MW		
	No.	Total (kW)	Average (kW)	No.	Total (kW)	Average (kW)	No.	Total (kW)	Average (kW)
Power Utility	236	107,889	457	553	2,113,005	3,821	255	4,386,050	17,200
Power Producer	89	34,387	389	221	858,560	3,885	95	1,507,400	15,867
Private	210	69,321	330	101	339,208	3,358	24	392,150	16,340
Total	**535**	**211,597**	**396**	**875**	**3,310,773**	**3,784**	**374**	**6,285,600**	**16,806**

Source: Hydropower potential (March 31, 2012)
Hydropower potential survey of untapped energy (March, 2009)

2. Business structure of small-scale hydropower

Owners of hydropower facilities (30MW capacity or below) in Japan are categorized into the following business types:

2.1 Power Utility (Hold power generation and transmission facilities)

(1) General Electric Utility

General Electric Utilities are defined as electricity suppliers to general demand from an unspecified number of users. There are ten General Electricity Utilities including Tokyo Electric Power Company.

(2) Wholesale Electric Utility

Wholesale Electric Utilities are defined as suppliers of electricity to General Electric Utilities with power generation facilities of a capacity of 2,000MW or greater.

In this category, only the Electric Power Development Company (J-Power) operates hydropower generation.

Small-scale hydropower stations (30MW or below) owned by the above categories are approximately 60% of the number of sites and provide 70% of total output capacity.

2.2 Power Producer

(1) Wholesale Supplier (Independent Power Producer (IPP))

Wholesale Suppliers, or so-called IPPs, are defined as suppliers of electricity to the General Electric Utilities (other than the Wholesale Electric Utilities) operating under supply contracts of 1,000kW or greater for over 10 years, or 100MW or greater for over 5 years.

Owners of small-scale hydropower facility under this category include Public Electric Utilities operated by local governments and private companies such as The Tokyo Electric Generation Company Incorporated.

(2) Power Producer (non-regulatory)

The power producers do not meet definition of wholesale supplier.

In force FIT (feed-in-tariff) in July 2012, new entrants are established for small-scale hydropower business.

2.3 Private Power Producer (for private use)

(1) Private Power Producers

Private Power Producers are defined as entities that are not power producers but install power generating facilities for their own consumption and not for sales purposes.

They include private companies, local governments and Land Improvement Associations etc. who install their own small-scale hydropower facilities for the

purpose of reducing maintenance costs and heightening public awareness of environmental issues.

(2) Other private power producers for self-consumption

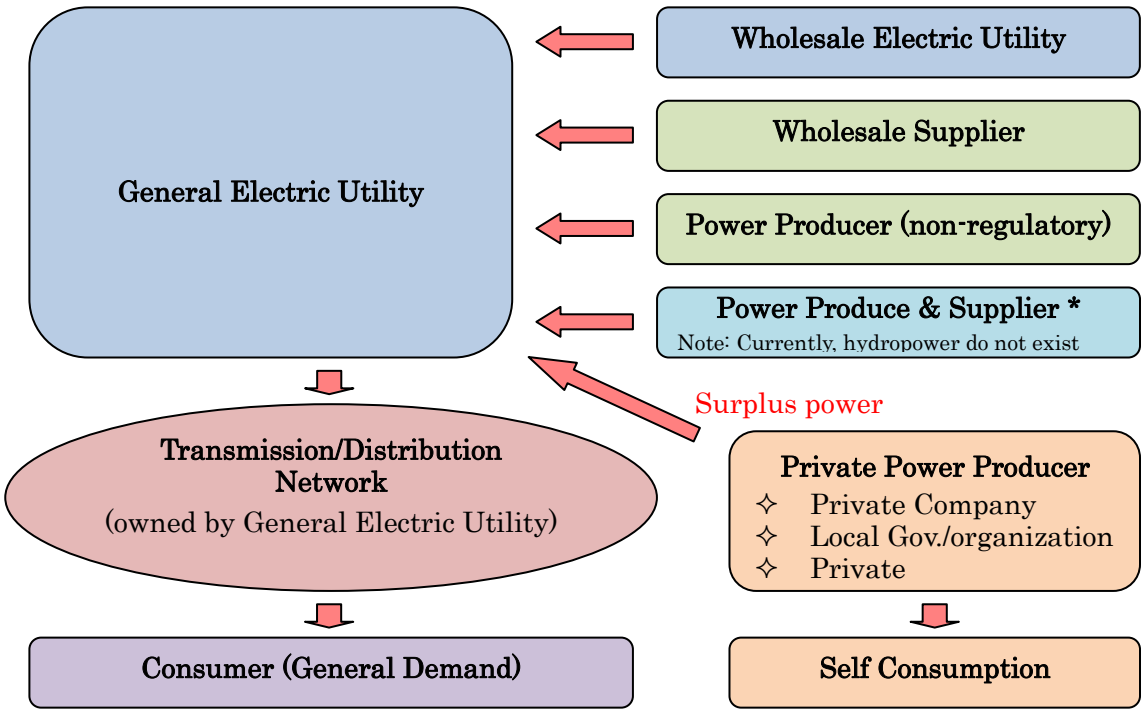


Figure-1 Business Structure of Small-scale Hydropower

2.4 Electricity System Reform

The increase of electricity charges and power supply constraint following The Pacific Coast of Tohoku Earthquake and the Fukushima Nuclear accident highlighted the limitations of the existing electricity system in Japan. With the aim of securing stable power supply, suppressing further increase of power charges as well as expanding options of power users and business opportunities of the power companies, the government has initiated fundamental reforms for fully liberalizing the retail electricity market, to be implemented in three stages.

【Schedule for Electric System Reform】

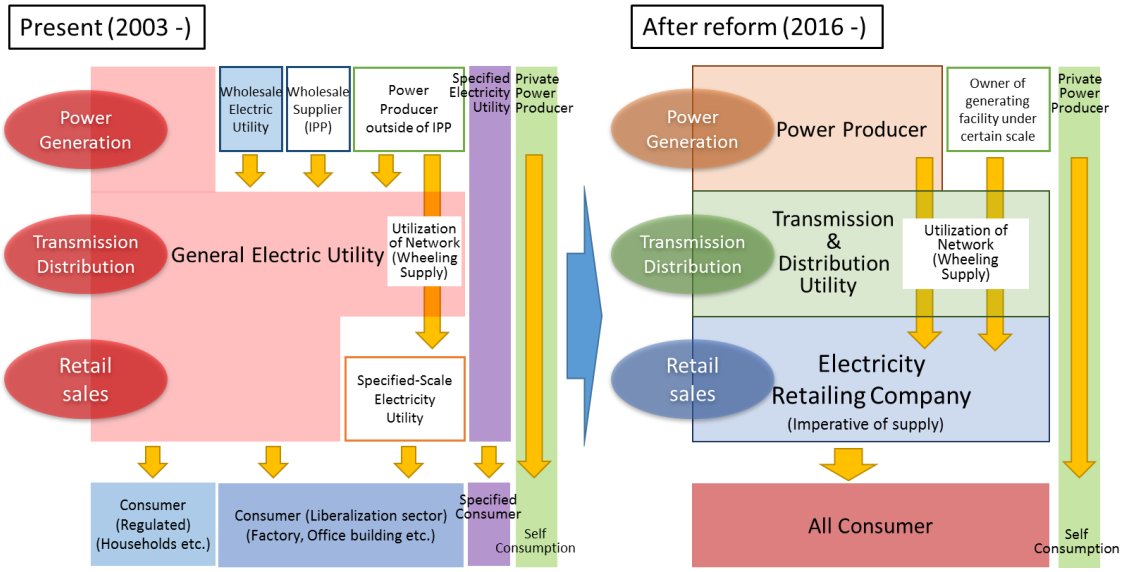


Figure 2 Electricity Industry Structure Before and After Reforms

3. Regulation / Facilitation Measures

3.1 Water Right

The Water Right is the exclusive and continuous right for river water use for the purpose of specific utilization (hydropower, irrigation and water supply etc.).

In addition, the documentation procedure necessary for obtaining permission of water use for hydropower generation (so-called "Sub-ordination generation") has been simplified if the same flow of water use is already permitted for agriculture and tap water service. Further, if power generation is performed by using drainage of the agriculture water and sewerage treatment water, the permission of the water utilization may not be required.

(1) Regulatory Agency

1st class river	Ministry of Land, Infrastructure, Transport and Tourism Prefectural Government
2nd class river	Prefectural Government Government-ordinance-designated City
Locally designated river	Municipality

(2) Permitted Period

In principle, water rights are granted for a period of approximately 20 years. However, in some cases this period permitted to hydropower facilities may be shortened. Such facilities located on the 1st class river including ones whose water rights were first granted a while ago are classified so that water rights permission is handled accordingly.

(3) Water Usage Charge

(The upper limit is determined pursuant to "The charge determined by the Minister of Land, Infrastructure and Transport" in the River Act enforcement order Article 18 Clause 1 third paragraph (Ministry of Land, Infrastructure and Transport's 351st notification (March 28, 2001))

¥1,976 x (normal theoretical output) + ¥436 x {(maximum theoretical output) – (normal theoretical output)}

River water usage charge which is paid by power producers will be revenue for the local governments.

3.2 Environmental Flow

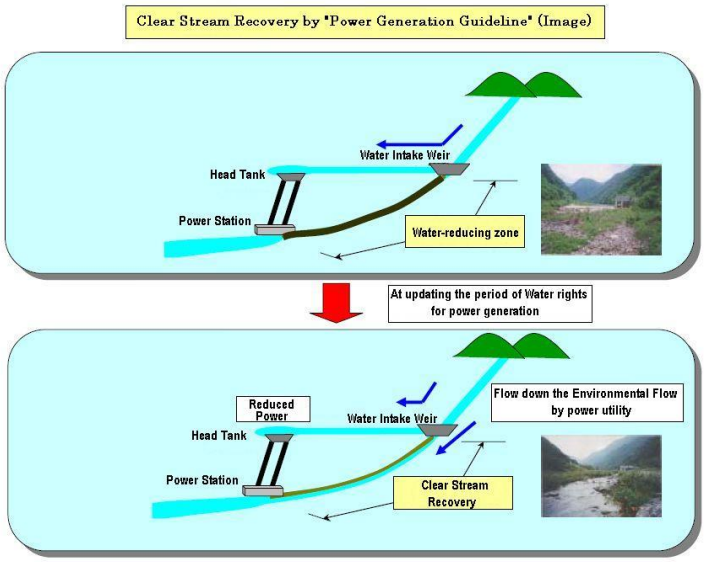
The Environmental Flow is the discharge that guarantees water functions such as navigation, fisheries, land scape preservation, prevention of salt damage and river-mouth clogging, protection of river management facilities, maintenance of groundwater levels, ecosystem protection, and the necessary flow rate to keep the river clean.

The environmental flow is approximately 0.1 to 0.3 m^3/s per 100 km^2 of catchment area measured at the water intake of the power plant.

In case transbasin diversion is necessary to secure the flow rate, water use in the river system to which the water is diverted must not be impacted.

[Overview of the hydropower plant corresponding to the power generation guidelines]

1. Overview of the conditions that necessitate a hydropower plant to discharge river water in order for the permission of water rights to be updated for the purpose of environmental conservation:.
   1) By transbasin diversion, the water is diverted to a different water system other than the river having a dam or water intake, or discharged directly into the sea.
   2) The length of water-reducing is more than 10km, and falls under any of the following requirements:
      a) The water catchment area at water intakes for power generation and etc. is more than 200km^2,
      b) The whole or partial zone of water-reducing is in the area designated as National Parks by National Parks Law,
      c) The river in water-reducing zone is substantially used by local residents and tourists.



Source: Ministry of Land, Infrastructure and Transport: "Power Generation Guidelines"
(6th River Maintenance Basic Policy Examination Subcommittee (July 18, 2003))

2. Environmental Flow

1) Environmental flow is assumed to be approximately 0.1 ~ 0.3m³/s per 100km² catchment area at the water intake or the like.

2) However, if the water user operates a power plant (from which water is discharged) in pursuant to the agreement with the local municipality that handles water-reducing area, and if the river administrator allows the discharge at less or more flow rate than the environmental flow prescribed in 1) is necessary, the water user may discharge at a different rate.

3.3 Support Scheme

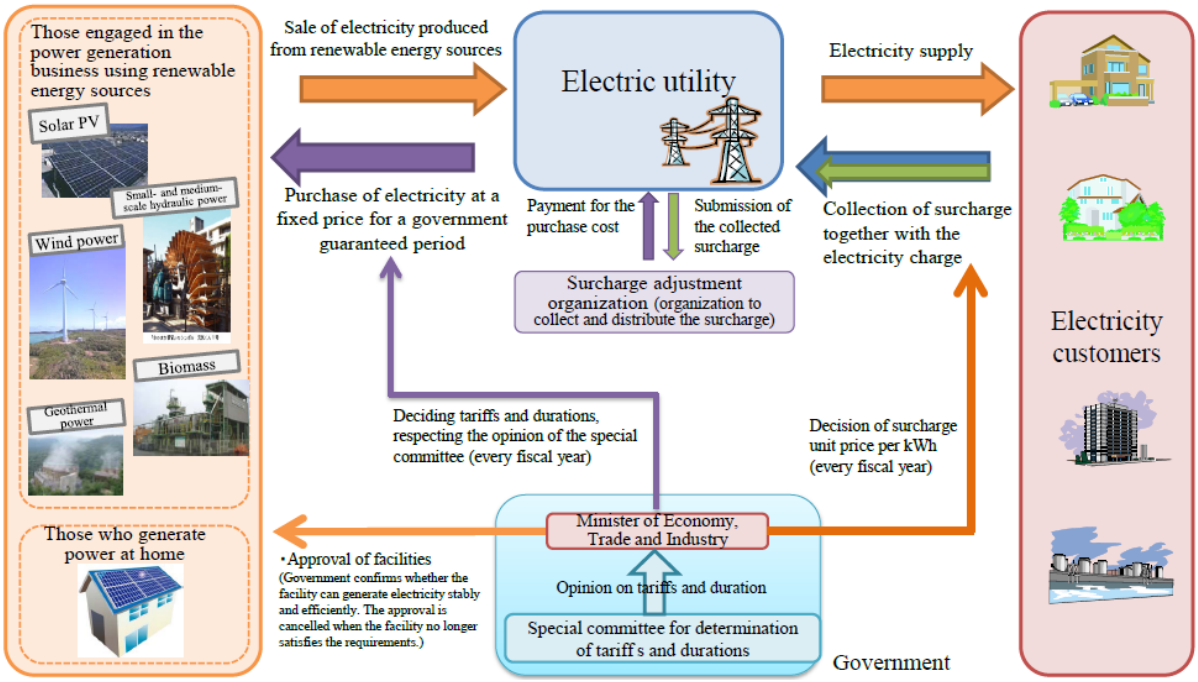
(1) Feed-in Tariff Scheme

Under the feed-in tariff scheme that was enforced on July 1, 2012, electric utilities are obligated to purchase electricity produced from renewable energy sources (solar, wind, hydro, geothermal and biomass) at a fixed price and for a fixed period set by the government.

Table-1 Tariffs and Duration for Hydropower : FY2014
(parenthesized figures are price excluding tax)

	1,000kW <= < 30MW	200kW <= < 1,000kW	< 200kW
Tariff (excl. Tax)	JPY 24 (14)	JPY 29 (21)	JPY 34 (25)
Duration	20 years		

※（ ）: Utilize existing headrace; replace electric facilities and steel penstock



Source: http://www.meti.go.jp/english/policy/energy_environment/renewable/pdf/summary201207.pdf

Figure-2 Feed-in Tariff Scheme

(2) RPS (Renewables Portfolio Standard)

This act mandated electric utilities to utilize at least a certain ratio of electricity generated by renewable energy sources to promote the wider use of renewable energies. [Act on Special Measures Concerning New Energy Use by Operators of Electric Utilities (enforced in April 2003/repealed in June 2012)]

Applicable hydropower plants' capacity was to be 1MW or less and plant types were to be either conduit or dam.

Although RPS was repealed with enforcement of Feed-in Tariff Scheme for Renewable Energy in Japan on July 1, 2012, a part of the regulations was stipulated to be in force for a while, obligating the utilities to utilize a fixed amount of electricity generated by renewable energy.

(3) Subsidy System for Small-scale Hydropower Development

There are subsidy systems operated by different Ministries in accordance with the purposes of the project.

Ministry of Economy, Trade and Industry (METI): Installation of middle- and small-scale hydropower generation facilities; demonstration project

Ministry of Agriculture, Forestry and Fisheries (MAFF): Installation of hydropower generation facilities for electricity supply into irrigation facilities; feasibility studies; grants for regional development etc.

Ministry of Environment (MOE): Installation of hydropower generation facilities as countermeasures against global warming and introduction of RE power generation; feasibility studies etc.

Ministry of Land, Infrastructure, Transport and Tourism (MLIT): Feasibility and demonstration studies of small-scale hydropower generation projects for the purpose of regional vitalization

4 Others

(1) Grants, subsidies

For smooth hydropower development, understanding on the part of the local community is vital. For that purpose, grants and subsidies support local governments of the communities where power plants are planned to make the power source development enhance regional progress.

(2) Deregulation Measures

METI has increased flexibility in the application of rules and thereby easing restrictions with regard to small-scale hydropower facility construction projects. Such rules include safety regulations, selection of Chief Engineers and submission of construction schedules.

MLIT has simplified documentation procedures necessary for obtaining permission of water use with regard to those possessing the right to give such permits and the system in which the documents procedures are handled.

(3) Environmental Regulation

(4) Based on Environmental Impact Assessment Law and the Electricity Utility Industry Law, the 1st category projects (capacity of 30MW or above) are obligated to carry out an environmental assessment. The same Laws obligate the 2nd category projects (22,500kW or greater up to less than 30MW capacity) to carry out the "Simplified Environmental Assessment" designated by the Electricity Utility Industry Law for the purpose of screening the projects to ascertain that they are under the Laws' regulations.

Projects involving smaller capacity hydropower facilities also need to avoid or reduce impact that adversely affects the following items under different regulations, because there is a possibility that even small-scale hydropower projects can hinder the accomplishment of the purposes of such regulations and laws.

i. Conservation of natural environment
ii. Protection and conservation of animals and plants
iii. Protection and conservation of cultural assets
iv. National land conservation
v. Pollution control

vi. Landscape conservation of urban area

vii. Growth and protection of fishery resources

viii. Others (conservation of hot spring resources, conservation of water quality, etc.)

NO00

Current status of small-scale hydropower (Norway)

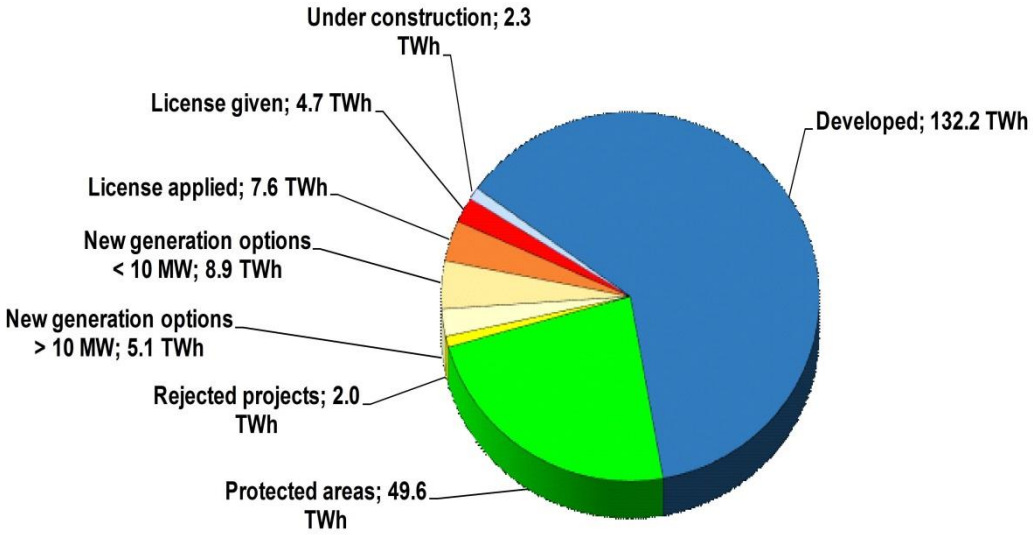
1. Outline of Small-scale Hydropower

Current development of small scale hydropower generation (less 10MW) in Norway is outlined as follows:

Table 1 Small-scale Hydropower potential in Norway (as of Jan. 2016)

Output (MW)	Undeveloped		Developed				
	Capacity (MW)	Generation (GWh)	Plant. No.	Capacity (MW)	Average Capacity (kW)	Production (GWh/y)	Average production (GWh/y)
Less 1	1,450	8,860	570	180	315	770	1.35
1-10			637	2,160	3,392	8,790	13.8

(Source : NVE)



(Source)NVE. The Figure was presented in IEA Annex II Expert Meeting Washington D.C. Nov.8-9, 2016

Fig. 1 Norway's hydropower potential as of January 2016, TWh/year

2. Business Structure of Small-scale Hydropower

2.1 Overview of the electricity market:

Norway is part of a common Nordic wholesale market for electricity together with Sweden, Denmark and Finland. The Nordic power market is also integrated into the European power market through interconnections to Germany, The Netherlands, Estonia and Russia.

The Nordic physical power exchange is Nord Pool Spots AS (Nord Pool), where large power volumes are bought and sold. Nord Pool calculates hourly prices based on buy and sell bids submitted by the market players. It has long been regarded as one of the best functioning power exchanges in the world.

The retail markets for electricity are national in which the customers can choose their electricity supplier. Since the grid operations are considered a natural monopoly, the

local grid company transfers the electricity of any electricity supplier the customer chooses. The retail market in Norway is divided into three equal parts:

- Household customers
- Industry
- Medium-sized consumers such as hotels and shops

An important prerequisite for an effective power market is a connected and well-developed power grid with access for all players. Since electricity distribution is a natural monopoly, Norwegian grid companies are strictly regulated by the authorities through revenue cap regulation and rules for stipulating tariffs for electricity grid pay tariffs to their local grid company for the transportation of electricity.

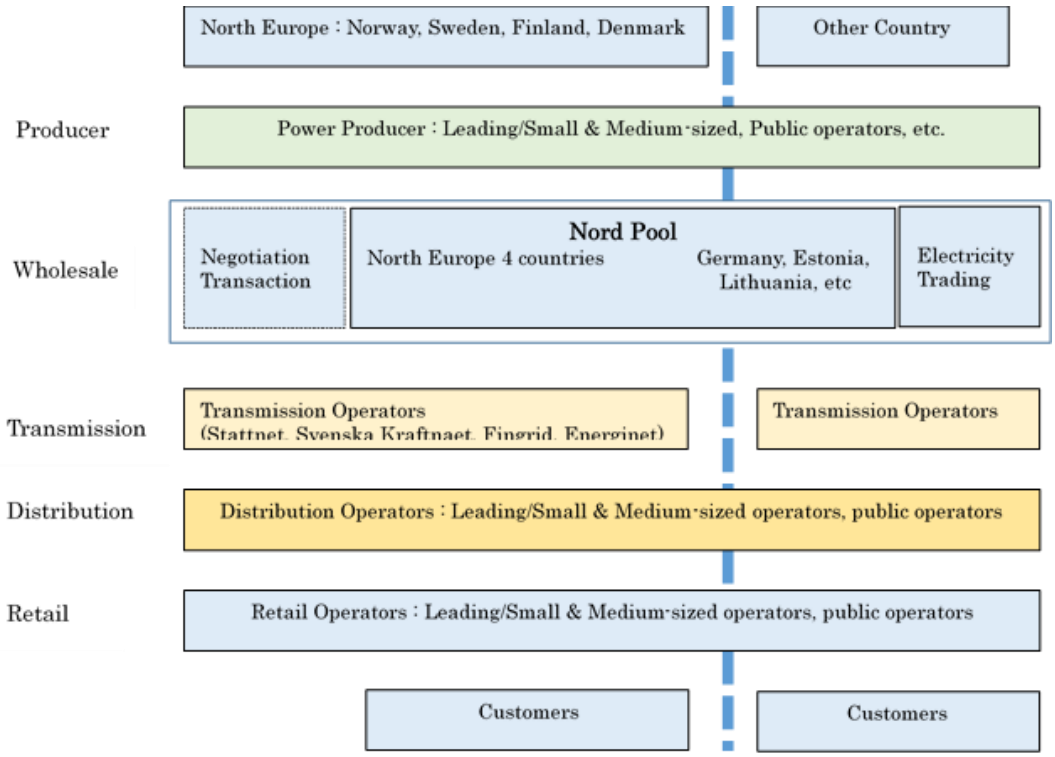


Fig. 2 Power Supply System in North Europe 4 Countries (Source : CRI)

2.2 Companies and Ownership:

- "The law on production, transformation, transportation, trading and distribution of energy (Energy Act)" entered into force in 1991.
- All operators, who intends to carry out power transmission and distribution business or sales to the others, are made compulsory acquisition of "Trading License (Omsetningskonsesjon)".
- All producers, grid owners and/or traders of power must have a licence from the NVE.
- Most of the operators are working across the multiple business areas of power produce, transmission, distribution and retail. Figure 3 shows the number of companies with licence(s) by different activities as of 1 January 2011.

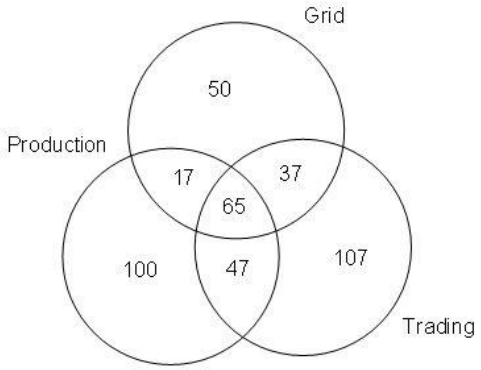


Fig. 3 Licensees by activity (as of March 2017)

(Source)NVE

- The transmission and distribution operators, which are monopoly sector, are legally separated from the liberalized operators of power producer and retail. (Except the operators having less than 100,000 consumers)

2.2.1 Power Producer

- Companies involved in power generation : 229 companies
- Only power generation business : 100 companies
- Statkraft, the country's largest power producer, which is government-owned, shares about 34% of total domestic power generation.

Table 2 The ten largest production companies by MW installed capacity

(as of 31 Dec. 2016)

Production company	Total installed capacity (MW)	Share (%)	Production (GWh/y)	Share (%)
Statkraft Energi AS	11,531	34.8	47,650	34.2
E-CO Energi AS	2,833	8.5	9,986	7.2
Norsk Hydro AS	1,903	5.7	9,088	6.5
BKK Produksjon AS	1,843	5.6	7,460	5.4
Agder Energi Vannkraft AS	1,815	5.5	7,953	5.7
Lyse Produksjon AS	1,587	4.8	6,284	4.5
NTE Energi AS	821	2.5	3,457	2.5
Eidsiva Vannkraft AS	813	2.5	3,362	2.4
Sunnhordland Kraftlag AS	603	1.8	2,035	1.5
Hafslund Produksjon AS	579	1.7	3,232	2.3
Sum ten largest	24,329	73.4	100,506	72.1
Others	8,818	26.6	38,854	27.9
Sum Norway	33,147	100.0	139,360	100.0

(Source)NVE, March 2017

2.2.2 Transmission and Distribution Operators

- Companies involved in transmission and distribution business: 151 companies
- Only transmission and distribution business : 50 companies
  (The others involve power produce and retail businesses)
  (Source : NVE, March 2017)
- Statnett, the government-owned transmission system operator (TSO), owns and operates the backbone transmission lines. This operator owns approximately 90% of the central grid, and plays the role of the construction and operation of international interconnection line. Private companies, country authorities and municipalities.

2.2.3 Retail Supply Business Company

- Retail supply businesses that sell electricity to final consumer : 256 companies
- Only retail supply business : 107 companies
  (Source : NVE, March 2017)

2.3 Electricity Purchase Price

(Source)Electricity costs of energy-intensive industries in Norway – a comparison with energy-intensive industries in the selected countries.(Fraunhofer, ECOFYS)

Norway is divided into 5 bidding areas (East, South West, Mid, North and West). Price differences occur when there is not enough transmission capacity between the areas to equate prices. Over the year, price differences between bidding areas within Norway are generally around 10-15%. In 2013, the spot prices of the 5 bidding areas averaged between 37.3 and 39.0 €/MWh; in 2014, between 27.3 and 31.5 €/MWh; in 2015, between 19.9 and 21.3 €/MWh; and in 2016, between 24.9 and 28.7 €/MWh.

Figure 4 depicts the regional spot prices in Norway as well the spot price of a selected region in Denmark (DK1) and one in Sweden (SE1), and the Nordic system price (SYS). While the spot price in Denmark is above the Nordic system price, spot prices in Sweden (SK1), Oslo and Kristiansand range around or slightly below the Nordic system price.

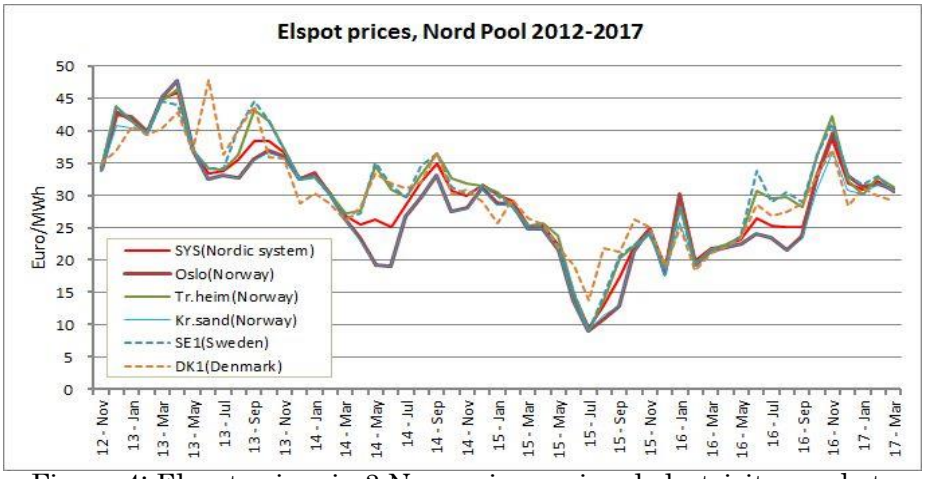
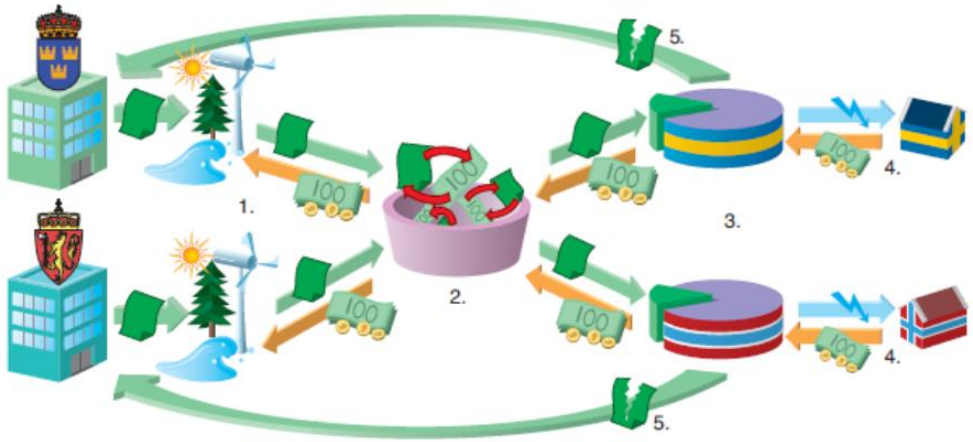


Figure 4: Elspot prices in 3 Norwegian regional electricity markets and the Nordic system price (source: Nord Pool).

2.4 The Norwegian-Swedish Electricity Certificate Market

Sweden and Norway have had a joint market for electricity certificates since 1 January 2012. This common market is based on the Swedish electricity certificate market, which has existed since 2003. The goal is to increase renewable energy production by a total of 28.4 TWh together in the two countries from 2012 to the end of 2020, and thus contribute to the countries' targets in relation to the EU Renewable Energy Directive. Norwegian power plants must start production within the end of 2021 to be approved for the electricity market. The common electricity certificate market is an example of a so-called collaboration mechanism under the EU Renewable Energy Directive.4

Electricity certificates represent a form of financial support for the production of electricity from renewable energy sources in Norway and Sweden. The electricity certificate system is market-based and is intended to increase energy production from renewable energy sources in a cost-effective manner.



1 : The energy producers receive one electricity certificate for each megawatt hour (MWh) of renewable energy produced, over a maximum 15 years.

2 : The electricity certificates are sold in a market where prices are determined by supply and demand. In this way, the producers receive extra income in addition to the energy price.

3 : Demand for electricity certificates arises in that energy suppliers and certain electricity customers are obligated by law to buy electricity certificates corresponding to a certain proportion (quota) of their calculation-relevant electricity consumption.

4 : The electricity end users pay for the development of renewable energy production because the cost of the electricity certificates is included in electricity bills.

5 : Every year, the market participants with quota obligations must cancel electricity certificates in order to fulfil their quota obligation.

Fig. 5 The Norwegian-Swedish Electricity Certificate Market

(Source) The Norwegian-Swedish Electricity Certificate Market (NVE Annual Report 2015)

3 Regulation/Facilitation Measures

As the aim of the Norwegian Water Resources and Energy Directorate (NVE) and the Ministry of Petroleum and Energy is to ensure an efficient and adequate use of Norway's water resources, they created a legal framework. Fig. 6 gives an overview of the respective acts and regulations which are applied when exploiting water as an energy source.

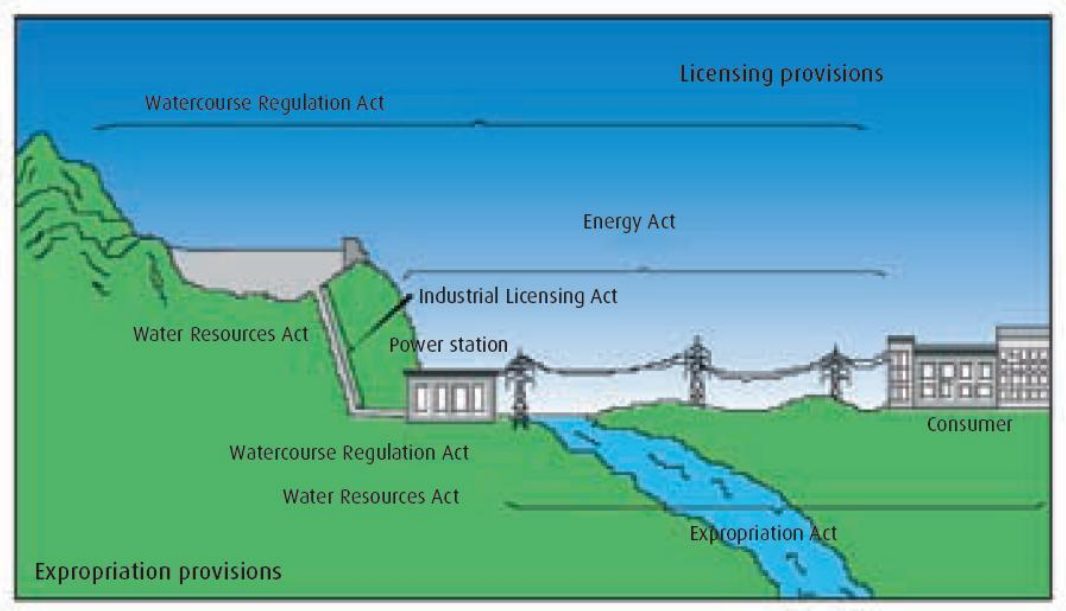


Fig. 6 Legislation governing licensing in the hydropower sector

(Source)Norwegian Ministry of Petroleum and Energy(2008), The Legal Framework (Internet)

The Watercourse Regulation Act (Act No. 17 of 14 December 1917 relating to regulation of watercourses):

It is economically necessary to be able to regulate the output of a power plant according to the current need. Therefore, it should be possible to store the water in a regulation reservoir. The authority to use water from a regulation reservoir is not included in the ownership of a waterfall but is determined separately by the Watercourse Regulation Act. The measures of the Watercourse Regulation Act are meant to balance fluctuations in the water flow during the year.

The Energy Act (Act No. 50 of 29 June 1990 relating to generation, conservation, transmission, trading, distribution and use of energy etc.):

The Energy Act sets out the framework for organization of the Norwegian power supply system. The Energy Act made Norway the first country in the world to allow customers to freely choose their supplier of electricity. Various licensing schemes under the Act regulate matter such as the construction and operation of electrical installations, district heating plants, power trading and control of monopoly operations, foreign trade in power, metering, settlement and invoicing, the physical

market for trade in power, system responsibility, rationing, quality of supply, energy planning and power supply preparedness.

The Industrial Licensing Act (Act No. 16 of 14 December 1917 relating to acquisition of waterfalls, mines and other real property etc.):

In case the applicant wants the ownership of a waterfall to implement a hydropower plant there, he will be licensed according to the Industrial Licensing Act. Exceptions are the State as well as small waterfalls with less than 2,944kW.

The major regulations of the Industrial Licensing Act are the pre-emption rights, the right of reversion to the State and the licences of limited duration. The pre-emption right says that the State is allowed to take over an agreement instead of a purchaser without changes in the rights and obligations. With the right of reversion, the State can get possession of a "waterfall and any hydropower installation free of charge when a license expires".

The Water Resources Act (Act No. 82 of 24 November 2000 relating to river systems and groundwater):

The Water Resources Act gives regulations to "compensate for and mitigate the adverse impacts of developments in river systems". Even though it is considered better to have a license following the Water Resources Act, small power stations are not obliged to undertake the process. The Water Resources Act is valid for any kind of works in a watercourse and all measures that are needed to exploit the hydropower potential.

The strict provisions on water intake point change, power scale down of the plant, an environmental impact assessment and etc. have been established in the law. Permitting process will take about one year at the earliest, but depend on the power scale. It will take several years due to the recent small hydropower development boom.

3.1 Water Rights

- Based on the "Planning and Building" decree, Water Right of small hydropower is licensed by NVE. The application procedure of Water Right for small-scale hydropower is simplified compared to large-scale power generation.
- Power plant of 1MW or less, is required NVE deliberation, but this deliberation is faster compared to the licensing application of large-scale power plant. Small hydropower less than 1MW is also possible development in rivers that are protected, but all applications and approvals are required.
- All environmental assessments are not required for small hydropower generation. However, the following items should proceed the application.
  ① Hydrology

② Water temperature, ice conditions and local climate
③ Groundwater and water supply
④ Rock-and earth fall, landslide, flood and erosion
⑤ Fauna and flora
⑥ Red list species
⑦ Hunting, fishing and other uses of nature for recreation
⑧ Territorial environment
⑨ Aquifer environment
⑩ Landscape and nature
⑪ Cultural monuments and cultural environment
⑫ Reindeer husbandry
⑬ Resources of agriculture and forest
⑭ Freshwater resources
⑮ Pollution
⑯ Social impacts
⑰ Transmission lines
⑱ Total assessment
⑲ Total impacts

The items are more or less relevant, and are dealt with as thoroughly as the case may be
Source: NVE, May 2013.

3.2 Environmental Flow

RF > Q350 (flow rate that is equaled or exceeded on average 350 days in/year).
(Source)Hydropower and Environment(SHERPA, Intelligent Energy Europe

3.3 Support Scheme

There is no financial support for hydropower as a renewable energy technology. However, the small hydropower can obtain the benefits for the simplification of licensing application and tax deductions. Since being traded freely in the market, there is no power purchase contract(compulsory purchase contracts).

3.4 Others

(1) Environmental Protection

No special support for environmental protection related to small scale hydropower. Expenses necessary for the preservation shall be covered by the developers.

(2) Technical Standards

- Regulation of grid-connection is relaxed for equipment -100kW or less
- Simplified equipment is tolerated for less 1MW power unit.

(3) Workshop on diffusion of small hydropower generation

The Norwegian Energy Act was given in 1990, and came in force in 1.1.1991.

NVE held 25 workshops on regulations, permits and licenses, financing and etc. between 2004 and 2006 in order to increase the revenues of agriculture and forester. The majority of the participants are water right holders, landowners and farmers, and NVE explains the financial characteristics of hydropower projects and deepens their understanding at the meetings with the banks.

(4) Guide book for new investors in small-scale hydropower project

- NVE has produced a guidebook for the inexperienced small-scale hydro developer guiding him on the initial planning, the licensing, financing, construction and operation phase.
- NVE has prepared a Cost Manual for small HPPs (< 10 MW) for quick, but trustable cost calculations in an early stage (good enough for the stage).

  The Manual is revised every fifth year, last time with price level January 2015.

Current status of small-scale hydropower (Philippines)

1. Outline of Small-scale Hydropower

Hydropower is the most dominant source of Renewable Energy based capacity in the country today. As of 2010, hydropower accounted for 21% of 16,359MW total installed capacities in the country.

Philippines has vast hydro resources. Studies indicate that total untapped hydro resource potential is estimated at 13,097MW. It is estimated that 85.7% or the equivalent of 11,233MW of the hydro resource potential can be developed for large hydro in eighteen (18) sites all over the country. Other sites, about 888 sites have been identified as having mini-hydropower (defines Mini-hydro as: 100kW < MINI < 10MW) potential totaling 1,847MW, the remaining 29MW being micro hydropower potential. All of the run-of-river small hydropower plants are in private hands.

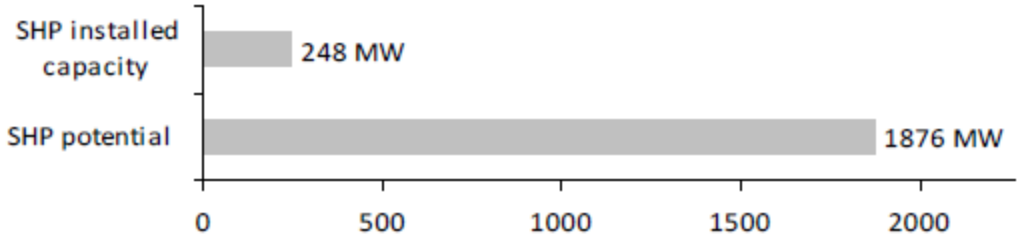


Fig.1 Small hydropower capacities in the Philippines

(Source)World Small Hydropower Development Report 2013, ICSHP

Hydropower Sector envisions an addition of 5,394.1MW hydropower capacity (Table 1). This installation target is expected to be met by 2023. Of the total capacity addition, nine (9) projects with a total capacity of 27.8MW have already been committed for installation. Six (6) of these projects are located in Luzon while there are two in the Visayas and one in Mindanao.

Table 1. Targeted Hydropower Capacity Addition (MW), By Grid

(Source)Peer Review on Low Carbon Energy Policies in the Philippines, APEC

Location	Commissioning Year			Total Capacity Addition (MW)	% Share
	2011 - 2015	2016 - 2020	2021 - 2025		
Luzon	182.0	2,169.5	1,510.0	3,861.5	71.6
Visayas	84.5	102.4	81.8	268.7	5.0
Mindanao	74.8	889.1	300.0	1,263.9	23.4
Total Philippines	341.3	3,161.0	1,891.8	5,394.1	100.0

2. Business Structure of Small-scale Hydropower

(Source)Japan Electric Power Information Center, Inc.

With the EPIRA(The Electricity Power Industry Reform Act) enforcement of 2001, the electricity company was divided into a generation section and a transmission section, a power distribution and retail section by partition and privatization of NPC, and other than the power transmission sector was expected to build a pro-competitive and reasonable price mechanism. However, it is an oligopoly state without the regulation as the actual situation because a group (Lopez, Aboitiz, San Miguel) affiliated with financial combine has generation, power distribution and retail companies as an affiliate.

2.1 Power Generation and Transmission Operators

About the generation section, generating facilities of NPC were transferred to PSALM(Power Sector Assets and Liabilities Management Corporation), and a sale procedure was pushed forward, except for some facilities owned by NPC-SPUG(NPC-Small Power Utilities Group), which could not expect economy and the profitability.

For the power transmission sector, the power transmission business rights have been transferred to the NGCP, a private company, after the establishment of the TransCo, splitting from NPC.

As a result, NPC and IPPs operate the generation section, and NGCP operates the transmission section.

2.2 Distribution Line Operators and Retails

The power distribution and the retail section is composed by 20 private distribution companies like MERALCO(Manila Electric Company) and VECO(Visayan Electric Co), 8 government enterprise organizations (LGUs), 110 electrification cooperatives(ECs), 27 retail electricity suppliers which entered newly into competitive retail electricity market by the introduction of Open Access and Retail Competition System.

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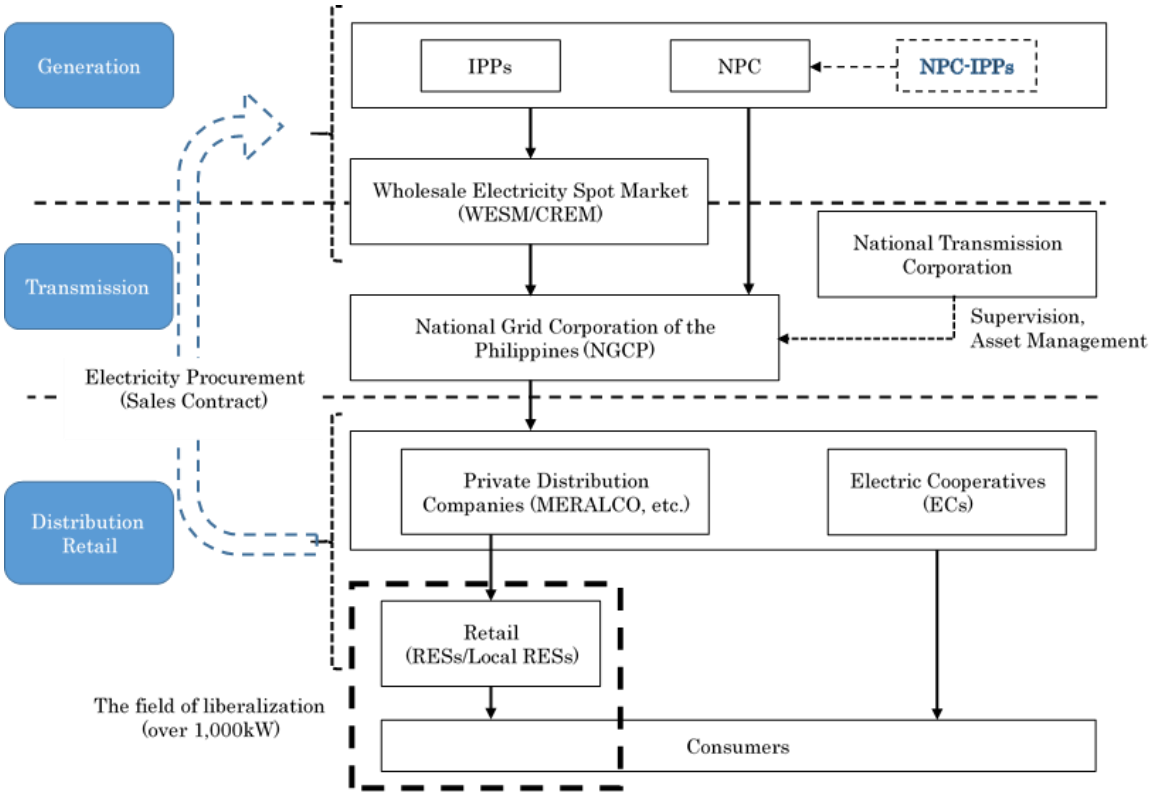
Power distribution operators supply the power to customers of regulated areas (substantially regional monopoly) by procuring the electricity by the relative transactions between power distribution operators and spot trading in WESM (Wholesale Electricity Spot Market). For the transmission system and regional and islands that are not interconnection, qualified third-party(QTP) and NPC-SPUG secure the power supply, and local Electric Cooperatives(ECs) are supplying power.



(Source：Japan Electric Power Information Center, 2010)

Fig. 2 Structure of Power Supply System

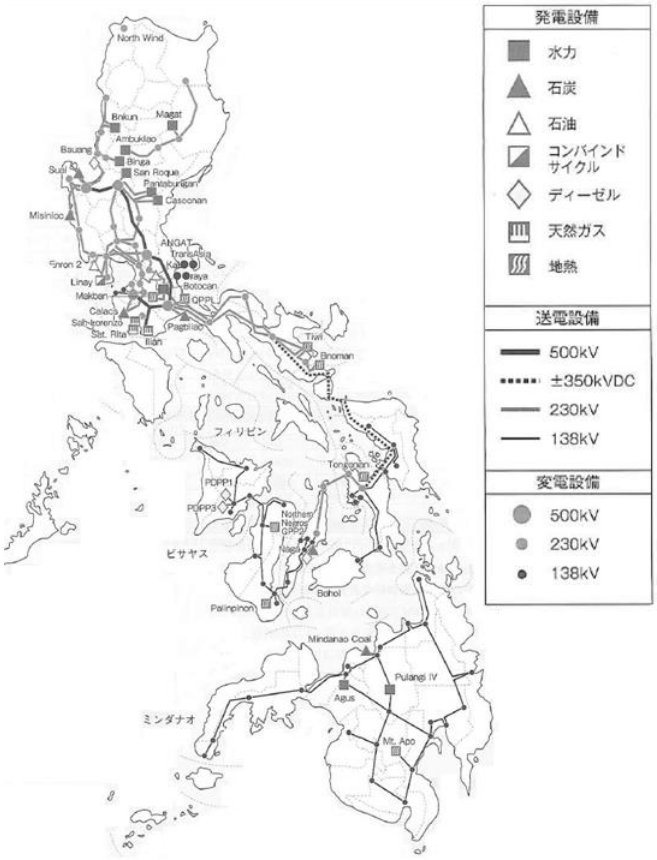


Fig.3 Power Grid Map of the Philippines (Source: JEPIC)

3. Regulation/Facilitation Measures

3.1 Water Rights

(Source) Water Code of the Philippines/Amended Implementing Rules and Regulations
http://www.nwrb.gov.ph/images/laws/pd1067_amended.pdf

The requirements for Power Generation purpose are;

1) Proof of land ownership of, legal title to, or right to use, the property on which the water source is situated.
2) Certificate of Registration from relevant agencies i.e Department of Trade and Industry (DTI), Cooperative Development Authority (CDA), Securities and Exchange Commission (SEC).
3) Schematic Diagram of proposed development/Vicinity Map/Location Map 1:50,000 showing exact location of the point of diversion.
4) Brief Description of the project stating among others, how water will be used, amount of water needed, power to be generated.
5) Environmental Compliance Certificate (for projects considered as Environmentally Critical Projects or projects located in Environmentally Critical Areas) or Certificate of Non Coverage from Department of Environment and Natural Resources (DENR)-Regional Office.
6) Initial Permit from DOE per R.A. 7156.
7) Such other documents that may be required by the Board.

3.2 Environmental Flow

(Source) Water Code of the Philippines/Amended Implementing Rules and Regulations
http://www.nwrb.gov.ph/images/laws/pd1067_amended.pdf

When the Council deems it necessary to establish minimum stream flows for river and stream and/or minimum water level or lakes as provided under Article 66 of the Code, it shall notify the public through newspaper that a public hearing shall be conducted for such purpose. In the conduct of the hearing, the following shall be considered:

a) Adverse effects on legal appropriators;
b) Priorities that may be altered on the basis greater beneficial use and/or multi-purpose use;
c) Protection of the environment, control of pollution, navigation , prevention of salt water damage and general public use; and
d) Other factors relevant to the situation.

In general, the Council shall consider the following criteria in the establishment of minimum stream flows of river and stream and minimum water level of lakes.

a) For water quality and environmental protection the minimum stream flow or lake water level shall be estimated based on the threshold concentration of pollutant and environmental requirement in cooperation with the National Pollution Control

Commission (NPCC) and National Environmental Protection Council (NEPC).

b) For navigation purposes, the minimum flow or water level to be provided shall be such that the resulting stream flow or water level shall remain navigable to the existing vessel that ply the river or lake.

c) For fish conservation consideration shall be made such that the resulting streamflow or lake level will not adversely affect the existing fish habitat.

The minimum flow/water level provided shall be determined by the Council in consultation with BFAR.

d) In any case, the minimum requirement shall be the observed or estimated absolute stream flow or lake level.

3.3 Support Scheme

(1) Mini-hydropower Incentive Act(Republic Act 7156)

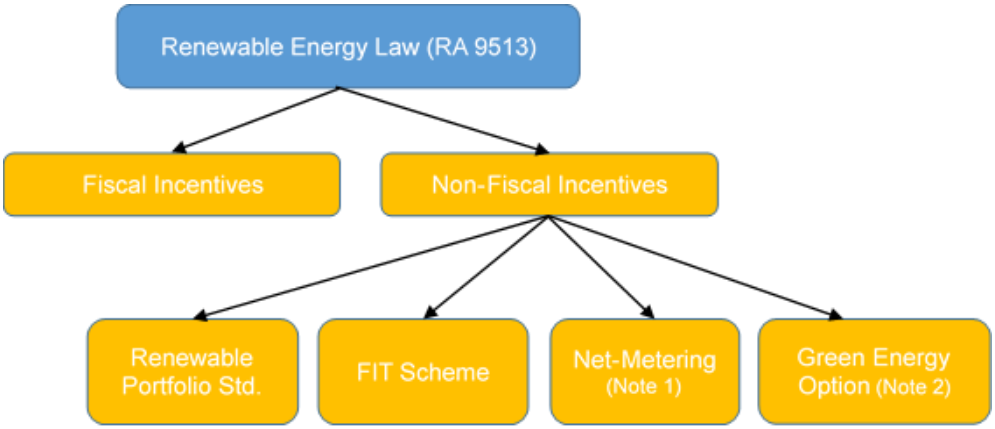
Republic Act No. 7156 or the Mini-Hydro Law provides the following rights and privileges of mini-hydro developers, as follows:

- Special privilege tax rates - Tax payable by developers/grantees to develop potential sites for hydroelectric power and to generate, transmit and sell electric power shall be 2 percent of their gross receipts.
- Income tax holiday for seven (7) years from start of commercial operations.
- Tax and duty free importation of machinery, equipment and materials- Exemption from payment of tariff duties and value-added tax (VAT) on importation of machinery and equipment (within seven (7) years from date of awarding of contract).
- Tax credit on domestic capital equipment - For developers who buy machinery, equipment, materials and parts from a local manufacturers, tax credit is given equivalent to 100 percent of value of VAT and custom duties that would have been paid to import said machinery, equipment, etc.
- Special realty tax rates on equipment and machinery - Realty and other taxes on civil works, equipment, machinery and other improvements of a registered mini-hydroelectric power developer shall not exceed 2.5 percent of their original cost.
- VAT Exemption - Exemption from payment of 10 percent VAT on gross receipts derived from sale of electric power whether wheeled via the NPC grid or electric utility lines.

(2)Renewable Energy Act(RA9513)/ Renewable Portfolio Standard (RPS)

& Feed-in-Tariff (FITs)

This Act, overseen by the Department of Energy, employs various instruments to encourage the supply of electricity from renewable sources.



(Note) 1. "Net Metering" refers to a system, appropriate for distributed generation, in which a distribution grid user has a two-way connection to the grid and is only charged for his net electricity consumption and is credited for any overall contribution to the electricity grid.

2. "Green Energy Option" refers to the mechanism to empower end-users to choose renewable energy in meeting their energy requirements.

Fig.4 Incentives under the Renewable Energy Act

Table 2 Summary of Incentives

Incentives	RE Developers	RE Commercialization
7-Year Income Tax Holiday	Yes	Yes
Duty-free importation	Yes	Yes
VAT-free Importation	No Tax Credit	Yes
Special Realty Tax Rate <=1.5%	Yes	
Net Operating Loss Carryover	Yes	Yes
10% Corporate Tax Rate after Income Tax Holiday	Yes	
Accelerated Depreciation	Yes	Yes
Zero Percent VAT on RE Sales & Purchases	Yes	Yes
Cash Incentive=50% of Universal Charge for Missionary Electrification	Yes	
Tax Exemption on Carbon Credits	Yes	
Tax Credit on Domestic Capital Equipment & Services	Yes	Yes

Renewable Portfolio Standard :

The Act creates a Renewable Portfolio Standard (RPS) for electricity generation from renewable sources, setting a minimum percentage of renewables supply for every electricity supplier. Annual minimum incremental percentage of electricity

sold by each mandated electric power industry participant which is required to be sourced from eligible RE Resources and which shall, in no case, be less than one percent (1%) of the supplier's annual energy demand over the next ten (10) years.

Feed-in-tariff :

A feed-in-tariff is introduced, which includes priority connection to the grid of all renewable sources, as well as priority purchase and transmission.

In 2012, the government launched the new feed-in tariff (FIT) and is summarized in the Table 3.

Table 3. Feed-in Tariff scheme in Philippines

(Source) ERC (2012)

Source	Feed-In Tariff (per kWh)
Solar	9.68PHP (24 cent USD)
Wind	8.53PHP (21 cent USD)
Biomass	6.63PHP (16 cent USD)
Hydro	5.90PHP (14 cent USD)

Note : The conversion rate from PHP to USD is 0.0245 (as of March 2013)

3.4 Others

(1) Barriers to small hydropower development

(Source)World Small Hydropower Development Report 2013

- Political ambivalence and bureaucratic delays in the implementation of the Renewable Energy Act of 2008. Legislators are now calling for 'competitive auctions' to achieve installation targets for the qualified renewable energy technologies, ostensibly to minimize their tariff impacts.
- A more recent development that has alarmed run-of-river small hydropower developers is the recent policy shift by the National Water Resources Board (NWRB) to drastically reduce the maximum water flow rates from rivers that can be used for electricity generation, rendering projects that have already been awarded service contracts by the Department of Energy unviable.

Current status of small-scale hydropower (Portugal)

1. Outline of Small-scale Hydropower

Since the mid-20th century, Portugal has enjoyed electricity production from hydropower plants. According to the World Energy Council, in 2013, Portugal's energy mix consisys of conventional thermal (45.2%), hydroelectricity (30.7%) and other renewables (24.1%). The hydropower capacity is mainly located in the North and center of Portugal.

The development status of small scale hydroelectric power (less than 10MW) is as follows:

(As of 2013)

Output (kW)	Undeveloped			Developed		
	Plant No.	Capacity (MW)	Generation (GWh)	Plant No.	Capacity (MW)	AverageCapacity (kW)
Less 1,000	250	750	1,511	62	453	2,885
1,001～10,000				95		

(Source)ESHA_Stream map_HYDI Database
World Small Hydropower Development Report 2013

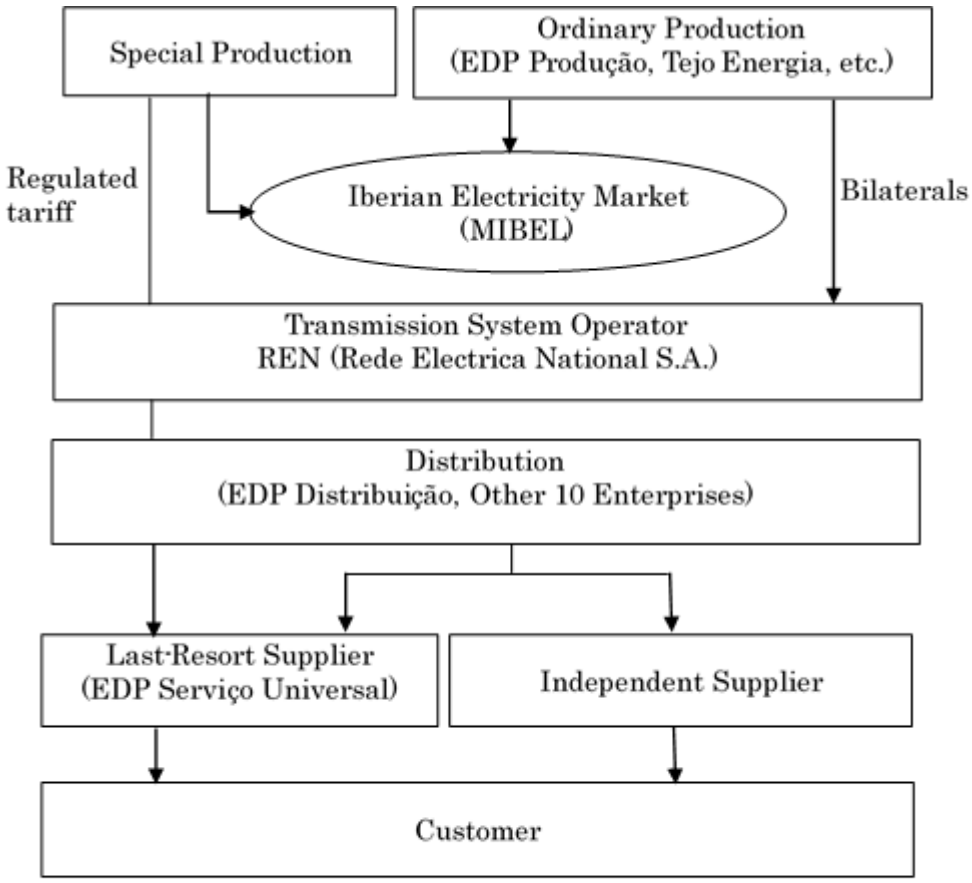
2. Business Structure of Small-scale Hydropower

Today, electricity is generated using different technologies and primary energy sources (coal, natural gas, fuel oil, diesel, water, wind, sun, biomass and waste). The number of generators in mainland Portugal has increased significantly as, in addition to the old, large thermoelectric and hydroelectric power stations, there are now many others with lower power using co-generation or generation from renewable sources.

REN - Redes Energéticas Nacionais operates the National Transmission Grid (RNT), which connects generators to consumption centres and ensures a balance between energy supply and demand. It is the only electricity transmission entity in Portugal under a concession agreement with the Portuguese state.

The RNT delivery points feed the distribution network that supplies most final consumers.

Electricity supply companies are responsible for managing relations with end consumers, including billing and customer service.



(Note) The Last-Resort Supplier is responsible for the purchase of all electricity generated by special regime generators.

(Source : Japan Electric Power Information Center, 2013)

Fig.1 Structure of Power Supply System

3. Regulation/Facilitation Measures

3.1 Institutional framework for hydropower

(Source) Regimes for granting rights to use hydropower in Europe

In Portugal, national legislation requires that hydropower generation facilities have valid hydroelectric concessions to operate. These concessions are granted by the federal government and basin authorities. Expiring concessions must go through a call for tender for renewal.

The main pieces of legislation regulating hydropower concessions are the following:

- Decree-Law no. 46/1994 of 22 February defining the water concession regime.
- Water Act no. 58 of 29 December 2005 determining the institutional framework for sustainable water management and assigning responsibilities to govern water.
- Decree-Law no. 97/2008 of 11 June defining the calculation method for water royalty.
- Decree-Law no.29/2006 of 15 February transposing Directive 2003/54/EC

establishing the general structure of the Portuguese National Electricity system, including the rules for the activity of production.

(1) Institutional framework

1) Authorities fir granting rights of use

- Directorate General for Energy and Geology(DGEG)

  The DGEG is responsible for the development and implementation of energy policies.

- Regulatory Authority of Energy Services(ERSE)

  The ERSE is mainly responsible for monitoring energy prices for end-users as well as monitoring quality of service and security of supply.

- Regional Basin Authorities(ARH)

  The ARHs are public institutions responsible for licensing hydropower concessions, which was before under the Government's jurisdiction.

2) Types of hydropower right and granting procedure

Hydropower concessions are granted in two different ways.

- A private investor files a project with an ARH
- The ARH itself identifies the need for the development of hydropower installations and organizes a call for tender

(2) Framework for granting right to use hydropower

1) Duration

- Concession : up to 75 years
- Procedures from 3 to 11 years

2) Competitive process

2-1) Case of application by a private investor

- Request concession licence with ARH
- ARH call for tender if project in the interest of the river
- Opening to competing projects
- Applicant selection based on highest bid for up-front payment with a possibility to outbid for the first applicant.

2-2) Case of ARH identifying need for hydropower installations

When the ARH identifies the need for the development of hydropower installations, it organizes a call for tender for the construction and/or operation of a hydropower installation. The same competitive process is valid, but the preference right is not applicable in the case of call for tenders initiated by the ARHs.

2-3) For concession renewals

National legislation does not appear to provide for competitive procedure.

3.2 Residual Flow Regulation

(Source: World Small Hydropower Development Report 2013)

There is no regulation published establishing the residual flow. Yet, there are indications that the ecological flow in Portugal should be, 5 to 10% of the modular flow. The residual flow would be the sum of the ecological flow with flow necessary for the existing uses as irrigation and water supply.

3.3 Support Scheme

(1) Feed-in-Tariff

(Source: Renewable energy policy database and support – RES-LEGAL EUROPE, 28 March 2013)

In Portugal, the most important means of promotion is a feed-in tariff. Operators of renewable energy plants are contractually entitled against the grid operator to payment for electricity exported to the grid. The grid operator is obliged to enter into a contract on the purchase of electricity at a statutorily set price ("obligation to enter into a contract"). The feed-in tariff consists of two elements: a guaranteed payment rate and an amount calculated by a statutorily set formula. Most of the feed-in tariffs were defined in 2007 and are applicable to renewable technologies (except large hydropower plants) for a certain timeframe (i.e., 2, 12, 15, 20, 25 or 35 years) or until an upper limit of production is reached, whichever occurs first. Currently, a new regime for the remuneration of RES-E is under discussion.

For existing traditional hydro power plants (up to 10 MW), the indicative average rate is € 91-95 per MWh (DL 126/2010)

For microproduction units the FiT consists of 40% of the reference tariff (art. 11(6) DL 363/2007 amended by DL 118-A/2010).

For miniproduction units, the FiT consists of 50% of the reference tariff (art. 11(7) DL 34/2011).

3.4 Others

(Source: Stream Map for Small Hydropower in the EU-27 in the View of 2020 Targets)

(1) Licensing Procedure:

The licensing procedure of a SHP plant takes in average 3 to 11 years (there are inclusively cases of SHP that took two decades to be licensed), being quite costly and with an unpredictable outcome. The main reason for this is the dependency from entities instructed by different Ministries which are not properly coordinated, implying a slow and bureaucratic process.

(2) Environmental and Technical Constrains:

The obligation to comply with more stringent environmental requirements, particularly resulting from the implementation of the Water Framework Directive, (for example, the imposition of more demanding environmental flows and significant compensatory measures, which often go beyond the dimension of the investments

and the scope of activity of the promoters) leads to a limitation of the technical characteristics and potentially to a reduction in the profitability of SHP plants. Also, it is important to promote a better coordination between the water resources management instruments and the energy sector planning, in order to optimize the existing resources.

Current status of small-scale hydropower (United Kingdom)

1. Outline of Small-scale Hydropower

Current development of small hydropower generation (less than 10,000 kW) in the United Kingdom is outlined as follows:

(As of 2011)

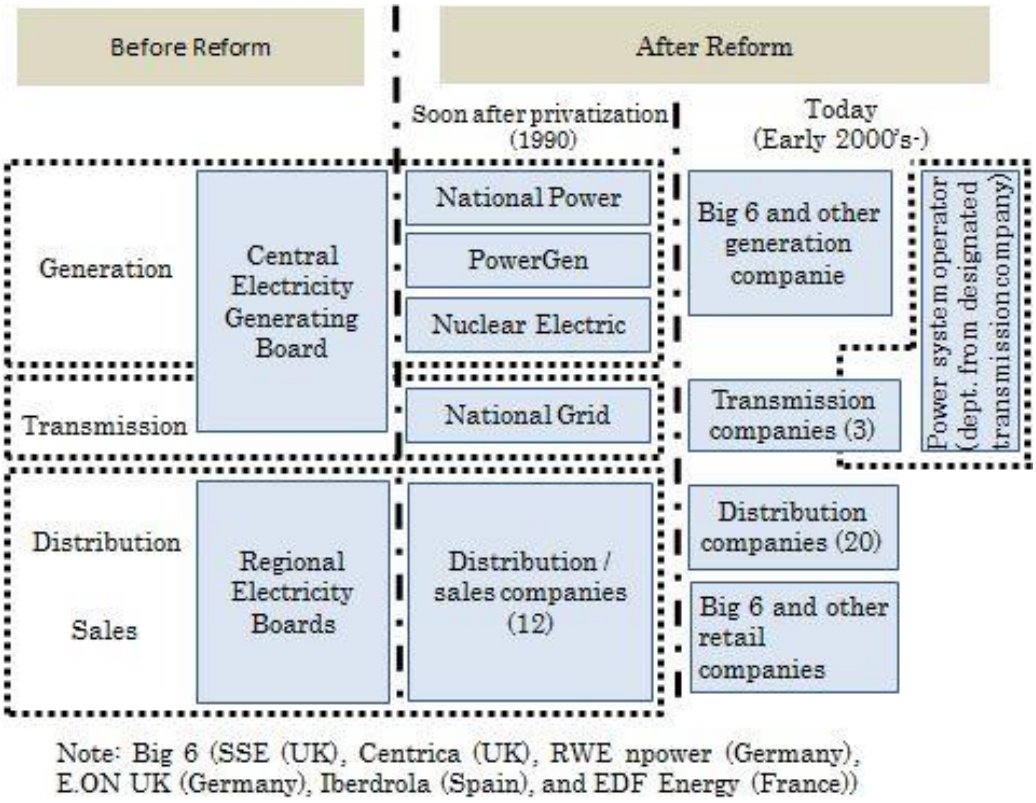
Output Category (MW)	Undeveloped Hydro Potential	Developed Hydro Potential			
	Generation (GWh)	Plant No.	Total Capacity (MW)	Average Capacity (kW)	Total Generation (GWh/year)
Less 1.0	2,353*	136	56	412	167
1.0～10.0		47	162	3,447	530

(Note)* Only economical potential with environmental constraints

Data : "HYDI Database" and "Condensed research data for EU-27"/ESHA_Stream Map

2. Business Structure of Small-scale Hydropower

In the United Kingdom, de-regulation in the power trade market began in 1990, and today, both power generation and supply have been totally liberalized. In the electric power industry in the UK, New Electricity Trading Arrangements (NETA) were introduced in the 2000's, which accelerated integration of power generation and retail supply sectors to minimize trading and imbalance risks, while the power industry was involved in the consolidation movement taking place in Europe, which integrated the electric power utilities operating in the UK into Big 6 (RWE npower, E.ON UK, EDF Energy, Iberdrola, SSE, and Centrica). The Big 6 accounts for over 90% of the retail market and about 70% of the generation sector as of 2013. The power industry has been functionally divided into generation, transmission, distribution and supply sections.



(Source: *Electric Power System in Europe,* Chugoku Electric Power Company, Energia Economic and Technical Research Institute, Energia Regional Economy Report No.468, July 2013)

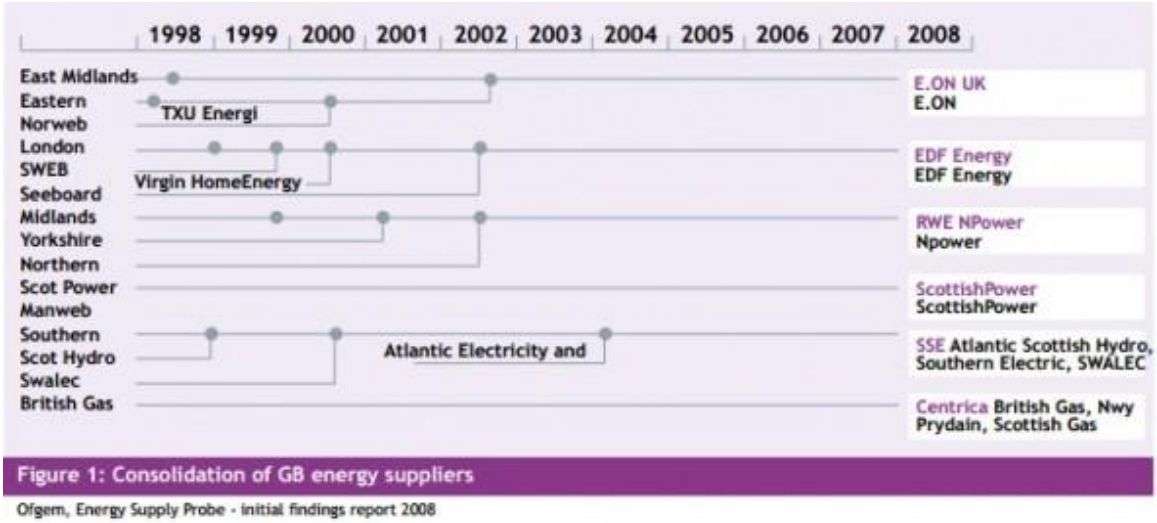


Fig. 1 United Kingdom (England and Wales) Electric Power System

(Note)The Business Structure of Small-scale Hydropower shall be described in this blank.

Wholesale power is traded under the system of the British Electricity and Trading Transmission Arrangement (BETTA) introduced in 2005. BETTA is a system that is based on negotiable transactions, wherein power generators and retail suppliers freely trade

wholesale power through negotiated contracts or stock exchange transactions, and conduct power generation supply based on the agreed contracts. The System Operator (SO) is responsible for maintaining the balance in the power system in such a free market. SO procures the power necessary for its system operation through negotiated contracts or the Balancing Mechanism (BM) Market. The Central Settlement Authority compares the contract amount and actual traded amount (measurement) of each power utility every 30 minutes, and executes settlement for differentials (imbalance). The transmission networks are currently owned by National Grid Electricity Transmission (NGET) in England and Wales, by Scottish Hydro Electric Transmission (SHET) in the northern Scotland, and by SP Transmission (SPT) in the southern Scotland, but SO operates these networks as if they are a single power system under the BETTA. As of today, the role of SO is performed by the power system operation department of National Grid Electricity Transmission (NGET).

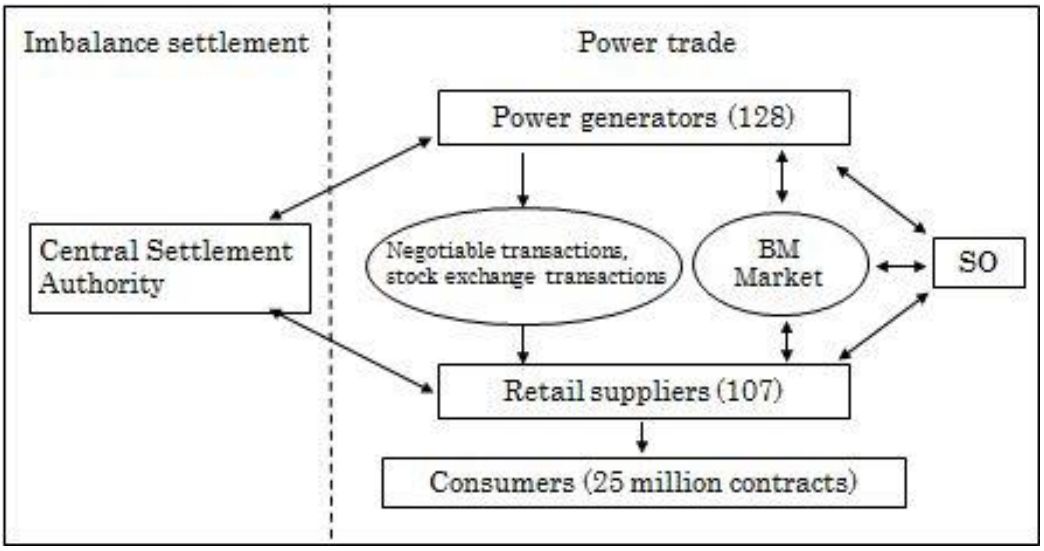


Fig.2: Power Trade under British Electricity and Trading Transmission Arrangement (BETTA) (as of 2013)

(Source: *Electric Power Industry in Oversea Countries 2014*, Japan Electric Power Information Center, Inc.)

3. Regulation/Facilitation Measures

3.1 Water Rights

All watercourses of any size are controlled by the Environment Agency/SEPA. To abstract water from them (even though it will be returned downstream) will almost certainly require their permission in the form of a licence. There are three licences that can apply to a hydropower scheme in England and Wales

(1) Abstraction Licence, if water is being diverted 'away from the main line of flow of the river'. In practice, this means that the only type of scheme which can avoid an abstraction licence would be a barrage-type project where turbines are installed on an existing weir and the water remains between the existing banks of the river. All new abstraction licences are now time-limited to between 6 and 18 years, after which they

must be renewed. The Environment Agency have stated that there will be a "presumption of renewal", but this is clearly an area of risk for new developments.

(2) Impoundment Licence, if changes are being made to structures which impound water, such as weirs and sluices, or if new structures are to be built.

(3) Flood Defense Consent, for any works being carried out in, or adjacent to, a 'main river'

The Environment Agency may also require a Section 158 Agreement to be drawn up, which defines certain further details on the way the scheme must be operated in order not to conflict with the Agency's river management duties, e.g. rights of access, the control of river levels, flood waters, maintenance of the weir and river structures, etc.

In Scotland a single licence may be applied for under the Controlled Activities Regulations (CAR) this single licence will cover all aspects of the environmental licence required for a hydropower scheme of any size.

If you believe the terms of the License you are issued are unfair or unsatisfactory, then it is possible to appeal the against conditions of the licence issued within 28 days.

3.2 Residual Flow Regulation

(Source) A Guide to UK Mini-Hydro Developments(BHA)

(1) England and Wales:

The Environment Agency's "Good Practice Guidelines to the Hydropower Handbook" published August 2009 for low head sites relate residual flow to "Hands off flow" (HOF). A table is provided to indicate minimum HOFs for various river types and lengths of developed reach. Values vary from Q95 to Q85. The guidance is being reviewed at present (Spring 2012) and will include high head applications.

(2) Scotland:

The Scottish Environmental Protection Agency (SEPA) has "Guidance for Applications on supporting information requirements for hydropower applications" in December 2010. The default residual flow is Q95 but each project must be reviewed individually.

(3) Northern Ireland:

The Northern Ireland Environment Agency (NIEA) has "Guidance for Run-of-River hydropower schemes in Northern Ireland" published in July 2011. The default residual flow is Q95 but, under certain categories of river and river protection, this can increase to Q80.

3.3 Support Scheme

Since 2000, there has been a big increase in the desire for new and refurbished hydropower projects to be built. This was a result of introducing the Renewable

Obligation with its associated Renewable Obligation Certificates (ROCs). The means by which renewable energy developers benefited via a government-lead initiative based on payment via the nation's electricity bills was seen as fair and resulted in a surge to generate renewable power with wind, being the biggest and quickest technology to benefit and develop. In 2010, a FIT was also introduced to incentivize the lower generation area (up to 5MW) and, in particular, to individuals and communities to promote renewable energy projects.

(1) Renewable Obligation Certificates (RO)

The RO came into effect in 2002 in England, Wales and Scotland and in 2005 in Northern Ireland. It places an obligation on UK electricity suppliers to source an increasing proportion of electricity they supply to customers from renewable sources. Renewables Obligation Certificates (ROCs) are green certificates issued to operators of accredited renewable generating stations for the renewable electricity they generate. ROCs can then trade with other parties. They are used by suppliers to demonstrate that they have met their obligation. ROCs are now available over 50kW plant capacity except in Northern Ireland. ROCs are due to be phased-out in 2027, a recent review of the ROC banding system proposed that hydro should, from 2017, receive only half of the ROC value per MWh than is enjoyed at present.

(2) Feed-in Tariffs(FITs)

FITs were introduced to all UK apart from Northern Ireland in April 2010. FITs are available for RE projects up to 5MW capacity. As a result of the UK Government spending review from late 2010, the FIT system is being subjected to an early review. In January 2012 the Department of Energy and Climate Change (DECC) started a consultation about a revised FIT system, the results were recently announced with new tariffs applicable from April 2013.

Although the proposed 2013 tariffs for hydro (per kWh) are reasonable, as shown below, these are subject to whether degression as targets set by DECC are met, which is creating a rush for development and does not encourage sustainable growth of the industry.

Feed-in Tariffs for Hydropower

Plant Capacity (kW)	Feed-in Tariffs (Pence/kWh)
Up to 15	21.65
15～100	20.10
100～500	15.50
500～2,000	12.48
2,000～5,000	3.23

(As of April 2013)

3.4 Others

(Source) Stream Map.

(1) Average duration of authorization procedure:

For a new small hydro project, the time taken to obtain environmental consents, planning permission and accreditation from the electricity regulator (The Office of Gas and Electricity Markets : Ofgem) varies from 1 to 3 years. Appeals against refusal of environmental and planning permissions take from 6 months to 1 year.

(2) Power granting schemes:

Every hydro project must have three permissions before it can be built and generate electricity:

1) Environmental license

This is normally covered by separate licenses to abstract, impound and transfer water whichever apply to the project.

2) Planning permission

This is permission to build the project including any restrictions on design, construction and amenities which are relevant. Permission will also include compliance with the environmental permits. Planning permission is administered by regional councils or National Park authorities.

3) Accreditation to generate and export electricity

This permit is provided through Ofgem, the UK-wide electricity and gas regulator. Permission will depend on the generator's technical ability to produce and deliver electricity.

Current status of small-scale hydropower (United Sates of America)

1 . Outline of Small-scale Hydropower

Current development of small scale hydropower generation (less than 30MW) in the United States of America is outlined as follow:

【Existing(Developed Hydro Potential)】

Category	～1MW			1MW～30MW			**Total**		
	Plant No.	Total Capacity (MW)	Average Capacity (kW)	Plant No.	Total Capacity (MW)	Average Capacity (kW)	Plant No.	Total Capacity (MW)	Average Capacity (kW)
Federal	2	1.55	775	47	704.7	14,994	**49**	**706.3**	**14,413**
Non-Federal	887	470.4	530.3	831	6,120	7,365	**1,718**	**6,590**	**3,836**
Non-Federal on Reclamation	10	7.34	733.9	53	360.5	6,801	**63**	**367.8**	**5,838**
Non-Federal on USACE	6	6.41	1,069	50	440.2	8,803	**56**	**446.6**	**7,975**
Total	**905**	**485.7**	**536.7**	**981**	**7,625**	**7,773**	**1,886**	**8,111**	**4,301**

Data source : ORNL, USA, NHAAP Program

【Hydro Potential】

Category	～1MW			1MW～10MW			**Total**		
	Plant No.	Total Capacity (MW)	Generation* (GWh)	Plant No.	Total Capacity (MW)	Generation* (GWh)	Plant No.	Total Capacity (MW)	Generation* (GWh)
NPD	87	107.0	422.3	310	1,199	4,355	**397**	**1,306**	**4,777**
NSD	171	207.1	1,084	864	4,114	22,289	**1,035**	**4,321**	**23,374**
Total	**258**	**314.1**	**1,506**	**1,174**	**5,313**	**26,644**	**1,432**	**5,627**	**28,151**

*assuming an efficiency of 0.85

NPD: Non-powered Dams

NSD: New Stream-reach Development

Data source : ORNL, USA, NHAAP Program

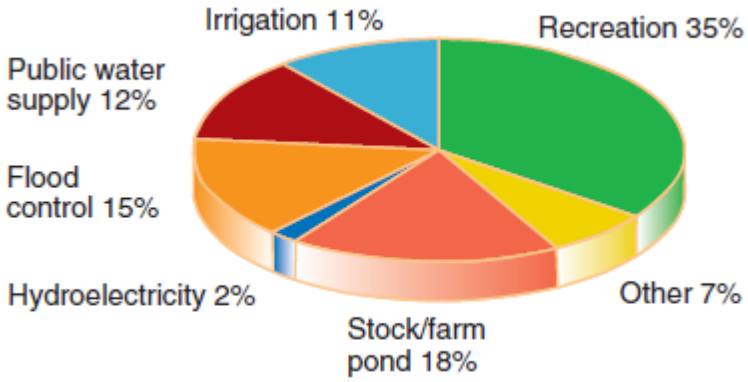
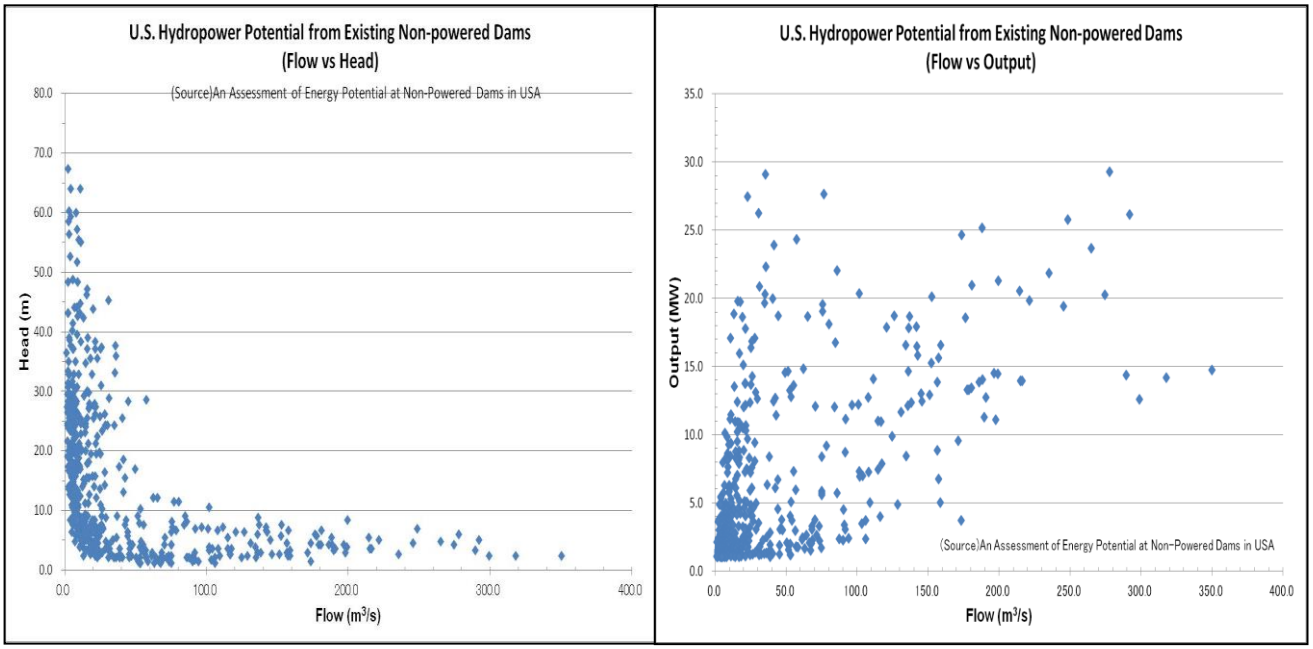


Fig.1 Primary purposes or benefits of U.S. dams

Place No. less 30MW: 526places　　Total Capacity: 3,439.8MW



(Source)An Assessment of Energy Potential at Non-Powered Dams in the United States
(DOE, April 2012, Oak Ridge National Laboratory)

Fig.2 Hydropower potential from Existing Non-powered Dams

According to a water energy resources assessment conducted by the U.S.Department of Energy (DOE), the estimated average power of undeveloped U.S.resources is 170,000MW. Available resources are resources that have not been developed and are not excluded from development by federal statutes and policies. The Alaska Region contains the largest available potential with slightly less than 45,000MW. The Pacific Norwest Region has the second highest amount of available potential with almost 40,000MW. Together these two regions contain about half of the estimated available U.S. hydropower potential.

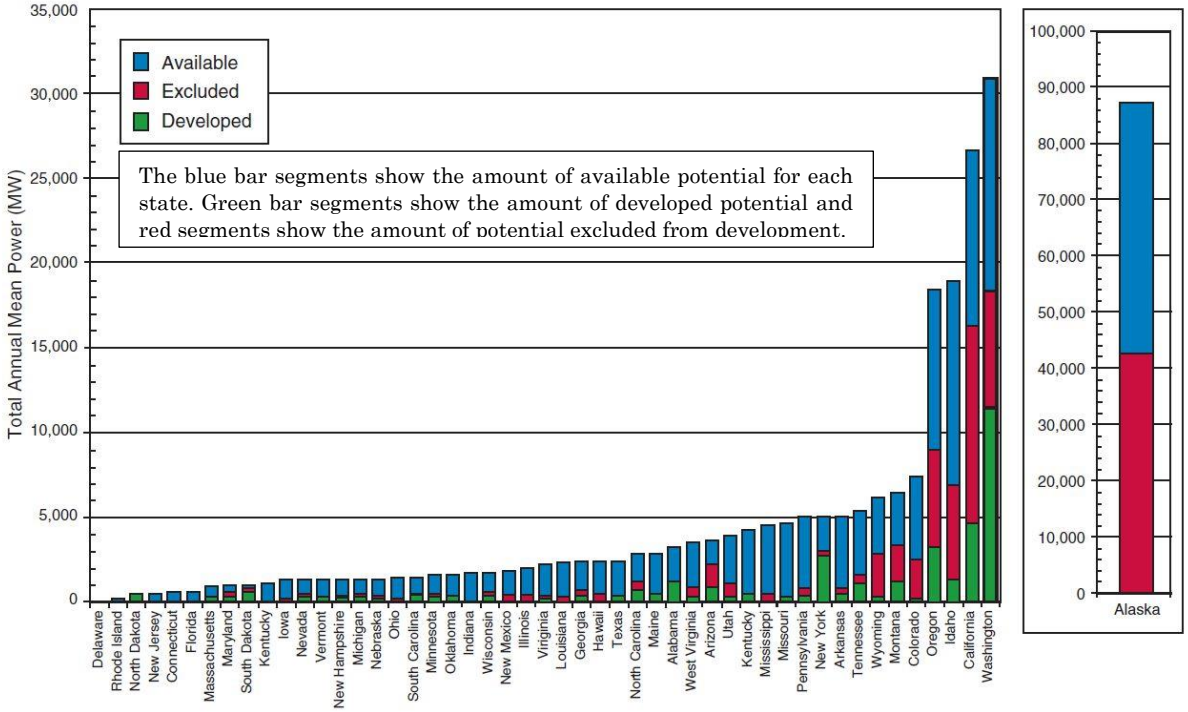


Fig.3 Total power potential of water energy resources in the 50 states

(Source)Hydropower/Setting a Course for Our Energy Future

U.S. Department of Energy, Energy Efficiency and Renewable Energy

2. Business Structure of Small-scale Hydropower

2.1 Outline of Liberalization of the Electric Power Sector

In the United States, the Energy Policy Act of 1992 provided for liberalization of electric power by designating a new power generator category, Exempt Wholesale Generator (EWG), exempted from the application of the Public Utility Holding Company Act (PUHCA) regulations, that is generally called independent power producers (IPP). This Act enabled EWG engaging in power generation for wholesale purposes to freely own, operate and sell power within the scope of designated business schemes and geographic areas, thus substantially liberalizing the wholesale power market across the United States.

The Federal Energy Regulatory Commission (FERC) obligated the electric power utilities to separate the functions of transmission and generation and to open their transmission lines for third party utilization in 1996 in order to facilitate further competition in the wholesale power market. This development led to a recommendation of establishing Independent System Operator (ISO) from the standpoint of efficient management of power system operation and assurance of neutrality, and thereby some ISOs were set up. Moreover in December 1999, FERC instructed the utilities to establish a cross-regional power system operating organization called Regional Transmission Organization (RTO) with a view to complementing deficiencies of ISO's role. As a result, seven ISO/RTO

organizations have been set up in the United States up until today.

The liberalization of the retail power market and introduction of a competitive market has been promoted in each of the states. In the initial stage, 24 states and Washington D.C. enacted the laws for implementing the liberalization and providing regulations. From 2000 to 2001, however, the State of California suffered a power crisis, and thus the state discontinued the retail competitive market in September 2001. Arkansas and New Mexico abolished the acts that stipulated the liberalization which were once enacted therein.

As of January 2016, of the 50 states, the retail market is totally liberalized only in 13 states and Washington D.C., while Alaska has not liberalized the retail market at all.

2.2 Power Producer

Electric utilities 3,250 or more companies are present in the United States. The ownership of the company, etc. These are classified Investor-Owned Utilities, Federally-Owned Utilities, Publicly-Owned Utilities and Cooperative-Owned Utilities by the company ownership.

(1) Investor-Owned Utilities : 194 companies

Consistently provide power generation, transmission and distribution and retail supply service.

As a result of electricity deregulation in the 1990s, each department is separated to another company and specialized in transmission and power distribution business.

(2) Federally-Owned Utilities : 9 companies

Wholesale sales of power generation and power hydropower development is the main business.(TVA, BPA, etc.)

(3) Publicly-Owned Utilities : 2,006 companies

Local government or state-owned.

It is engaged in the distribution business, mainly small-scale operators in the majority

(4) Cooperatively-Owned Utilities : 874 companies

Businesses to be established by suburban residents and rural area outside of the supply of private operators. Power supply toward the union members primarily.

(5) Marketer : 168companies

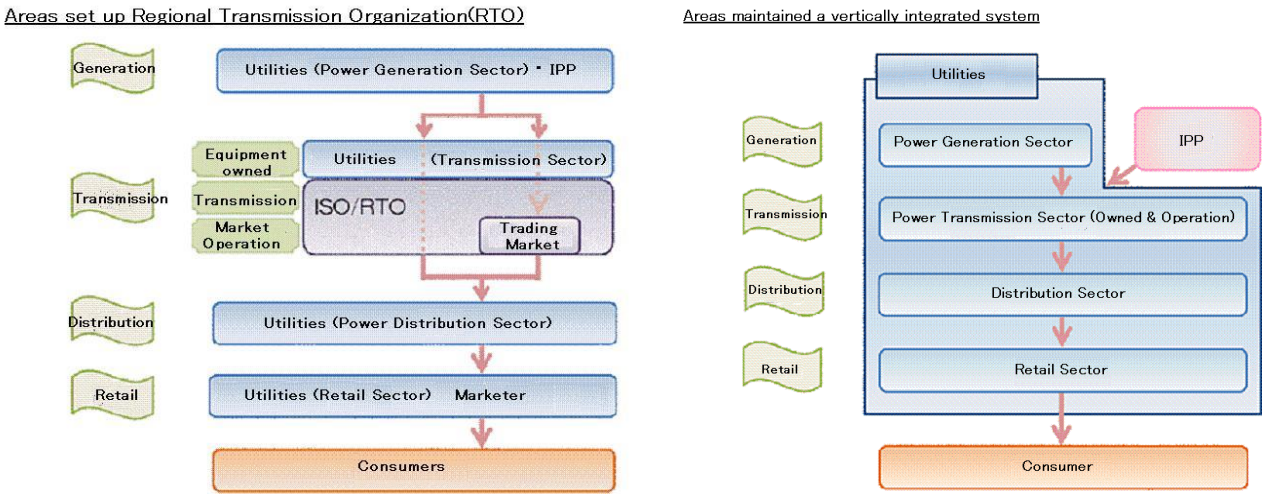


Fig.4 Structure of Power Supply System

(Source : Japan Electric Power Information Center, 2013)

3. Regulation/Facilitation Measures

3.1 Water Rights

(Source)Instream Flow Protection in Alaska, 2010/Special Publication No.12-03

FERC administers the Federal Power Act (FPA), which governs the regulation of hydroelectric projects in the United States, among other duties. FERC issues licenses16 that specify how projects will be constructed and operated including any mitigation measures. FERC licenses specify how streamflows will be allocated between energy generation and other beneficial uses recognized by the FPA and other applicable laws (Roos-Collins and Gantenbein 2005).

Under the FERC process, applicants generally obtain a preliminary permit that gives them the exclusive right to study the project's feasibility for three years. If an applicant is still interested in pursuing the project, a license application is submitted before the end of the permit term. ADF&G plays an important role in assisting the applicant to obtain fish and wildlife information needed by regulatory agencies. The licensing process typically takes two years after a license application is filed with FERC and includes an environmental review in accordance with the National Environmental Policy Act.

3.2 Environmental Flow

(Source)Chapter 12 Legal Tools for Instream Flow Protection (Sandra Zellmer)

Most western states have adopted some type of legislation to sidestep the common law requirement that an actual, physical diversion be made, and also to allow at least limited protection of instream flows through the state water rights system.

All western states except Colorado and Oklahoma require new appropriations to satisfy

some sort of general public interest test, which typically includes environmental considerations as well as economic and social factors. And most western states also impose a public interest test on transfers or changes in use (see Grant 2006 for a list of states that include instream values as part of the public interest review).

Statutes in Alaska, California, Colorado, Wyoming, Montana, Idaho, Oregon, Washington, Kansas, Nebraska and Utah explicitly permit the appropriation andlor transfer of instream flows. Arizona and Nevada protect instream flows through administrative procedures, while New Mexico recognizes instream flow appropriations under an Attorney General opinion. Restrictions vary from state to state.

Some of the states allow instream appropriations only from unappropriated waters, and some allow only state agencies to hold an instream flow right. A few states recognize a broad array of beneficial instream purposes, while others allow instream appropriations for fisheries only.

In general, the western states' handling of instream flows differ in three ways:

(1) sources for instream flow appropriations;

(2) who may appropriate instream flows; and

(3) allowable purposes for instream flows.

In their instream flow legislation, western states typically restrict the source of water that can be utilized for instream flow appropriations. This can severely limit the use of water for environmental purposes. Alaska, Idaho and Nebraska statutes expressly require that water for instream flow appropriations come from unappropriated (surplus) sources (of which there are few). Other western states either explicitly allow additional sources or have no source restrictions.

Alaska:

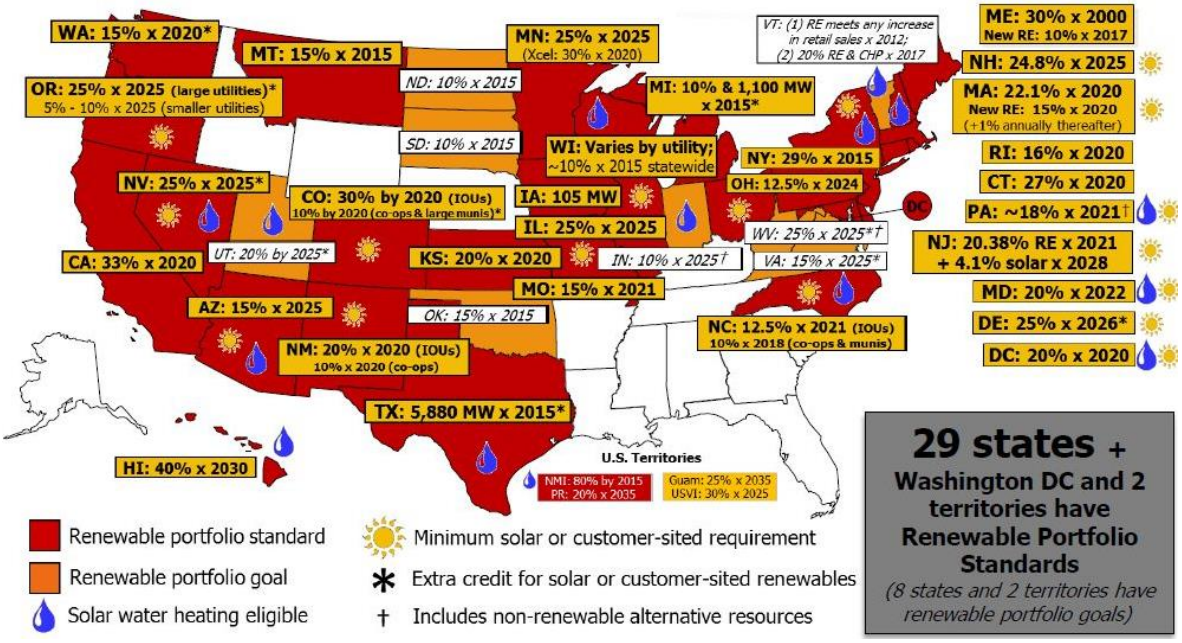
Alaska's legislation requires that the water used for an instream flow be unappropriated and "sufficient for the reservation". It is unclear if "sufficient for the reservation" means that the water must be available 100% of the time, or just at some point during the time requested. In any case, very few of the state's waterways have yet been inventoried to establish water volumes and availability. Alaska protects the basin of origin from adverse effects of proposed water exports by requiring the state commissioner to reserve "a volume of water in the lake or an instream flow in the river or stream for the use of fish and to maintain habitat for fish."

3.3 Support Scheme

Table-1. Support Program Comparison of Major States in USA

(Source)The survey report for program possible use of U.S. Federal Government and Major States, aiming the effective use of renewable energy and improvement of energy efficiency (JETRO, 2010)

State	Existing Hydropower Capacity (MW)	Federal Rules, Regulations & Policies		Subsidy Measures of State Government Agencies		
		Renewable Portfolio Standard (RPS)	Net Metering	Grant, Rebate, etc.	Lending Mechani-sum	Tax Incentive
California	10,032	33%(by 2020)	○	◎	△	△
New York	4,654	30%(by 2015)	○	◎	△	◎
Texas	672	5,880MW(by 2015) 10,000MW(by 2025)	×	×	△	○
Florida	56	20%(by 2020)	○	△	×	○
Illinois	38	25%(by 2025)	○	◎	×	○
Pennsylvania	775	18%(by 2020)	○	◎	◎	△
New Jersey	13	22.5%(by 2021)	○	◎	△	△
Ohio	128	25%(by 2025)	○	◎	△	△
Georgia	1,932	×	○	◎	△	○
North Carolina	1,828	12.5%(by 2021)	○	◎	△	○
Michigan	374	10%(by 2015)	○	○	×	◎
Virginia	743	15%(by 2025)	○	◎	△	△
Massachusetts	272	15%(by 2020)	○	◎	○	◎
Washington	20,807	15%(by 2020)	○	○	×	△
Maryland	527	20%(by 2022)	○	◎	○	◎
Minnesota	186	25%(by 2025)	○	◎	◎	○
Arizona	2,718	15%(by 2025)	○	×	×	◎
Tennessee	2,418	×	×	◎	○	△
Indiana	92	×	○	△	×	△
Colorado	649	20%(by 2020)	○	○	×	△



(Source)Database of State Incentives for Renewables & Efficiency(DSIRE)

Fig.5 Renewable Portfolio Standard Policies

3.4 Others

Table-2 Grant and Financial Incentive Programs in Alaska

(Source) Database of State Incentives for Renewables & Efficiency(DSIRE)/NC Clean Energy Technology Center

No.	Program Name	Implementing Sector	Policy/ Incentive Type	Created	Last Updated
1	Renewable Energy Fund (REF)	AK	Grant Program	09/23/2008	07/09/2015
2	Rural Energy for America Program (REAP) Grants	US	Grant Program	04/09/2003	08/25/2015
3	Tribal Energy Program Grant	US	Grant Program	05/01/2003	07/31/2015
4	High Energy Cost Program	AK	Grant Program	09/27/2010	11/20/2014
5	Golden Valley Electric Association– Sustainable Natural Alternative Power	AK	Performance-Based Incentive	12/13/2005	06/18/2015
6	U.S. Department of Energy-Loan Guarantee Program	US	Loan Program	09/12/2008	11/20/2014
7	Renewable Electricity Production Tax Credit	US	Corporate Tax Credit	03/11/2002	04/13/2015

(1) Renewable Energy Fund (REF)

The Alaska Renewable Energy Fund (REF) provides benefits to Alaskans by assisting communities across the state to reduce and stabilize the cost of energy. The program is designed to produce cost-effective renewable energy for heat and power to benefit Alaskans statewide. The program also creates jobs, uses local energy resources, and keeps money in local economies.

The REF was established by the Alaska State Legislature in 2008, and extended 10 years in 2012. The REF is managed by the Alaska Energy Authority (AEA) and provides public funding for the development of qualifying and competitively selected renewable energy projects in Alaska.

(2) Rural Energy for America Program(REAP) Grants

(Source) https://www.rd.usda.gov/BCP_ReapResEei_Financing.html

The Rural Energy for America Program (REAP) provides financial assistance to agricultural producers and rural small businesses in rural America to purchase, install, and construct renewable energy systems, make energy efficiency improvements to non-residential buildings and facilities, use renewable technologies that reduce energy consumption, and participate in energy audits and renewable energy development assistance.

Renewable energy projects for the Renewable Energy Systems and Energy Efficiency

Improvement Guaranteed Loan and Grant Program include wind, solar, biomass and geothermal, and hydrogen derived from biomass or water using wind, solar, or geothermal energy sources. These grants are limited to 25% of a proposed project's cost, and a loan guarantee may not exceed $25 million. The combined amount of a grant and loan guarantee must be at least $5,000 (with the grant portion at least $1,500) and may not exceed 75% of the project's cost. In general, a minimum of 20% of the funds available for these incentives will be dedicated to grants of $20,000 or less.

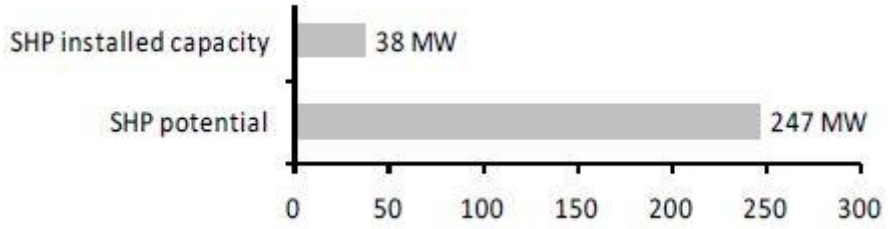
(3) Tribal Energy Program Grant

(Source) http://energy.gov/indianenergy/office-indian-energy-policy-and-programs

The U.S. Department of Energy's (DOE) Tribal Energy Program promotes tribal energy sufficiency, economic growth, and employment on tribal lands through the development of renewable energy and energy efficiency technologies. The program provides financial assistance, technical assistance, and education and training to tribes for the evaluation and development of renewable energy resources and energy efficiency measures.

Current status of small-scale hydropower (South Africa)

1. Outline of Small-scale Hydropower



(Note) 247MW of SHP potential includes the hydro potential of water transfer systems and gravity fed water system.

Fig. 1 Small hydropower capacities in South Africa
(Source : Baseline study on Hydropower in South Africa, Barta)

The small scale hydropower used to play an important role in the provision of energy to urban and rural areas of South Africa. The first provision of electricity to cities like Cape Town and Pretoria was based on small hydropower, while other smaller towns started local distribution of electricity through isolated grids powered by small hydropower stations. With the expansion of the national electricity grid and the increasingly cheap, coal-generated power supplied through it, a large number of such systems were decommissioned. A typical example is the Sabie Gorge hydropower station, with three 450-kW turbines, commissioned in 1928 to serve the town of Sabie in Mpumalanga and later closed in 1964, after the area was connected to the national Eskom grid.

After nearly 30 years of neglecting the hydropower potential of the country, the first new small hydropower station was commissioned in November 2009 at the Sol Plaatje Municipality (Free State province), and a few other stations are currently at varying stage of development.

By the end of the 1990s, the CSIR (The Council for Scientific and Industrial Research), Eskom and the Department of Minerals and Energy developed the South African Renewable Energy Database (Muller, 1999), which reported on the available renewable energy resources in the country, including the potential for hydropower. As follow-up, the resources available for the Eastern Cape region was detailed as part of a three-year investigative project entitled 'Renewable energy sources for rural electrification in South Africa'. The primary objective of the latter project was to identify the commercially viable opportunities for rural electrification in the Eastern Cape Province of South Africa using wind-, hydro- and biomass-powered energy systems. The maps in Fig. 2 and Fig. 3 present the outcomes of these two studies with respect to the potential for small hydropower in South Africa and the Eastern Cape respectively.

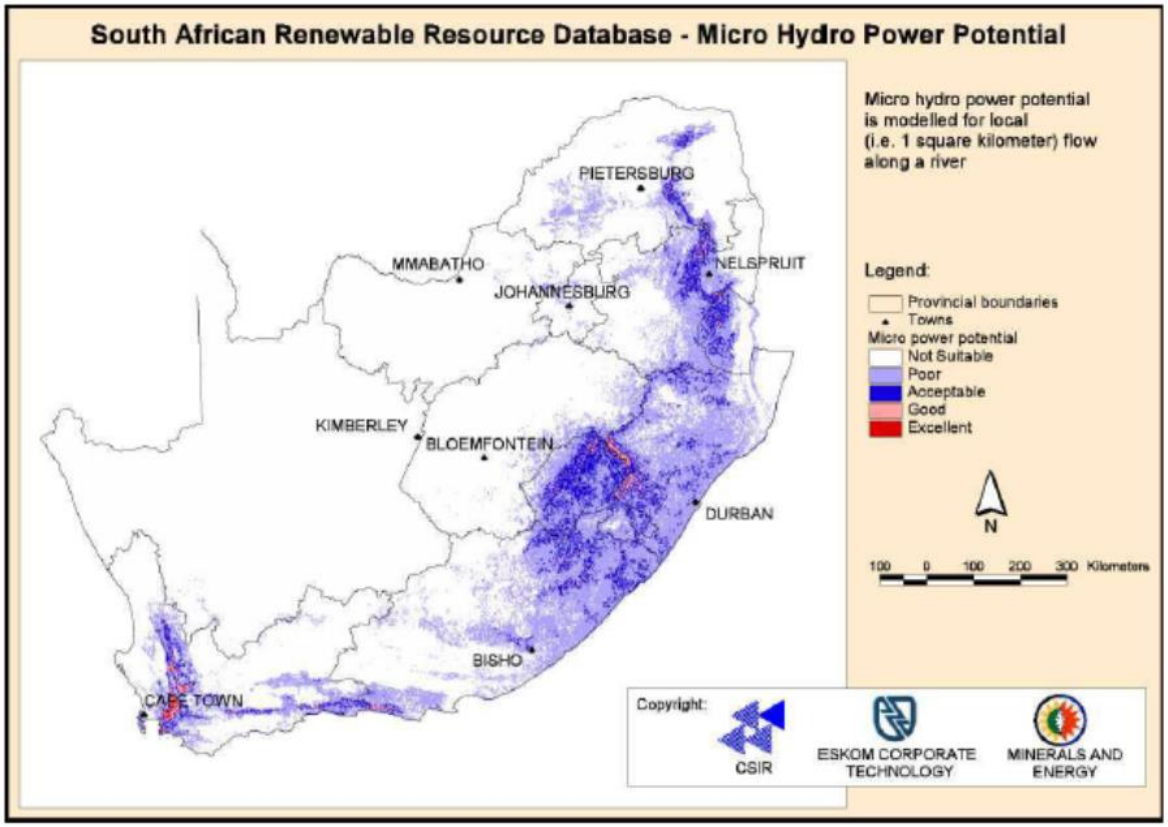


Fig. 2 Micro hydropower potential in South Africa (Source: Muller)

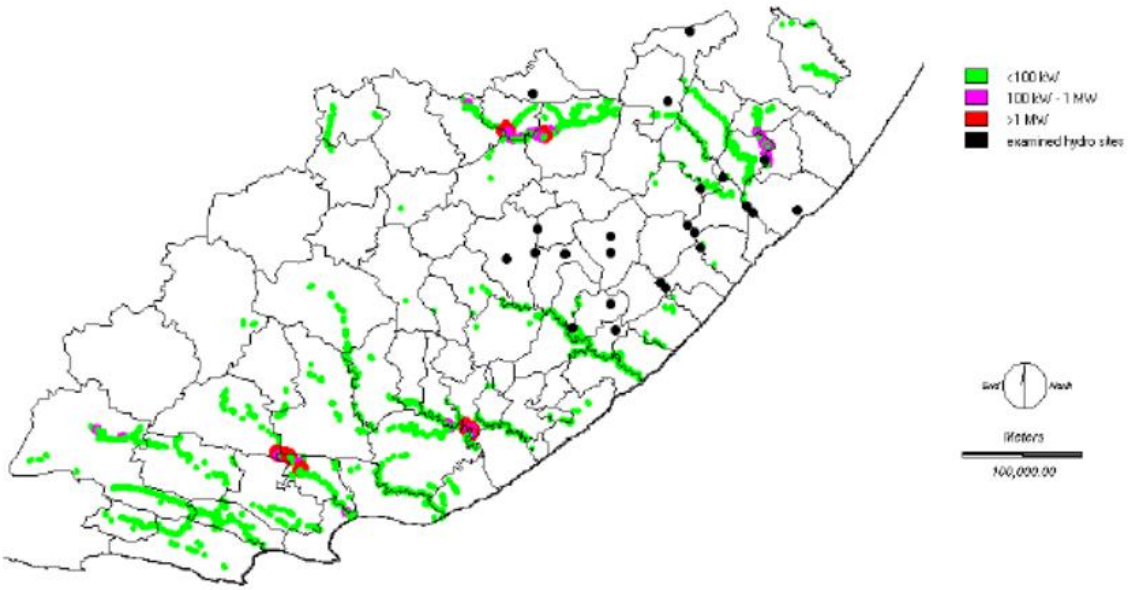


Fig. 3 Small hydropower potential in the Eastern Cape of South Africa (Source: Szewczuk, Fellows, and van der Linden)

The future for small hydropower in South Africa will see two main parallel tracks: grid-connected projects that will feed into the national grid and small scale systems for private use (not feeding into the grid, irrespective of whether a grid connection is

available or not). These tracks can be supplemented by a third category of isolated systems for rural electrification purposes. The grid-tied systems future is closely linked to the national government's policy on renewable energy development. The utilization of small scale systems for private use is expected to grow based on the foreseen rise in electricity prices, coupled with the reduced reliability of the grid. Off-grid electrification by means of small hydropower could fall under the "Working for Energy" program, as it is currently under development by the South African National Energy Development Institute (SANEDI). It could also be supported by the renewed focus of the Department of Energy in the off-grid electrification processes.

2. Business Structure of Small-scale Hydropower

South Africa has a total electricity generation capacity of about 45,000 MW. Nearly 90 per cent of electricity is generated in coal-fired power stations (Fig. 4). Koeberg, a large nuclear station near Cape Town, provides about five per cent of capacity, while the remaining five per cent is provided by hydropower and pumped storage schemes. Currently about 700 MW of installed hydropower capacity exists in the country.

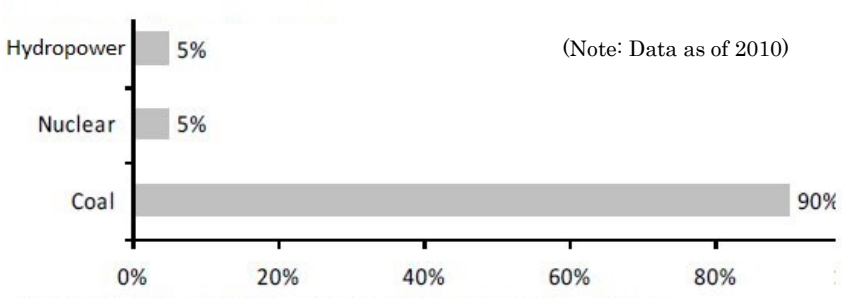


Fig. 4 Electricity generation in South Africa
(Source: Department of Energy)

Electricity generation is dominated by Eskom, the state-owned utility. Eskom generates about 96 percent of the country's electricity, owns and controls the national high-voltage transmission grid, and distributes approximately 60 percent of electricity directly to customers. Local authorities buy bulk from Eskom and distribute the balance. Direct electricity sales to mines and industry account for more than 40 percent of Eskom's distribution business. Eskom is one of the world's top seven energy producer in terms of generating capacity; one of the world's top nine in terms of sales, and it has one of the world's biggest dry-cooled power stations - Matimba Power Station (coal-fired; installed capacity 3,990 MW). South Africa, which for many years operated with overcapacity, has begun to experience a power crisis induced by rapid growth in electricity demand, coupled with prolonged underinvestment in new generation capacity.

Eskom's legal structure for the year ended 31 March 2011 is:

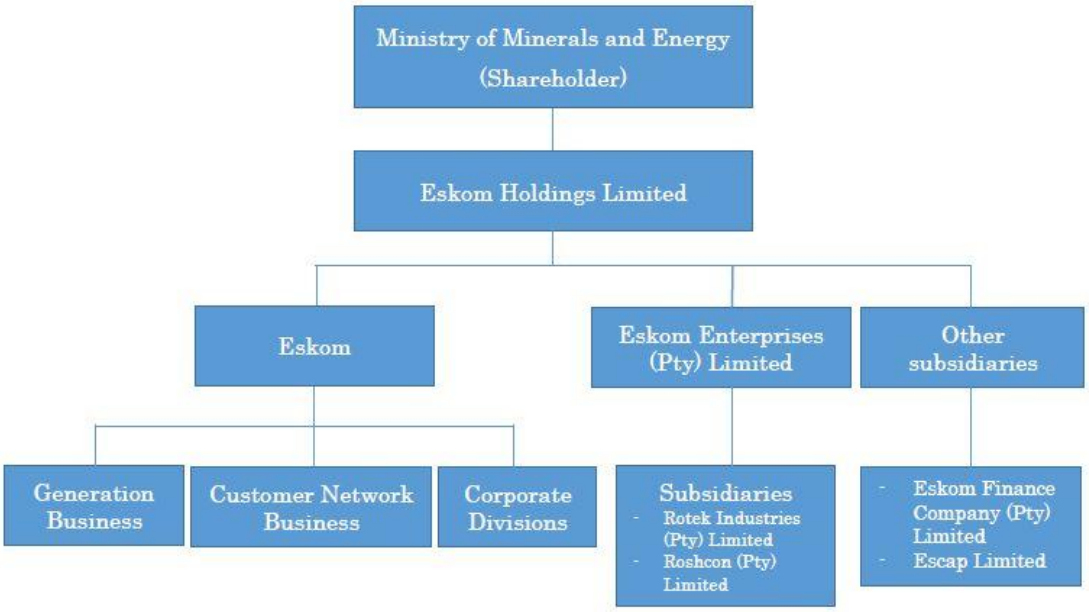


Fig. 5 Eskom Structure

(Source: Eskom Holdings Limited Integrated Report 2011)

3. Regulation/Facilitation Measures

3.1 Water Rights

- Based on the National Water Bill, promulgated in 1998, the Ministry of Water Affairs and Forests formulates and implements policies concerning the water sector and managing of water resources.
- The use of water resources is, in principle, licensed, except for the continuation of existing legal uses and specific use.
- The period of water use is indefinite or specified period within 40 years.
- The types of licenses include "protection of water resources and river flows", "management of water resources", "return and drainage", "controlled activities", "storage water", "flow reduction" and the like. "Controlled activity" is an activity which has a harmful effect on water resources, but is approved by declaring it as a control target, and hydroelectric power generation corresponds to this.
- The pricing policy concerning water use is formulated by the Minister in consideration of geographical factors and users.

3.2 Environmental Flow

There is no one stipulating the Environmental Flow.

3.3 Support Scheme

(1)Renewable Energy Feed-In Tariffs (REFIT)

(Source)-Journal of Energy in Southern Africa, Vol.24 No.3, August 2013

In March 2009, South Africa's energy regulator (NERSA) announced Renewable Energy Feed-In Tariffs (REFIT) for a selected number of renewable energy technologies. Small-scale hydropower (between 1 and 10MW) qualified for a REFIT of ZAR 0.94/kWh(approximately US$0.096) in 2011(NERSA, 2009). This was adjusted to ZAR 0.671/kWh (approximately US$0.089) in 2011(NERSA,2011)

However, the REFIT was never implemented. In 2011, it was replaced by the Renewable Energy Independent Power Producer Procurement Programme (REIPP), through which the government intends to procure 3,725MW of renewable energy. The programme will be implemented through a number of bidding windows, with an allocation of 75MW for small hydropower (Department of Energy, 2011).

3.4 Others

(1) Conduit Hydropower Projects:

With the main economic hubs located in areas suffering from water scarcity, the South African economy is heavily reliant on water transfer systems. Several water distribution companies are currently looking into the possibility of using in-flow hydropower turbines for electricity generation.

The City of Cape Town is operating hydropower turbines at four of its water treatment plants (the 700 kW Blackheath, 1.475 MW Faure, 340 kW Steenbras and 260 kW Wemmershoek plants), while eThekwini is developing six sites, Rand Water another four sites at their infrastructure and Bloemwater a small system to power their head offices. A 15 kW pilot system was installed at the Pierre van Ryneveld reservoir in Pretoria as part of a University of Pretoria research project (Kotze, 2011).

Bloem Water - the water utility is considering micro hydropower installations at the Uitkijk and Brandkop Reservoirs on the Caledon-Bloemfontein pipeline. These two sites could generate approximately 400 kW each. Currently a 96 kW installation at Brandkop is developed.

(2) Renewable energy policy:

(Source)World Small Hydropower Development Report 2013, ICSHP

In 2010, the Department of Energy presented the Integrated Resource Plan (IRP), outlining the electricity generation mixes for the period up to 2030. According to the policy, the adjusted development plan will see 17.8 GW of renewable energy as part of the energy mix in 2030. The main source of hydropower in the IRP will come from imported electricity (approximately 5.2 GW by 2030), while local, small hydropower shares an allocation of 125 MW alongside landfill gas electricity.

In the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) a total of 3,725 MW is to be procured by the Government, with an allocation of 75 MW for small hydropower (up to 10 MW). The bidding process will see a number of bidding rounds, of which the first has been concluded with allocation of 1,415 MW to 28 bidders, none of which involves hydropower. The second round of REIPPP provided two hydro developers with preferred bidder status: the Neusberg plant of Kakamas Hydro Electric Power and the Stortemelk plant of NuPlanet (4.47 MW). Although the Neusberg site has a potential of 12.57 MW, only 10 MW will be developed in order for it to qualify under the REIPPP.