INVESTORS VIEWS OF HYDRO POWER IN TURKEY

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Contents:

Energy Policy and Energy Production Scenario in the World

Energy is a **concept** that can be influenced by many variables that are not directly related technically. The financial crises in 2008, 2009, and partly in 2010, political uncertainty and regime change in Arabic countries, and rising unemployment rates are the developments affect all countries' energy policies for the next 10 years. It can be seen below, some sceneario of electricity production according to percentage of primary sources.

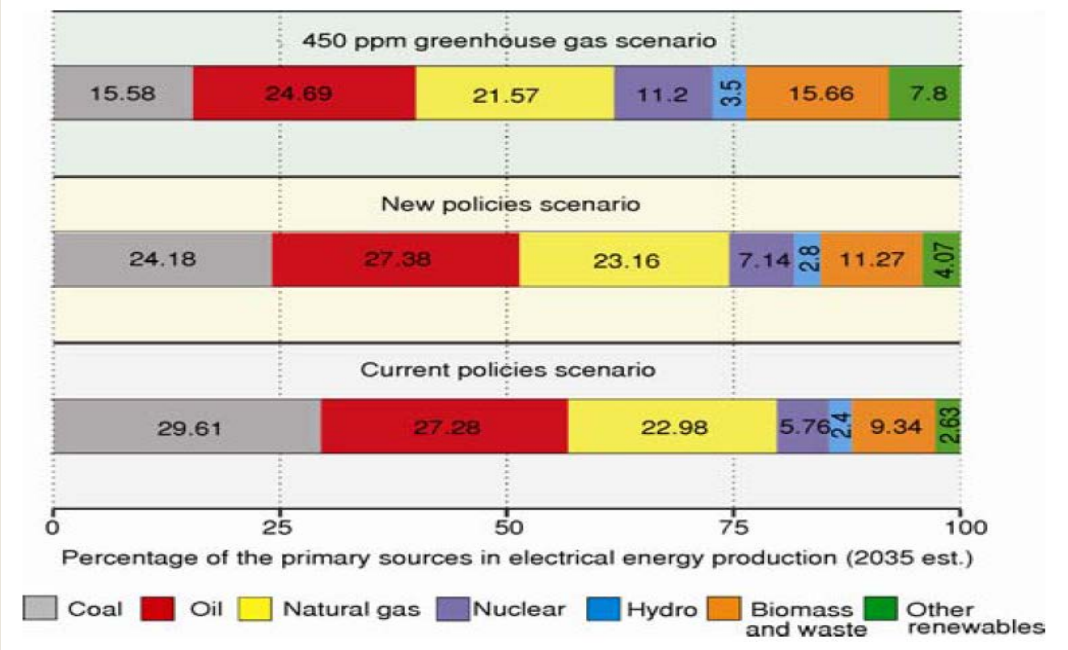


Figure-1 World Electrical Energy Production Scenario

Energy Policy and Energy Production Scenario in Turkey

- Economical expansion, rising per capital income, have been the main drivers of energy demand, which is estimated to increase by around 6 percent per year until 2023. Turkey offers favorable incentives to investors, such as feed-in-tariffs, purchase guarantees, connection priorities, license exemptions, etc., depending on the type and capacity of the energy generation facility.

- Turkey is highly dependent on energy imports. In 2013, 73 percent of the country's energy needs were covered by imports.

- According to the data from the Turkish Petroleum Corporation (TPAO);

Turkey's oil import dependency ratio is 90.4% and dependency ratio for natural gas import is 98.5 %.

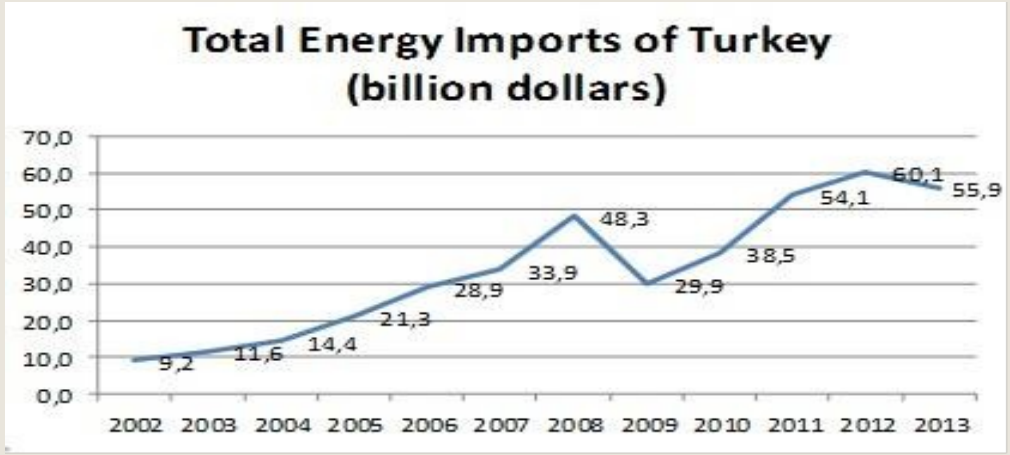


Figure-2 Total Energy Imports of Turkey

Energy Policy and Energy Production Scenario in Turkey

- According to Turkish Electricty Company scenario (as it can be seen in in Figure-3) in 2023 total capacity will increase to 130 MW usage of local sources will increase to produce electricty such as additional 15.000 MW of Hydro power investment is foreseen besides this 5000 MW Solar Power and additional 18.000 MW Wind Power station is forecasted to build up. As for the 2035 Scenario the total existing power capacity would be around 200 MW by investing especially in RENEWABLE ENERGY.

- The total investments required to meet Turkey's expected energy demand in 2023 is estimated to be around USD 110 billion, more than double the total amount invested in the last decade.

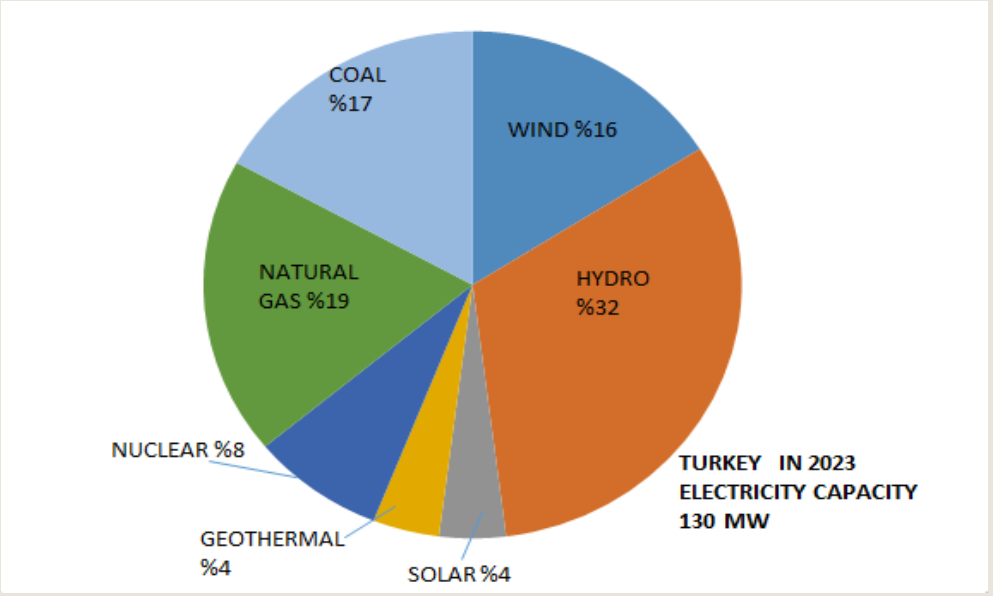


Figure-3 2023 Electricity Production Capacity of Turkey

Renewable Energy Incentives

- There has been a huge growth in the construction of wind power plants and small hydropower plants in recent years. To meet the growing energy demand, the Government has adopted incentives for investments in renewable energy production. Most crucial are the so-called "feed-in tariffs", which are available for 10 years from commissioning of the renewable energy plant.

- A feed-in tariff is the price paid to a (small or large scale) producer of renewable energy when he puts his generated energy on the national "grid" (network). In Turkey the feed-in tariffs (FIT) have two components: one is the 'basic' tariff for the electricity produced, the other one is a kind of 'bonus' in case.

Table -1 Renewable Energy Plant's Incentives Statistics

Power Plant Type	FIT (US$/MWH)	MAX FIT FOR USE OF DOMESTIC EQUIPMENT (US$/MWH)	MAXIMUM SUPPORT (US$/MWH)
Hydro	73	23	96
Wind	73	37	110
Geothermal	105	27	132
Biomass	133	56	189
Solar-photovoltaic	133	67	200
Solar- concentrated	133	92	225

Renewable Energy Incentives

- Turkish Law on Renewable Energy Resources only a certain category of energy resources is regarded as renewable resources. The renewable energy resources covered by the Turkish Renewable Energy Law No. 5346 (“Renewable Energy Law”) are wind, solar, geothermal, biomass, biogas (including landfill gas), wave, stream, tidal, river and arc type hydroelectric generation facilities, and the hydroelectric generation facilities with a reservoir area of less than 15 square kilometers.

- In the event that a hydroelectric power plant fulfils these conditions, this investment will be able to benefit from the following incentives and support mechanisms for renewable energy:
  - *Feed-in tariffs for renewable energy resources*
  - *Financial support for local equipment used in the power plant*
  - *Diverse financial supports of the state such as tax exemption or tax reduction depending on the scope and location of each project*
  - *Licensing incentives especially with regard to the license fee*
  - *Incentives in land allocation such as price reductions under certain conditions*
  - *Priority for electricity manufacturing plants from renewable energy and local natural resources in connection processes.*

Hydro Power Investments in Turkey

- Turkey's hydropower potential constitutes 16% of Europe's theoretical hydropower potential and 1% of the world's total. Turkey's technically feasible hydroelectric potential corresponds to approximately 42,000 MW. The installed capacity in hydro is stably increasing by means of incentive mechanism with a total capacity of almost 27,000 MW (total capacity in Turkey is around 70,000 MW).

- An Hydropower investor in Turkey has below alternatives;
  - To Invest to the Hydro Power Plant owned by EUAS by privatization,
  - Green Field Hydro Power Plant Investment,
  - Ready to start construction type Hydro Power Plant
  - To Purchase a Hydropower plant which is under operation,
  - To Supply equipment and technical supervision for the Hydro Power Project,
  - To make detail study to increase the efficiency of old Hydro power plants in Turkey and give proposal to increase the total power output (such as renewing turbines blades or new scada)

Privatization of Hydro Power

- Turkey continues to transfer generation assets owned by state-owned generation company EÜAŞ to the private sector.

Figure-4 Private Sector Capacity Share

- The liberalization process in the Turkish power market is now more than ten years old and the level of competition is quite satisfactory. Day-ahead market, intra-day market and future's markets are available supplementary to the many bilateral contracts between buyers and sellers.

Privatization of Hydro Power

- There are five types of operators in the market. EÜAŞ and its subsidiaries comprise more than two-fifths of the market. This is followed by build-operate-transfer and build-operate-own companies with rights to build and operate thermal plants that were developed before the previous electricity market law. Then there are companies operating under transfer of operational rights agreements, independent power producers and companies licensed to produce only for their own needs.

- Turkey completed its sale of all 18 state-run power distributors in 21 regions by late 2013, adding $12.7bn to state coffers. With full privatisation, TEDAŞ no longer distributes power. However, it continues to own assets and permit privateers to use them under a transfer of operation rights model. Distribution companies must make connection agreements with TEİAŞ for transmission services, connection and system-utilisation agreements, approved by the EPDK.

Privatization of Hydro Power

- The EPDK has issued some 1500 generation licences, of which 87 are held by EÜAŞ and 1377 by independent power producers. The build-operate-transfer and build-operate companies operate based on contracts with the Ministry of Energy and Natural Resources, which acts as a second regulator, without a generation licence issued by the EPDK.

- A total of approximately 32,000 MW are held in private hands, leaving roughly 25,000 MW with EÜAŞ, which includes 28 hydro-electric and 16 thermal power plants, or a total of 16,200 MW, that are slated for sale.

- 26 out of the 29 power plants to be privatized in this round are hydropower plants. However, they are not qualified for the renewables support mechanism since based on the legislation, canal or river type hydro power plants as well as plants with less than fifteen square kilometers reservoir area that came online after 18 May 2005 are eligible for YEKDEM. But as for the unit base it could be possible to be eligible of YEKDEM.

Privatization of Hydro Power

The privatization process for state-owned hydropower plants is underway. Ten hydropower plants were transferred to the private sector in 2014, all to local bidders.

High bids, USD 2.5m per MW on average, despite their small sizes.

	High Council for Privatization - Decision 15.6.2015; 2015/55		
		Type	Capacity (MW)
1	Hopa Thermal	Fuel Oil	100
2	Bursa Natural Gas	Gas	1432
3	Alaağa CCGT	Gas-Combined Cycle	180
4	Kesikköprü HPP	Hydro	76
5	Derbent HPP	Hydro	56
6	Çamlıgöze HPP	Hydro	32
7	Köklüce HPP	Hydro	90
8	Almus HPP	Hydro	27
9	Yenice HPP	Hydro	37
10	Adıgüzel HPP	Hydro	62
11	Kemer HPP	Hydro	48
12	Karacaören 1 HPP	Hydro	32
13	Karacaören 2 HPP	Hydro	46
14	Kepez 2 HPP	Hydro	6
15	Manavgat HPP	Hydro	48
16	Fethiye HPP	Hydro	16
17	Kadıncık 1 HPP	Hydro	70
18	Kadıncık 2 HPP	Hydro	56
19	Doğankent HPP	Hydro	74
20	Kürtün HPP	Hydro	85
21	Torul HPP	Hydro	105
22	Seyhan 1 HPP	Hydro	60
23	Seyhan 2 HPP	Hydro	7
24	Yüreğir HPP	Hydro	6
25	Kılavuzlu HPP	Hydro	54
26	Menzelet HPP	Hydro	124
27	Tortum HPP	Hydro	26
28	Çamlıca 1 HPP	Hydro	84
29	Şanlıurfa HPP	Hydro	51
	Total		3090

Table 2 Privatization Decisions in Turkey

	Plants Included	Total capacity	Deadline for proposal submission
Group 1	Karacaören 1, Karacaören 2	78.4 MW	27-Oct
Group 2	Kepez 2, Manavgat	54 MW	14-Oct
Group 3	Fethiye	16.5 MW	05-Oct
Group 4	Kadıncık 1, Kadıncık 2	126 MW	10-Nov
Group 5	Doğankent, Kürtün, Torul	265.1 MW	20-Nov

Table 3 Privatization Groups for Plants

Kadıncık 1 and Kadıncık 2; 700 MTL, Manavgat ;351 MT

Fethiye; 125 MTL, Doğan kent(channel), Kürtün(dam) ve torul(dam) hes 1225 MTL,

Manavgat HES 370 MTL

20% paid in advance and the rest 10% is paid in maturity as TL for 4 years.

Adıgüzel,Kemer, Tortum and şanlıurfa will be privatizated bids will be accepted until february 18, 2016. On the other hand a big portfolio of mix power plants will be privatized first quarter of 2016. http://www.oib.gov.tr/

Privatization Difficulties of Hydro Power

- Hydro Power Plants which have more than fifteen square kilometers reservoir area that are not eligible for YEKDEM. Plant specifications and flow rate should be well examined.

- High bids, USD 2.5m per MW on average, despite their small sizes. Investors must compare it with the greenfield Hydro investments. Eelectricity distribution companies give the highest bid for the Hydroelectric power plants to reduce their distribution costs. Competetion with these companies is very difficult.

- Turkish Privatisation Administration (PA) has not made any official announcement that whether the remaining plants in the portfolios will be restructured under new portfolios or whether they will be tendered separately. It seems that, privatization of thermal plants seems to be the priority for the (PA)

- Partnership with a distrubition company seems to be logical to invest for privatization.

Hydro Power Investments on Green Fields

- Unfortunately, time constraints and the inability to do enough research for feasibility report prepared by either insufficient or in many cases created with incomplete information. Most of the feasibility reports for HPP are not sufficient and not reflect the real situations.

- The projects in different locations Black Sea to the southeast subject to the same regulations of EIA (Environmental impact assessment)

- The EIA also intended to be a long process of revision and re- report every minor changes are leading many investors to start by considering the risk of punishment options . This follows the rules in both damaging to the environment has led to investors losing time and money

- Legislation blocks using of forest areas

Hydro Power Investments on Green Fields

- Application review and finalize the process of consensus-building projects in DSI is too long. After October 2007, DSI has not allowed development of projects from the private sector .

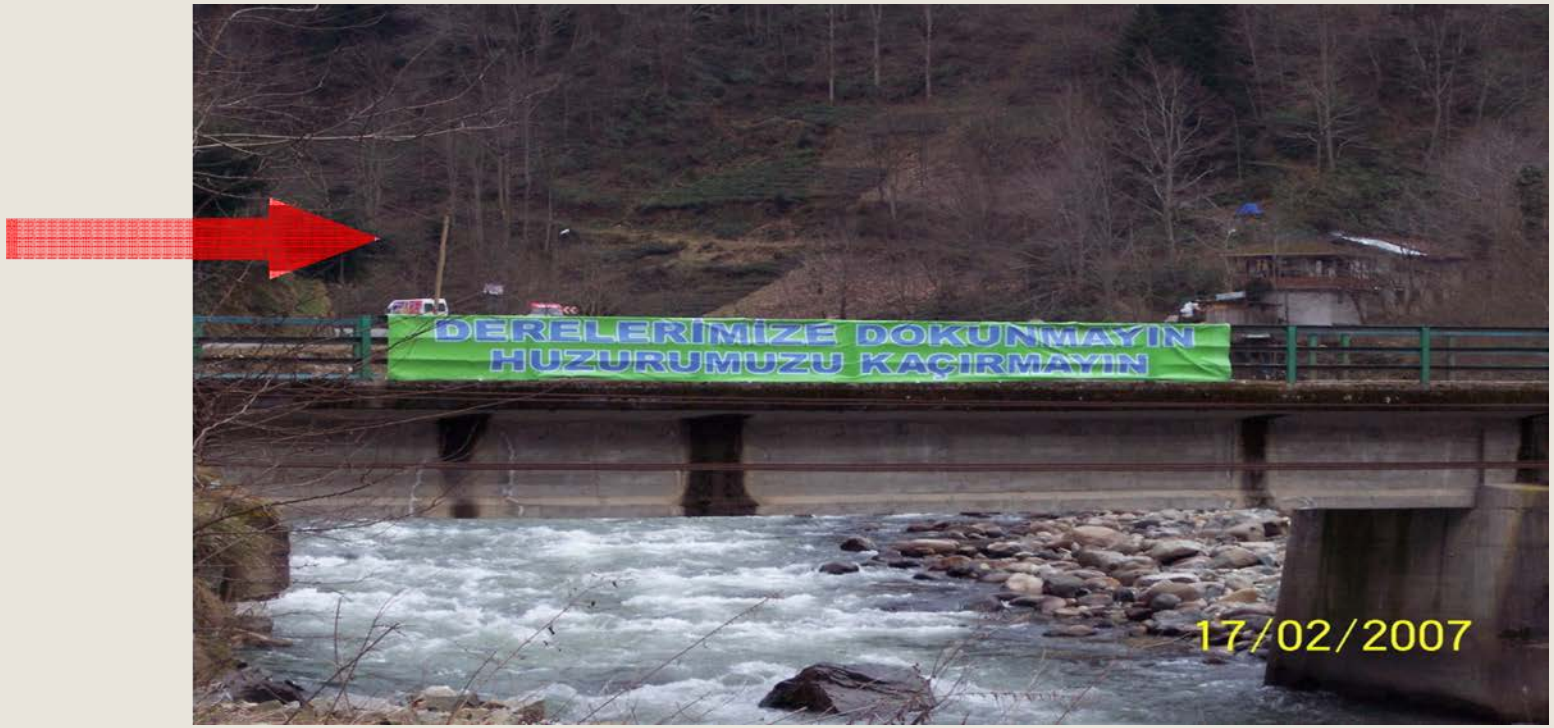
- Arrangements for the transfer of the licenses is positive this allows the projects realization by the more powerful companies.

- Transmission system for connection to the grid for the small and medium size projects is not sufficient this puts additional cost of the feasibility of infrastructure projects.

- TEİAS may execute the advance payment for the conductor when delivered at site. This allows transmission line to be finished in time.

Hydro Power Investments on Green Fields

- Local people's negative approach to the project,
- Investors primarily to inform the local people and to show maximum effort to the critical importance of good relations.



Picture 1 A protesting banner mounted by local people

Hydro Power Investments on Green Fields

For the same water resources if more than one application, The companies must participate the tender for the the highest contribition fee per kwh which they produce for 49 years. The licence is given to the company who gave the highest contribition fee. As it is seen below table contribition fee is very high and the feasibility study should be reconsidered according to below prices. (YEKDEM 7,3 cent/kwh)

If the contribition fee is very high, applications may apply to re-evaulate the project combining it with other projects in the same basin.

Table 3 The Number of Project and Contribution fee by Their Capacities

Projects		Installed Power (MW)	Energy Generation (GWh/Year)	Contribution Offer(2008) (YKr/kW)	Contribution Payment (MioUS$/Year)
Sum:	Total	7,173.96	26,030.73	-	584.66
207	Average	35.00	127.28	2.10	2.82
KP > 5Ykr	Total	1,620.53	6,313.80	-	309.12
29	Average	55.88	217.72	6.86	10.66

Hydro Power Investments Including Ready to Start Construction Type

- The plant or plants in question should have reached at least the "ready to build" status. This means that offers for the construction prices should already be available and the contracts for connecting the plants to the grid should also be signed.
- To structure a successful hydropower investment, location and a number of other key investment criteria must be considered.
- It is vital that all authorisations, licenses and concessions have been obtained for the project and proposed operations. Investors should also attach great importance to the availability of studies by independent experts. Such analyses should focus on environmental sustainability, geology and hydrology, using data covering at least 20 years.
- Not to meet additional cost investors should check land acquisition process to be completed.
- There are too many projects which is ready to build status but most of them are not feasible.

  investors should be careful.

Investment under Operation Type Hydro Power

- Location of Hydro Power Plant is very important. Investors shall consider plant location to reach easy,
- The partnership structure of the plant should be examined in detail whether they have debt or not.
- Investors should also attach great importance to the availability of studies by independent experts. Such analyses should focus on environmental sustainability, geology and hydrology, using data covering at least 20 years.
- For the operating phase of the plant, Investors shall check maintenance and operating costs so that any unexpected cost developments can be ruled out.. On the other hand investors shall again check the Turbine type according to existing water flow. Furthermore, a producer-performance guarantee, agreed and signed in advance, is also essential to carry out any repairs or replacements should key components such as turbines or generators break down.
- A further decisive factor for the profitability of a hydropower plant is whether the power being produced will also be purchased – and if so, at what tariff. As regards remuneration, there should either be a state-guaranteed minimum feed-in tariff or the possibility of selling the power to state-owned or private utilities.

Supply Equipment for Hydro Power Plants

- Due to the orientation of renewable energy on a global scale , delivery time of electro-mechanical equipment of HPP is too long. For İnstance, delivery time of turbine for Turkey is around in 24 months.
- Production of equipment and after-sales service quality European manufacturers are very good , but prices are high and long delivery times.
- Suppliers try to get letter of guarantee from investors and make price reduction accordingly.
- Alternatively (mainly to China, India and Eastern Europe), the risk for the manufacturing industry and particularly the quality of after-sales service , but the prices are cheap and relatively short delivery time.
- Not to risk small amount comparing with the total investment of HPP.
- During Installation and commissioning of the power plants and commercial operation of the facility, hiding experienced / competent staff is not easy.

Opportunities of Pumped Storage HPP & Rehabilitation Projects

- Around 70 GW of new power generating capacity is under construction in Turkey. There is a little bit of slowdown for the moment in new projects and some are being put on hold.

- The easiest projects have been developed already. What remains is a bit more difficult to develop and probably requires a higher market price to be economical, this could be why we see a slowdown of the Turkish market for new hydropower plant.

- The potential for additional hydropower investment even while the market for new-build projects is decelerating: What might come out of this situation is a shift to the rehabilitation market. The base for hydro is already very big and they will be sold by the government and acquired probably quite a lot in the coming years. So that might give burst to a rehabilitation market

Opportunities of Pumped Storage HPP & Rehabilitation Projects

- Many Turkish hydro projects are run-of-river including cascades of plants along rivers. Such a design necessarily limits storage capacity. To store energy on the other side have the variability of hydropower and have wind and solar on top of that which are also very highly variable. There is not any pumping storage Hydro Power Plant available in Turkey. So it might be that in coming years the pumping storage power plant market will also grow or start in Turkey.

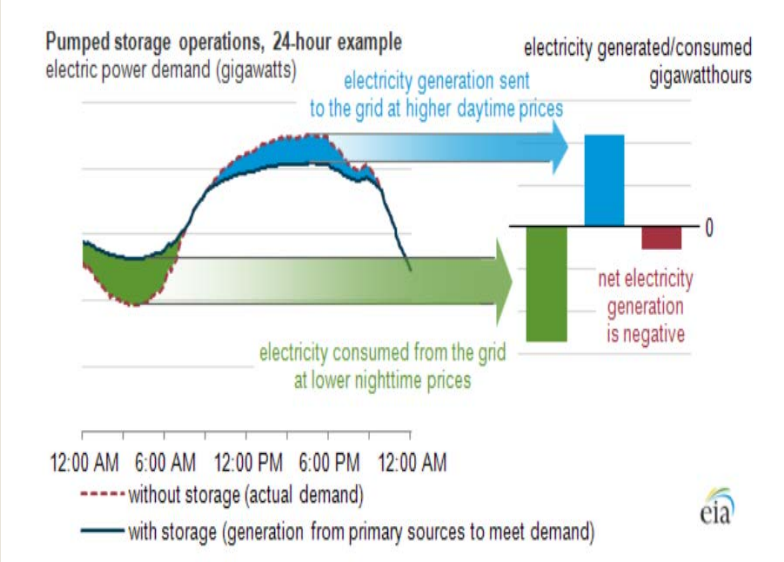


Figure-5 Pumped and storage operation

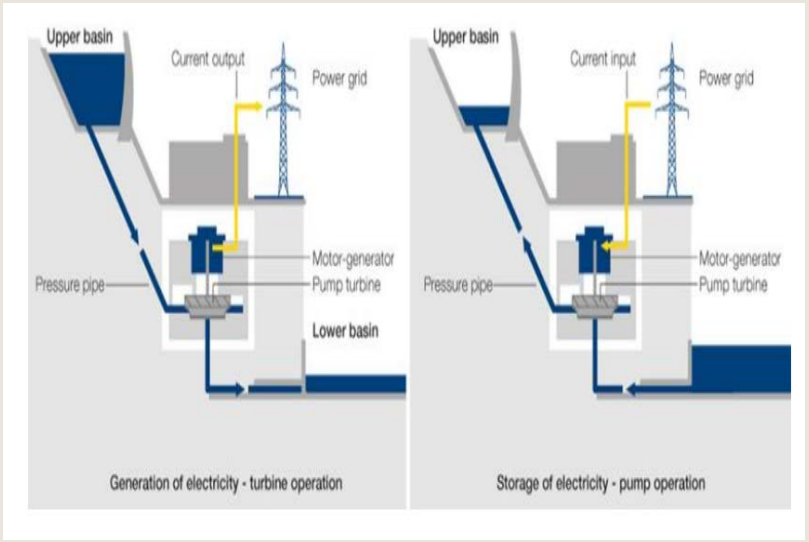


Figure -6 Pumped and Storage Turbines&Pumps

Opportunities of Pumped Storage HPP & Rehabilitation Projects

- It regulates the amount of energy absorbed in pumping mode. This facilitates energy storage during low power levels on the network thus reduces the number of starts and stops, and allows additional benefits from grid regulation services (network frequency and voltage) while in pumping mode
- Operates close to the turbines optimal efficiency point, which results in a significant increase in global plant efficiency.
- It operates smoothly (for example at partial load), thus eliminate hydraulic instability and/or cavitation. This results improved reliability, reduced maintenance and increased lifetime.
- It operates over a wider head range therefore the availability of the plant increases. It adjusts instantaneous power output in order to help to rectify sudden voltage disruptions/variations caused by network problems.

Opportunities of Pumped Storage HPP & Rehabilitation Projects

- This is an accepted fact that efficiency of HPP declines of 0.2 % per annum depending on aging, In this case the value of the project is estimated to have caused it to decline approximately 3% - 10 percent yield for 15 years and above work.Main rehabilitation items of HPP are; Changing of Sealing parts, Control valves, wear plates, new design wheel, renewing of scada system.

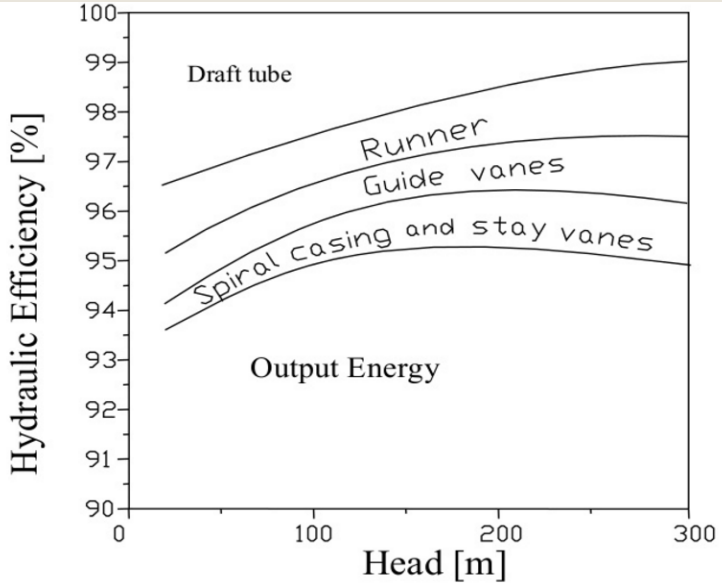


Figure-8 Hydraulic Efficiency change by rehabilitation (Turbine Section)

	Output [MW]		
Plant	**Old**	**New**	**Increase [%]**
La Villita	76	82	8
Guri II	610	715	17
Kiambere	72	84	17
Pantabangan	51.6	60.4	17
Ambuklao	25	35	40
Taloro II	13.6	15.6	15
Harsprånget	117	140	20
Kilforsen	100	120	20
Bajina Basta	95.4	108	13
Nedre Vinstra	50	65	30
Mequinenza	80.9	102	26
Såheim	54	60	11
Songa	120	136	13
Average increase in power output			**18**

Figure 7 Output increase by Rehabilitation of Turbines

Opportunities of Pumped Storage HPP & Rehabilitation Projects

- Keban is the third largest hydro plant in Turkey, operated by Turkey's General Directorate of State Hydraulic Works (DSi). It was built in two stages of four 157.5-MW units in 1974 and four 180-MW units in 1985.
  Rehabilitation is to include design, engineering, manufacturing, delivery, installation, testing, and commissioning of turbine-generators, supervisory control and data acquisition (SCADA) system, protection system, main transformers, switchyard, and intake gates.

- Succesful bidder is Bharat Heavy Electricals India Limited (BHEL) with the tender price of Euro 63,859,828.24 on 4/21/2015 aiming to incerase the efficiency of %8.

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