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Sustainable Energy and Hydro Power

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Presentation Guide

- ELECTRICITY AND SUSTAINABILITY SITUATION IN TURKEY
 - THE FUTURE ROLE OF HYDROPOWER IN TURKEY
 - PRESENT AND FUTURE SUSTAINABILITY ISSUES
 - ENERJISA'S APPROACH
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Sustainable Energy

The Turkish Viewpoint

- As the world population increases, rapid urbanization and development growth suggest even higher future needs for energy, especially electricity.
- In today's world, the most available and affordable sources of energy are still the fossil fuels. Hence, major changes have to be made in order to address the challenges of stabilizing greenhouse gas emissions. Efficiency improvements and new technologies are part of the solution.
- Turkey favors any provision of sustainable (renewable) energy (that meets the needs of the present without compromising the ability of future generations to meet their needs).
- **Sustainability can be achieved through:**
 - Renewable energy sources: wind energy, hydroelectricity, solar energy, wave power, geothermal energy, tidal power
 - Energy efficiency

Source: Sustainable Energy , Choosing Among Options



Turkey's endeavors towards preventing global warming

- When the United Nations Framework Convention on Climate Change ('UNFCCC') was adopted in 1992, all OECD members were included in the list of developed countries. However, Turkey asked for an exception, stating that its relative underdevelopment from other OECD members.
- Such an exception was granted in 2001, and Turkey was removed from the list. Flexible implementation mechanisms of the Kyoto Protocol should open up new opportunities for foreign investment for energy efficiency and clean technology projects.
- Following the ratification of the Framework Convention and the Kyoto Protocol, Turkey has become eligible for trade in carbon credits under the provisions of the Clean Development Mechanism, however since it has no country and/or industrial commitments CDM is not functional in Turkey, while only voluntary market activities are observed.
- While the necessary institutional capacities and information systems remain to be developed, the Turkish Government declared its willingness to comply with the general provisions of the UNFCCC.
- International pressure, especially through the European Union, is likely to lead Turkey to take real steps towards helping prevent global warming with additional commitments and responsibilities regarding emission reduction targets.



Turkey's previous steps towards preventing global warming

- In the early years of hydro development (60s and 70s), Turkey implemented basin development programs and initial hydro power development was conducted accordingly by the state.
- State investment mainly went to large dams and power plants due to the efficiency of constructing such assets and the growing electricity consumption.
- In the later years (90s) hydro development was reduced and mainly replaced by thermal power plant (CCGTs) implementation due to the quick delivery and implementation of such equipment. Hydro project implementation was seen slow and difficult, when compared to CCGT implementation.
- Since early 2000, there has been a very quick growth in hydro development after establishment of the new Electricity Market Law and relevant changes in State Hydraulic Works' (DSI) regulations. Since these years private sector is allowed to develop hydro projects, after approval of DSI and EMRA (Regulatory Body). However, this rapid development could not be followed with a strong basin development program (excluding some older basin development studies) and investors were allowed to make hydro license applications on any river and develop such projects.



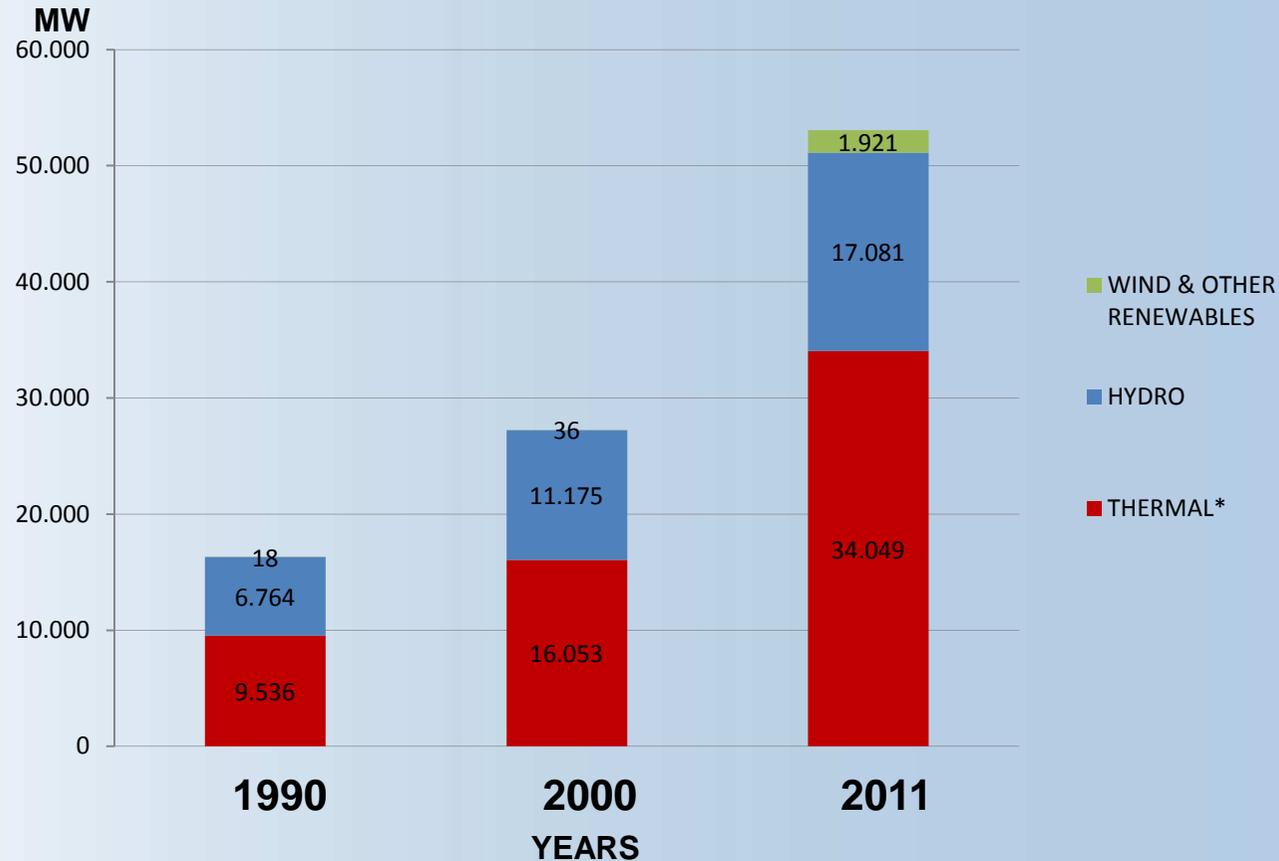
Sustainability Issues

Where Turkey stands

- › “Electricity Energy Market and Supply Security Strategy Paper” published by MENR in 2009 states that:
 - ❑ Considering climate change and environmental impacts will be crucial for all related activities of the energy industry
 - ❑ Minimum stable capacity of State owned (EUAS) hydroelectric power plants will be retained after a generation privatization process
 - ❑ Turkey is estimated to hold an energy-saving potential of 30% in the building industry, 20% in the production industry, and 15% in the transportation industry. Reaching these are considered as future goals.
- › “Energy Efficiency Law” of 2007 and relevant regulation on “Increasing Efficiency in the Use of Energy Sources” of 2008 were enacted by MENR.
- › "Hand-in-Hand for Energy Efficiency (ENVER) Movement" was initiated in December 2008 as a step of the “National Energy Efficiency Movement”:
 - ❑ Energy-efficient lamps were dispensed at primary schools, awareness-raising activities took place. 4.800.000 lamps were dispensed in 43 provinces from December 2008 to April 2009.
- › Projects below 500 kW were declared as exempt from generation license and accordingly distributed local renewable generation is supported.
- › Feed-in-Tariff support and additional incentives are provided for renewable investments.



Development of Turkey's Installed Capacity over the years:

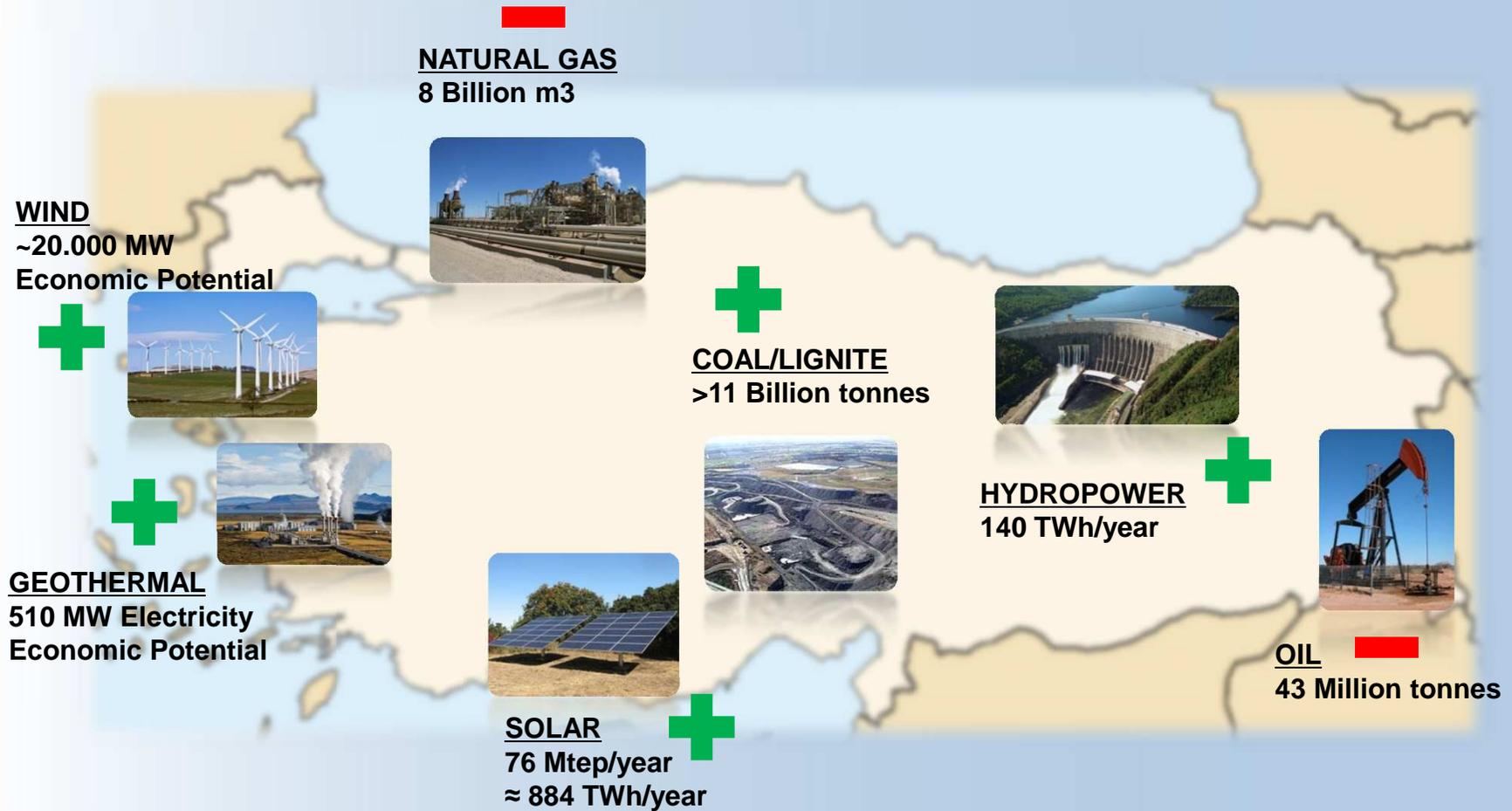


Question: How sustainable is the electricity market in Turkey?

**: Thermal includes 8100 MW lignite, 16,220 MW natural gas, and additional imported coal PPs along with other small scale thermal power plants (CHP's etc)*



Domestic availability of primary energy resources (+/-)



Source: MENR, EUAS, TKI, TTK, DSI



Future Installed Capacity Expectations

The Turkish Power Market

Gas Fired Plants	MW
Operational	16.220
Under Construction (Project Execution)	9.678
Licensed (Project Development)	2.490
Application (under investigation by EMRA)	23.506
Under Development / to be Developed	~5.000
TOTAL	~57.000

Lignite Plants	MW
Operational	8.100
Under Construction (Project Execution)	1.042
Licensed (Project Development)	1.100
Application	500
Planned	4.380
Under investigation	~7.000
TOTAL	~22.500

Hydro Plants	MW
Operational	17.081
Under Construction (Project Execution)	8.235
Licensed (Project Development)	7.530
Under Development / to be Developed	~5.000
TOTAL	~38.000

Wind Plants	MW
Operational	1.692
Under Construction (Project Execution)	1.821
Licensed (Project Development)	1.739
TEIAS tender winners	~5.500
Expected to be developed **	~9.000
TOTAL	~20.000

Additional note about Solar Plants:

According to Ministry of Energy's strategy documents, solar installed capacity is targeted to be 5000 MW in 2023, although there is no industrial multi-MW solar power plant at present.

Source: TEIAS and EPDK database



Sustainability & Hydropower

The Turkish Viewpoint

- › Although hydropower is currently the largest and most important producer of electricity from a renewable energy source, its further development will become more difficult on the long term.
- › While the potential for adding additional hydropower worldwide is substantial in terms of availability and reasonable capital investment, environment related concerns, especially relating to large scale dams and their subsequent land inundation, raise substantial barriers to deployment and growth of hydropower as a renewable source.
- › In order to address such environmental concerns, more scientific research should be focused on achieving quantitative understanding of the impacts and benefits of hydro and to developing new technologies that will mitigate these effects.
- › R&D support given to achieving more sustainable hydropower systems, which is currently low, should be increased.
- › Improvement addressing to fish migration and oxygen depletion issued of existing hydro plants should be made.
- › Long term innovations such as utilizing low-head and run-of-river resources in an environmentally and economically sustainable manner should be implemented.
- › Usage of micro-hydro power should become more common.

Source: Sustainable Energy ,Choosing Among Options



- Currently, around 17,000 MW of hydropower is in operation, around 20,000 MW is in various stages of development and a hydro potential of 6,000 MW still remains to be developed.
- Turkey has around 1% of the World's hydroelectric potential, which makes her the 8th largest country in hydroelectric power potential.
- In 2011, Turkey's hydro generation increased by 1.1% compared to 2010 and reached 52.1 TWh/year.



Hydropower in Turkey

- Turkey's geography is highly conducive to hydroelectric power generation. Turkey's average altitude is around 1300 m. Average yearly rain is 501 bn m³ and around 186 bn m³ joins in with the rivers in the Country.



- According to the studies made by DSI and EİE on 25 different areas in Turkey, Turkey's gross theoretical hydroelectric energy production potential is 433 TWh/year, and its technical potential is around 250 TWh/year. About 140 TWh/year is seen as economically feasible potential (52 TWh/year in operation, 88 TWh/year still to be developed).

**Positive Attributes of Hydropower:**

Hydropower and the multi-use aspects of hydropower developments (both small and large scale dam construction) show certain positive attributes to sustainability.

1. Emissions-free, with virtually no CO₂, NO_x, SO_x, hydrocarbons or particulates
2. Renewable resource with high conversion efficiency to electricity (>80%)
3. Dispatchable with storage capability
4. Usable for base load, peaking and pumped storage applications
5. Scalable from 10 kW to 10.000 MW
6. Low operating and maintenance costs
7. Long life time (around 50+ years)
8. Multipurpose dams often provide flood control and stored water for agricultural irrigation and managed water supplies

**Negative Attributes of Hyrdopower:**

Issues regarding the construction of hydropower plants focus on environmental, social and health impacts. There is a certain public resistance to both proposed and existing hydropower plant construction.

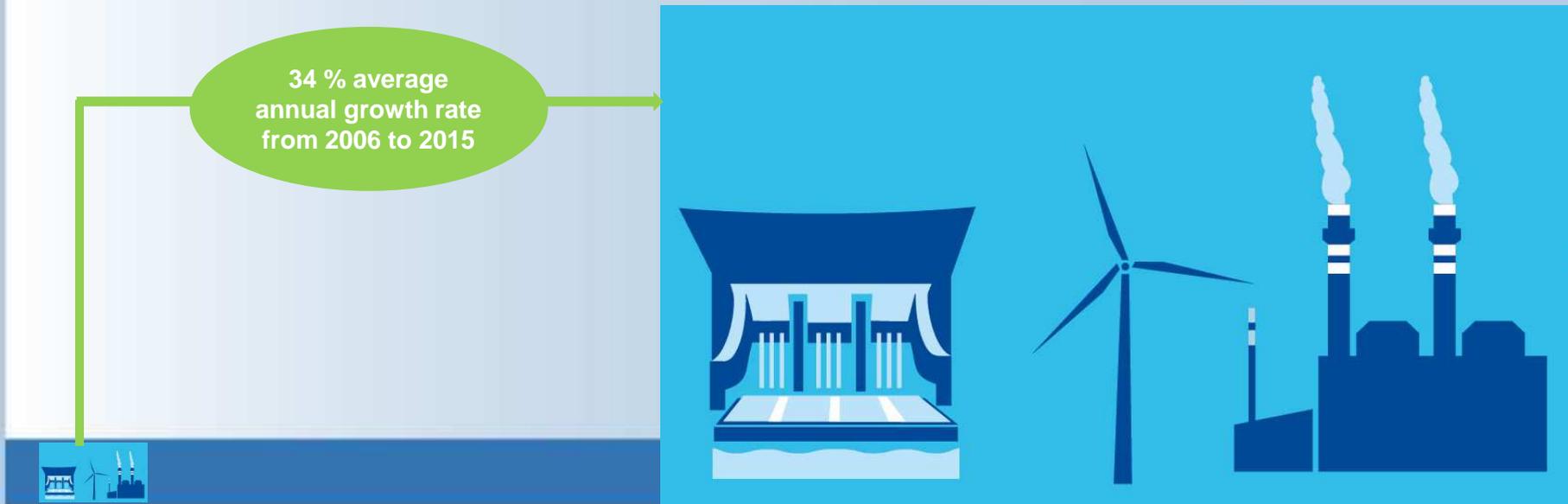
1. Impoundment of large amounts of water may lead to loss of habitat due to land inundation
2. If not properly designed and constructed, reservoirs can suffer from silt buildup with shortened lifetime and/or reduced productivity
3. GHG emissions may occur from concrete used in dam construction and from land inundation
4. Variable output, dependent on annual rainfall and snowfall
5. Impacts on river flows and aquatic ecology, including fish migration and oxygen depletion
6. High initial capital costs
7. Long lead time in construction of mega-sized projects. Mega-sized projects have to be located where the resources exit and long distance electric transmission lines are needed.



Enerjisa Growth Story

from 370 MW to 5000 MW

34 % average
annual growth rate
from 2006 to 2015





Enerjisa business model: vertical integration, 2011 electricity flow



In 2011:
 40% of the supply is from own generation
 65% of the consumer sales will be to large consumers

■ Enerjisa function
 ■ External/third party



Enerjisa aims to be market leader in this strong growth environment

- Focus on Turkey as a key strategic growth market
- Own minimum market share of **10%** in the Turkish electricity market by 2015
- Generation portfolio of hydropower, gas, coal and wind power plants with a minimum capacity of **5,000 MW** by 2015
- Pursue opportunities in the power sector in neighboring countries



Sustainability Attributes of Hydropower

Several Examples from Enerjisa

ENERJISA

- ~ works on developing a balanced portfolio, including up to 50% renewable generation resources (hydro, wind, solar)
- ~ invests according to international rules and environmental protection standards (i.e. Equator Principles, World Bank Rules etc.)
 - Fish passes
 - Social impact assessments
 - Noise studies
 - Bird migration studies etc.
- ~ owns wind and hydro facilities distributed throughout Turkey, which increases the dispatching quality of its renewables portfolio and reduces the overall impact on environment.
- ~ develops and constructs multiuse dams (e.g. 280 MW Alpaslan II Dam and HEPP for irrigation, flood control and power generation), as well as various sizes of HEPPs, including small and mid scale run-of-river facilities.



Enerjisa – asset map (including licences acquired)



- CCGTs in operation
- CCGT under construction
- Lignite fired power plant under construction
- Wind PPs in operation
- Wind PPs under construction
- Hydro PPs under construction
- Hydro PPs in operation
- Enerjisa Başkent DisCo
- ★ Enerjisa Head Quarter



Thank you for your attention



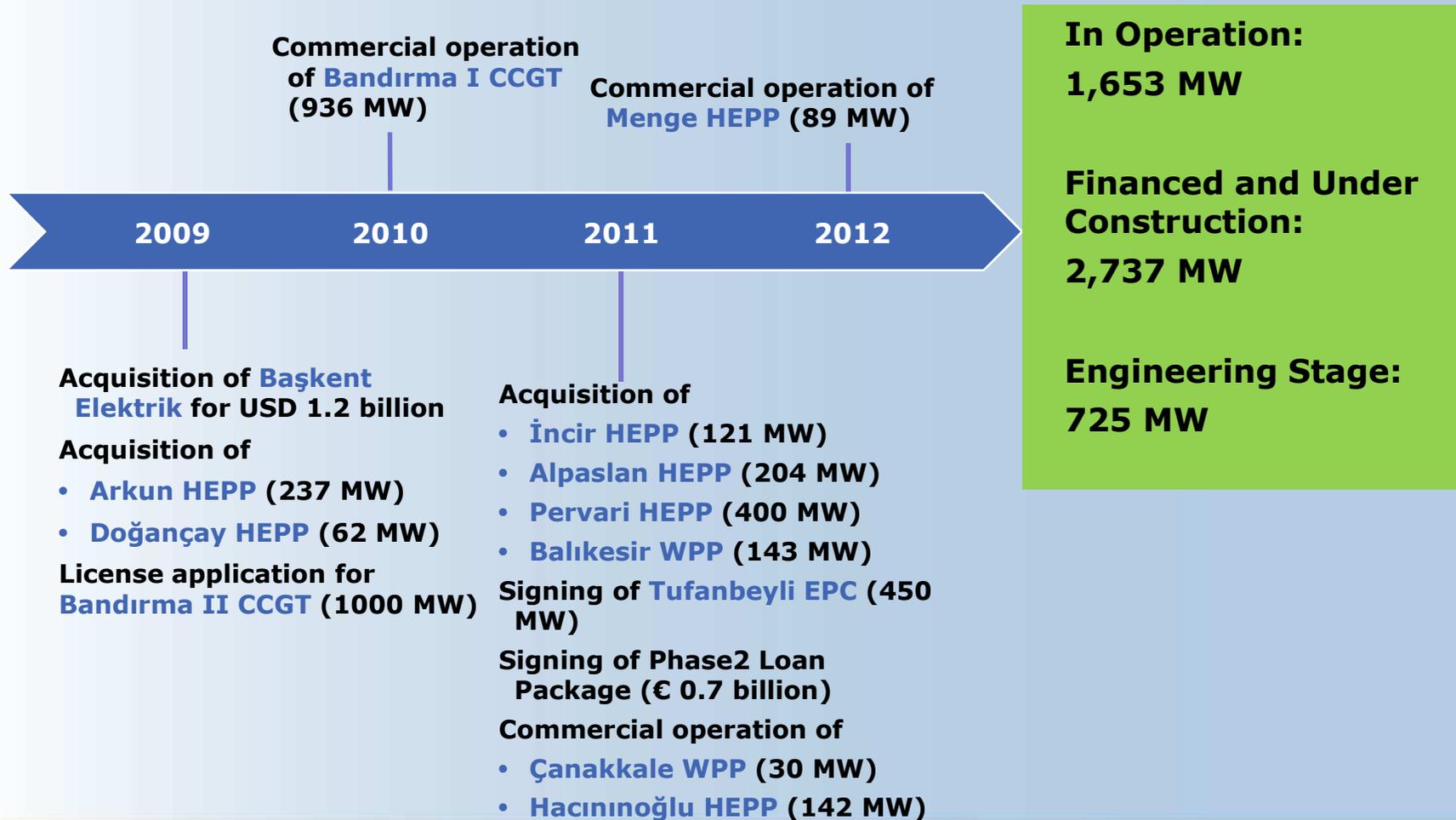


Fast and committed growth through greenfield project development and M&As





Further Portfolio Growth: Total >5,000 MW Licence





Plant Name	Location	Stage	Installed Capacity (MW)	Type	Active Reservoir Volume (mio m ³)
Şahmallar	Adana	Operational	14	ROR	-
Kızıldüz	Antalya	Operational	16	ROR	-
Suçatı	Kahramanmaraş	Operational	7	ROR	-
Birkapılı	Mersin	Operational	48	ROR	-
Hacınınoğlu	Kahramanmaraş	Operational	142	ROR	-
Menge	Adana	Operational	89	Reservoir	23
Kavşakbendi	Adana	Implementation	180	Reservoir	7.4
Yamanlı II	Adana	Implementation	80	Reservoir	0.45
Çambaşı	Trabzon	Implementation	45	ROR	-
Köprü	Adana	Implementation	156	Reservoir	47.3
Sargüzel	Kahramanmaraş	Implementation	103.2	Reservoir	13
Kandil	Kahramanmaraş	Implementation	213.9	Reservoir	324
Dağdelen	Kahramanmaraş	Implementation	8	ROR	-
Arkun	Erzurum	Implementation	237	Reservoir	234
Kuşaklı	Adana	Implementation	20	ROR	-
Doğançay	Adana	Engineering	62	Reservoir	-
Alpaslan	Muş	Engineering	204	Reservoir	1099
İncir	Siirt	Engineering	121	Reservoir	60.6
Pervari	Siirt	Engineering	400	Reservoir	96.3