

# TURKISH ELECTRICITY NETWORK

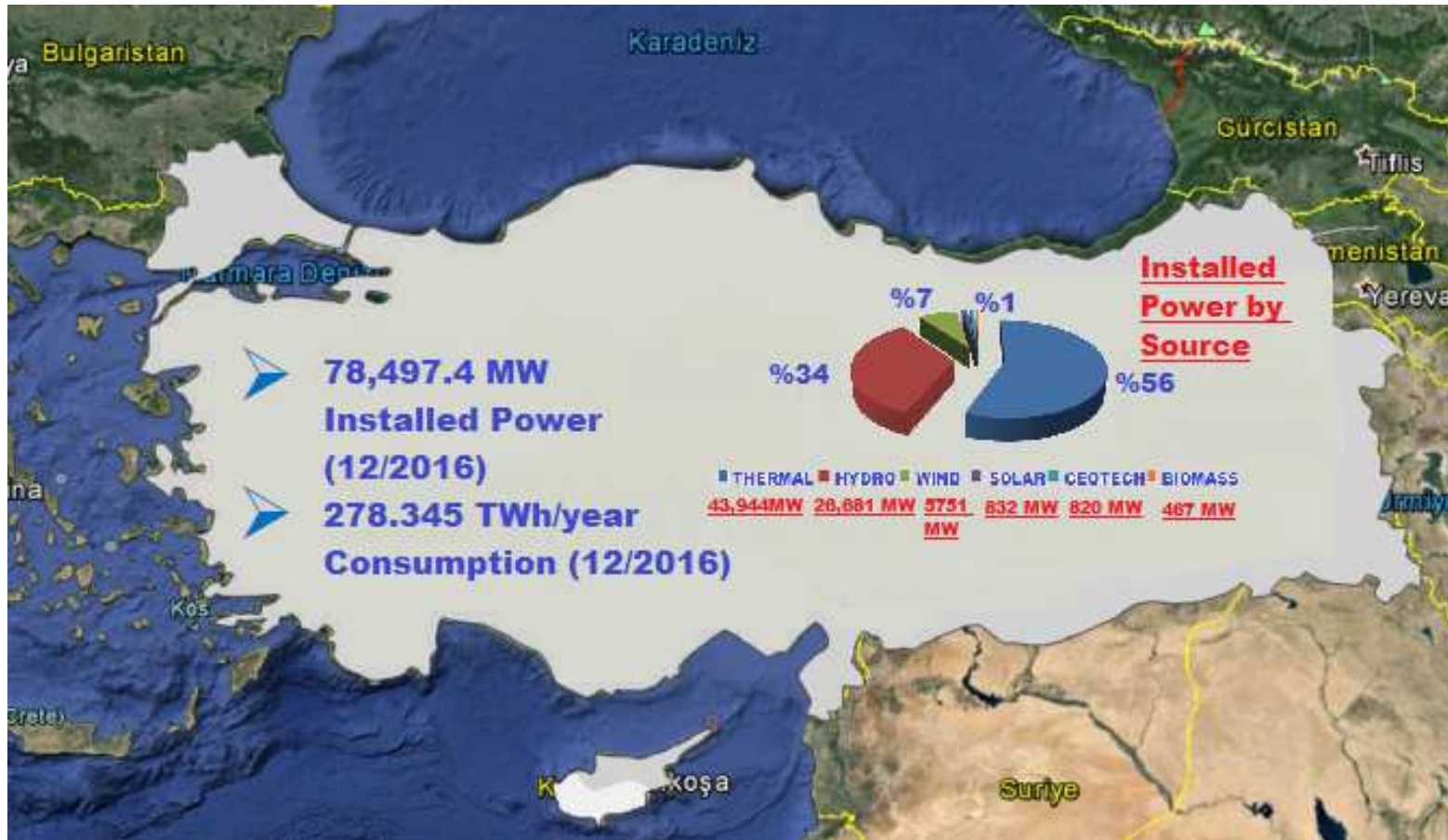
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Network Assessment Workshop

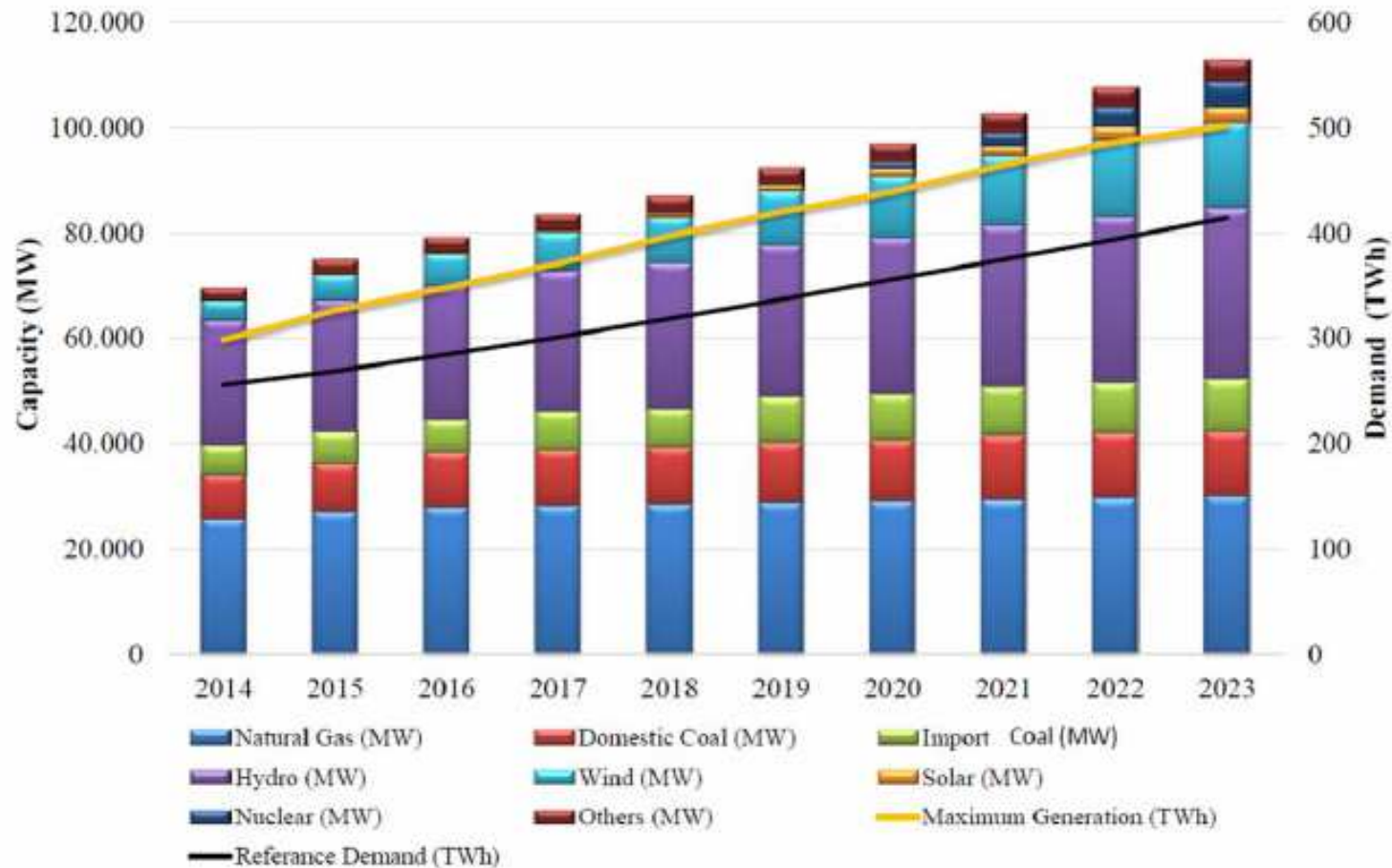
Athens, Greece

March 2017

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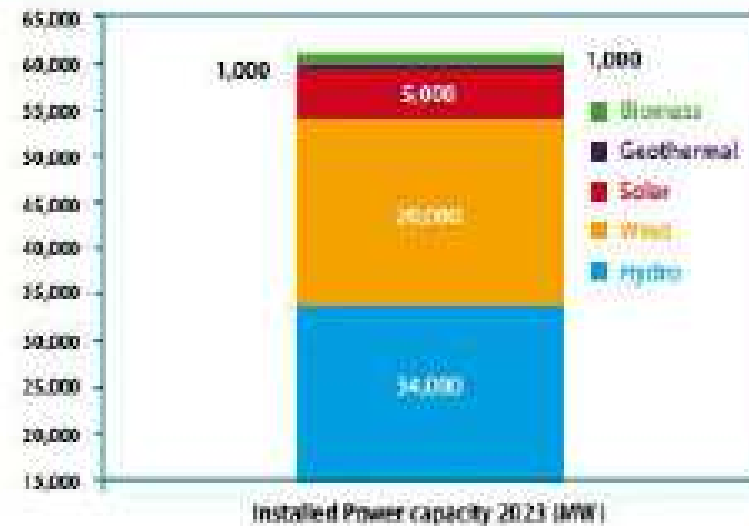
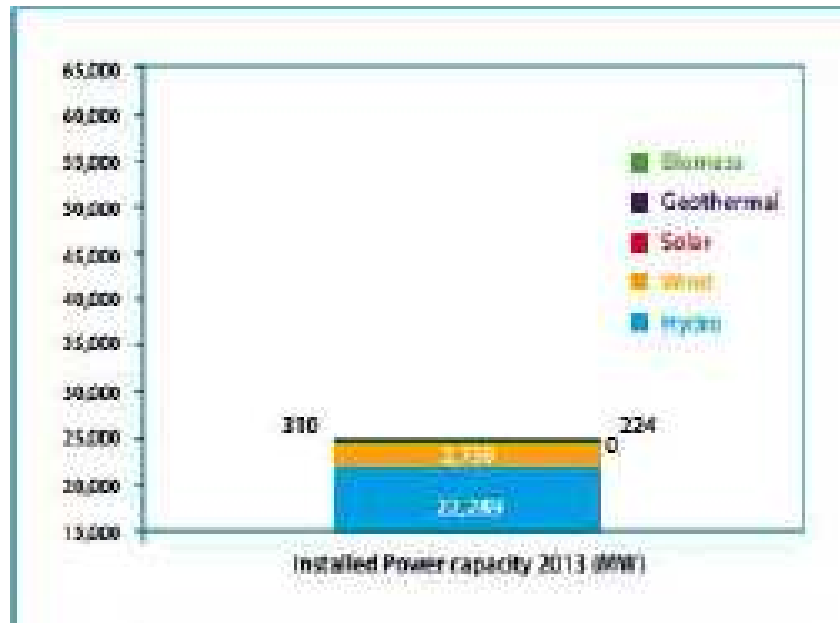
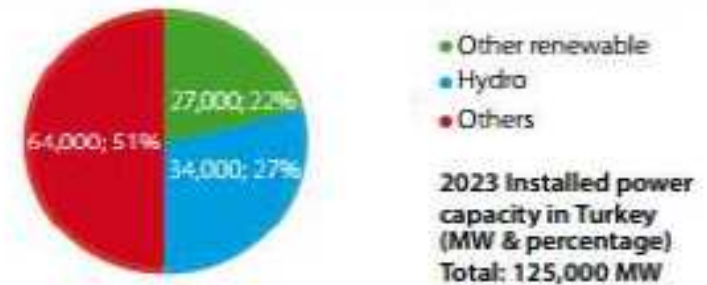
# INSTALLED CAPACITY AND DEMAND



# 2013-2023 RES targets

Based on Directive 2009/28/EC, Turkey's national Renewable Energy Action Plan (REAP) has been published by the Ministry on December 2014 to establish strategies to promote the development of renewable energy in Turkey.

The targets in REAP for RES are set to:  
RES production has increased to 30%



# Turkey' s REAP

## Measure

- Discount/Exemption of Network System Usage Fees for RES
- Supports/Subsidies for Capacitor integrated WPPs
- Strengthening of international electricity interconnections with neighbours
- Setting up procedures for connection, signalization, balancing and production monitoring of RES in distribution network

## Targeted Result

- To support the investors for grid connected large scale RES and increase their share within the total electricity production
- Improve the energy quality and integration of wind power plants to the network systems.
- Improve the system security and stability and increase the RES deployment
- Increase the capacity of distributed RES

# TURKISH ELECTRICITY NETWORK

Turkish Electricity  
Transmission Corp. (TEİAŞ)



- a) Stable Network Frequency Band  
 $49,8 \text{ Hz} \leq f \leq 50,2 \text{ Hz}$
- b) Acceptable Network Frequency Band:  
 $49,5 \text{ Hz} \leq f < 49,8 \text{ Hz}$  ve  $50,2 \text{ Hz} < f \leq 50,5 \text{ Hz}$
- c) Critical Network Frequency Band:  
 $47,5 \text{ Hz} \leq f < 49,5 \text{ Hz}$  ve  $50,5 \text{ Hz} < f \leq 52,5 \text{ Hz}$
- d) Unstable Network Frequency Band:  
 $f < 47,5 \text{ Hz}$  ve  $52,5 \text{ Hz} < f$

## SUBSTATIONS

400 kV : 92

220 kV : 1

154 kV : 568

66 kV : 14

Total : 675 Subs.

with 125.898 MVA capacity

## TRANSMISSION LINES

400 kV : 17.429 km

154 kV : 34.919 km

220 kV : 85 km

66 kV : 509 km

154 & 400 kV Cable: 296 km

Total : 53.238 km

# ANCILLARY SERVICES

## **Frekans Kontrolü (Frequency Control)**

- Primary Frequency Control, automatically activated (2-4 second, full load in 30 sec.)
- Secondary Frequency Control, automatically activated (30 sec., full load in 5 min.)
- Stand-by reserve-Strategic Reserve- has not been implemented yet
- Tertiary Reserves- Balancing Power Market-System Marginal Price

## **Emergency Control**

- System Restoration and Black-start- 17.08.1999 (earthquake) & 31.03.2017

## **Voltage Support/VAR Control**

- Reactive Power Support and Voltage Control

# TEİAŞ Strategy Paper (2015-2019)

| TEİAS Targets (2015-2019 Strategic Plan)   | Performance Indicators                        | 2015 | 2016 | 2017 | 2018 | 2019 |
|--|---|------|------|------|------|------|
| 2500 km lines investment for RES integration   | 400 kV & 154 kV lines length                  | 500  | 500  | 500  | 500  | 500  |
| 32 substations will be procured by TEİAS and constructed by users within the scope of connection agreement | 400 kV & 154 kV transformation station number | 7    | 7    | 6    | 6    | 6    |
| 600 MW DC Back to Back Interconnection Line with Iran  | Construction %                                | 10   | 40   | 100  | -    | -    |
| 600 MW DC Back to Back Interconnection Line with Syria   | Construction %                                | 0    | 0    | 0    | 0    | 30   |
| 500 MW DC Back to Back Interconnection Line with Iraq  | Construction %                                | 0    | 0    | 0    | 30   | 70   |



# TEİAŞ Strategy Paper (2015-2019)

| TEIAS Targets (2015-2019 Strategic Plan)   | Performance Indicators                        | 2015 | 2016 | 2017 | 2018 | 2019 |
|--|---|------|------|------|------|------|
| 400 kV Interconnection line between Georgia & Turkey   | Construction %                                | 0    | 10   | 40   | 80   | 100  |
| 400 kV Interconnection line between Iraq & Turkey  | 400 kV & 154 kV transformation station number | 30   | 70   | 100  | 0    | 0    |
| *Procurement of 4000 new generation relays with numeric technology and suitable for Smart Grid Apps. | Number of relays                              | 1000 | 1000 | 1000 | 1000 | -    |
| ** Procurement of 250 Remote Transformer Monitoring Systems  | Number of RTMs                                | 50   | 50   | 50   | 50   | 50   |
| Research & Planning Phase for FACTS power electronic applications to be completed.                   | Progress%                                     | 20   | 100  | -    | -    | -    |

\*11000 relays already existing before 2015

\*\* 250 RTM syst. Were existing before 2015

# TEİAŞ Strategy Paper (2015-2019)

| TEIAS Targets (2015-2019 Strategic Plan)               | Performance Indicators | 2015 | 2016 | 2017 | 2018 | 2019 |
|--|------------------------|------|------|------|------|------|
| 154 kV 100 MW DC Back to Back facility in Doğu Beyazıt | Progress %             | 10   | 30   | 70   | 100  | -    |
| Establishment of National SCADA System Prototype       | Progress%              | 0    | 10   | 50   | 70   | 100  |
| Tendering Mechanism for Primary and Secondary Reserves | Progress%              | 0    | 50   | 100* | -    | -    |
| Secondary Reactive Power Control Systems               | Progress %             | 20   | 50   | 100  | -    | -    |

\*New Ancillary Services Regulation has been drafted by EMRA

# TURKEY' S ENTSO-E CONNECTION

| Milestone                                       | Date                  |
|---|-----------------------|
| Contractual Agreement between ENTSO-E & TEİAŞ   | 18 December 2009      |
| Isolated Operation Test (Peak Load)             | 11-24 January 2010    |
| Isolated Operation Test (Min. Load)             | 22 March-5 April 2010 |
| Synchronous Parallel Operation Test Phase 1,2,3 | 2010-2011             |
| Increase of NTCs                                | 17 April 2013         |
| Decision for Permanent Synchronous Operation    | 9 & 24 April 2014     |
| Signing of the Long Term Agreement              | 15th April 2015       |
| Observer Membership process is initiated        | 18th June 2015        |
| Observer membership Agreement                   | 14th January 2016     |



# EXISTING AND PLANNED INTERCONNECTIONS



# EXISTING INTERCONNECTIONS

| Interconnection        | Line Characteristics  | Thermal Capacity (MVA) | Current Operation Mode        |
|------------------------|---|------------------------|-------------------------------|
| Bulgaria               | Hamitabat (TR)-Maritsa East (BG), 400 kV- 2x954 MCM, Rail -133 km                 | 995                    | Synchronous                   |
| Bulgaria               | Hamitabat (TR)-Maritsa-East (BG), 400 kV- 3x954 MCM, Cardinal - 145 km            | 1510                   | Synchronous                   |
| Greece                 | Babaeski (TR) – Nea Santa (GR), 400 kV – 3x954 MCM, Cardinal – 130 km             | 1510                   | Synchronous                   |
| Georgia                | Hopa (TR) - Batum (GE), 220 kV - 954 MCM, Rail - 28 km                            | 287                    | Emergency                     |
| Georgia                | Borçka (TR) - Akhaltsikhe (GE), 400 kV - 3x954 MCM, Cardinal -155 km              | 1510                   | 700 MW HVDC Back-to-Back @ GE |
| Armenia                | Kars (TR) - Gumri (AR), 220 kV - 2x954 MCM, Cardinal - 80,7 km                    | 574                    | Not in Operation              |
| Azerbaijan (Nahcievan) | Iğdır (TR) - Babek (AZ), 154 kV - 477 MCM, Hawk - 180 km (Double circuit)         | 132                    | Not in Operation              |
| Iran                   | Doğubeyazıt (TR) – Bazargan (IR), 154 kV - 954 MCM, Cardinal - 40 km              | 204                    | Isolated island mode in TR    |
| Iran                   | Başkale (TR) – Khoy (IR), 400 kV - 3x954 MCM, Cardinal - 100 km                   | 1510                   | Isolated island mode in TR    |
| Iraq                   | PS-3 (TR) – Zakho (IQ), 400 kV (operated at 154 kV) - 2x954 MCM, Cardinal - 28 km | 408                    | Not in Operation              |
| Syria                  | Birecik HES (TR) – Aleppo (SY), 400 kV- 2x954 MCM, Cardinal – 124 km              | 1005                   | Not in Operation              |

# PLANNED INTERCONNECTIONS

| Interconnection | kV  | Description   | Present Situation  | Commisioning Date | Characteristic                                 |
|-----------------|-----|---|--------------------|-------------------|--|
| Bulgaria        | 400 | Addition of one or two new line. Total expected NTC 2000 MW       | Under Discussion   | -                 | -  |
| Georgia         | 400 | Tortum (TR) - Akhaltsikhe (GE)                                    | Investment Plan    | 2019              | 380 kV, 3B<br>CARDINAL ACSR<br>954 MCM, 150 km |
| Georgia         | 154 | Muratlı (TR) - Batumi (GE)  | Under construction | 2020              | 154 kV, 1272 MCM                               |
| Iran            | 400 | HVDC B-to-B Station with 600 MW capacity @ Van (TR)               | Under construction | 2019              | 600 MW HVDC B-to-B Station                     |
| Iran            | 400 | Van (TR) - Khoy (IR) OHL for HVDC B-to-B Station                  | Under construction | 2018              | 380 kV, 3B 954 MCM, 111 km                     |
| Iran            | 154 | HVDC B-to-B Station with 100 MW capacity @ Doğubeyazıt (TR)       | R&D Project        | 2017              | 100 MW HVDC B-to-B Station                     |
| Iraq            | 400 | HVDC B-to-B Station with 500 MW capacity @ Cizre (TR)             | Under discussion   | -                 | 500 MW HVDC B-to-B Station                     |
| Iraq            | 400 | New line between Cizre (TR) and Mousul (IQ)                       | Under construction | -                 | 380 kV, 3B 954 MCM, 35 km                      |
| Syria           | 400 | HVDC B-to-B Station with 600 MW capacity @ Birecik (TR)           | Postponed          | -                 | 600 MW HVDC B-to-B Station                     |
| Syria           | 400 | Addition of a new 400 kV AC OHL together with HVDC B-to-B station | Under discussion   | -                 | -  |
| Saudi Arabia    |     | HVDC Link Undersea Cable Interconnection                          | Under discussion   | -                 | -  |

# PLANNED PARTICIPANTS FOR THE FUTURE GRID

- Capacity Mechanism
- Demand Side Response
- Energy Storage (esp. for ancillary services)
- Smart Grids
- Electrical Vehicles

# CAPACITY MECHANISM

- New regulation has been discussed between EMRA and TEİAŞ (TSO)
- Local resources to be prioritized (6446 Electricity Law)
- Restriction for PPs which are already supported with another tools
- Capacity Auctions by TEİAŞ

Questions: Regional or national auctions? Yearly or monthly Auctions?



# DEMAND SIDE RESPONSE

- An aggregator company has signed a protocol with TEİAŞ in February 2015 for 1 year
- Company surveyed the large scale commercial consumers which are directly connected to the transmission systems
- Cement factories are volunteers, steel factories are not volunteers

## **Questions to be decided for regulation:**

- For industrial consumers the payments shall cover their loss for stopping the factory
- Who will pay for the smart meter installation costs? -The owner is the DSOs but the consumers pay?

# NEW ANCILLARY SERVICES REGULATION

- Energy storage systems and demand side management is planned to be included within ancillary services
- Secondday reserves are planned to be procured via auctions (currently it is obliged)

# SMART GRID ROADMAP

Turkish Smart Metering Vision & Strategy 2023  
Project (has been implemented by Association of  
DSOs)

- CBA is needed.
- Roadmap shall be developed.
- The first interim report is expected to be published in July 2017.



**Thank you for listening.**

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