Energy Policy and Economics in Turkey

ECON 405 – Energy Economics
"Turkish Case"

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Contents

1. General Overview

Energy Policy in General

- Generally "resource" based
- Mostly pragmatist (like all policies)
  - "No matter if it is a white cat or a black cat; as long as it can catch mice, it is a good cat."

    Deng Xiaping
- An enabler for economic development

Context

Economy	Government	Regulations
Commodity Prices	Banks	Market
Domestic Resources	Investors	Investments

CONSUMERS

Several stages

1. Access to energy resources
2. Availability of these resources
3. Acceptability of these resources
4. All of the above

- A new trend: PV example in Africa

2. Energy Policy Making in Turkey

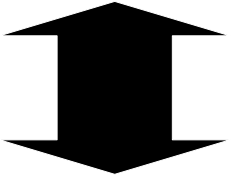
A Brief Overview

Parliament
(Budget/Laws)

Court Orders

Ministeries:
- Economy
- Foreign Aff.
- Environment
- Defence

MENR
&
Institutions



Consumers
&
Investors

In Turkish context

- Policy maker is MENR (Ministry of Energy and Nat. Resources) by law
- MENR ≠ Ministry of Electricity
- Priorities change
  - Investment environment
  - Domestic resources
  - Market Structure
  - Sustainability

Hierarchy of Decision Makers

- President
- Minister of Energy & Natural Resources
- Deputy Ministers (subject areas)
- Director General (Specialized Govt Agencies)
- Deputy DGs (subject areas)
- Head of Department/division (Technical side)

Hierarchy of Legislation

- Constitution
- International Agreements (For ex:)
- Law
- Regulations
- Methods & Announcements

Hierarchy in Energy Policy Making

- Law
- Decrees (YPK etc)
- Regulation
- Strategic Plans
- Institutional Decrees

Public

International aggreements

EU legislation

Stakeholder NGOs

Private companies

Energy Policy : Nuts&Bolts

- "High level" pull -> Minister's Vision
- "Lower level" push -> Institutional plans
- Collective push -> Strategy papers
- Coordination with other Ministers
  - Minister
- Coordination with other High Level Institutions
  - DGs or Deputy Ministers
- Technical study -> Head of Division

Energy policy priorities

- Domestic Resources (inc efficiency&ren)
- Acceptable prices
- Security of Supply
- Sustainability
- Predictability (Private sector)

Changing role of institutions

- Pre 2001
  - Ministry coordinating SOE investments
- Post 2001
  - New players (Entreprenuers)
  - New structures (Energy Exchange)
  - Growing emphasis on competition

3. Economic Fundamentals

Economically different objectives

- Electricity(6446)

Amaç

MADDE 1 – (1) Bu Kanunun amacı; elektriğin yeterli, kaliteli, sürekli, düşük maliyetli ve çevreyle uyumlu bir şekilde tüketicilerin kullanımına sunulması için, rekabet ortamında özel hukuk hükümlerine göre faaliyet gösteren, mali açıdan güçlü, istikrarlı ve şeffaf bir elektrik enerjisi piyasasının oluşturulması ve bu piyasada bağımsız bir düzenleme ve denetimin yapılmasının sağlanmasıdır.

Low cost

- Natural Gas(4646)

Amaç

Madde 1 – Bu Kanunun amacı; doğal gazın kaliteli, sürekli, ucuz, rekabete dayalı esaslar çerçevesinde çevreye zarar vermeyecek şekilde tüketicilerin kullanımına sunulması için, doğal gaz piyasasının serbestleştirilerek mali açıdan güçlü, istikrarlı ve şeffaf bir doğal gaz piyasasının oluşturulması ve bu piyasada bağımsız bir düzenleme ve denetimin sağlanmasıdır.

Cheap

- Petroleum(5015)

Amaç ve kapsam

Madde 1- Bu Kanunun amacı; yurt içi ve yurt dışı kaynaklardan temin olunan petrolün doğrudan veya işlenerek güvenli ve ekonomik olarak rekabet ortamı içerisinde kullanıcılara sunumuna ilişkin piyasa faaliyetlerinin şeffaf, eşitlikçi ve istikrarlı biçimde sürdürülmesi için yönlendirme, gözetim ve denetim faaliyetlerinin düzenlenmesini sağlamaktır.

economic

Pricing structure

- Coal (TTK & TKİ selling price as benchmark)
- Petroleum products (International markets)
- Natural gas (BOTAŞ and EPİAŞ OTSP)
- Electricity (EPİAŞ Day ahead price)

Economics of energy prices

- Petroleum product prices -> ~1 week delay
- Natural gas prices -> 6 months delay (wrt oil)
- Electricity prices
  - Market prices closely follows NatGas & Imported Coal (Merit order)
  - Depends highly on wind & hydro production (and now solar)

Investment environment

- Very capital intensive
  - Banking services
- There are not many financial instruments
  - Mostly credit (project or company)
- PO (Public offering)
  - Limited

4. Historical perspective

Heritage from Ottoman Period

- "Menafii Umumiyeye Müteallik İmtiyazat"
  - Public good/interest
- Govt is not the investor/builder
- But gives investors for certain periods of time to provide a public service
- "concession"

Sel felaketinden sonra Silahtarağa Fabrikası'nın halini gösteren manşet

Servet-i Fünun, 13 Eylül Perşembe 1329/ 1913

www.mevzuat.gov.tr/MevzuatMetin/0.1.6.pdf

Resim: Yahya Çoşkun, Yüksek Lisans Tezi

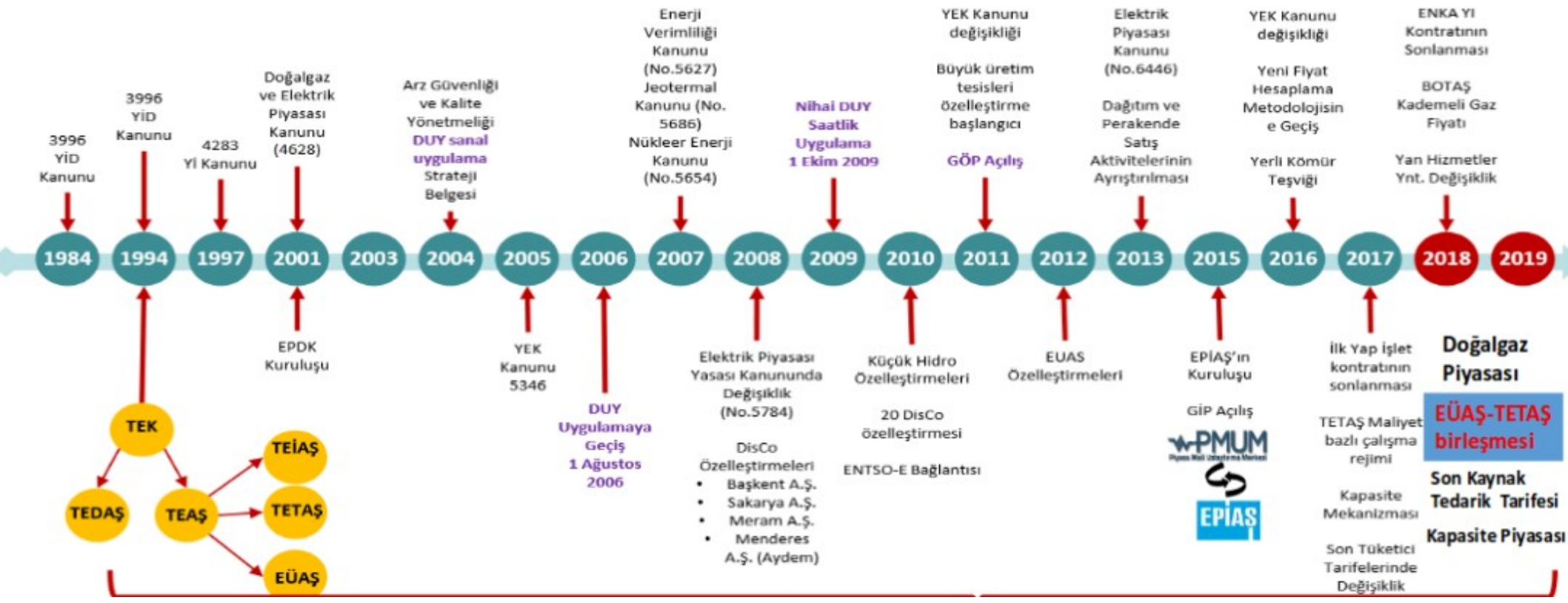
Early Period

- Concessions continue until 1935
- Mining, natural resources and investment
- Etibank (14 June 1935)
  - Investing in infrastructure
- Maden Tetkik ve Arama (14 June 1935)
  - Mining(Coal) resources
- Elektrik İşleri Etüt İdaresi (24 June 1935)
  - Electrification & Hydro studies

Different Tracks

- Coal -> State owned
- Oil -> TPAO (1954) & Companies
- Hydro -> DSİ (1954)
  - Only State Water Works until 2001
- Natural gas -> BOTAŞ (1974)
- Electricity
  - Concessions->Municipalities-> TEK(1970)->SOE

Electricity



https://www.dunyaenerji.org.tr/wp-content/uploads/2018/09/FYazitasSunum22Eylul.pdf

Why such a complex path?

- Municipalities didn't make the investments
- Govt created TEK based on French EDF (discussions 1954-1970)
- Govt tried to invest by himself
  - Major projects took many many years (Keban 1938-1974)
- Govt then created concessions/aggrements
  - BO/BOT/ToC (Özal era)
- Then tried "Market economy" as a last resort

Changing priorities

- Ottoman period/Early Republic
  - Public service
- 1935-1950s
  - Finding and utilising domestic resources
- 1950s-1970s
  - Economic development
- 1970s-1990s
  - Major Investments & economic
- 1990s
  - Privatization & new models
- 2000s
  - Open to entreprenuers

Changing trends

- Up to 1970s:
  - domestic resources
- 1970s
  - Prices
- 1980s-1990s
  - Private sector& privatizations
- Late 1990s
  - Security of supply
- Late 2010s
  - Sustainability of investments, "National Energy Policy", Technology

National Energy Policy - 2015

- Security of Supply
- Predictability
- Local manufacturing of energy technologies

MİLLÎ ENERJİ

Major emphasis on technology

More of an Industrial strategy

National Energy Balance

2016

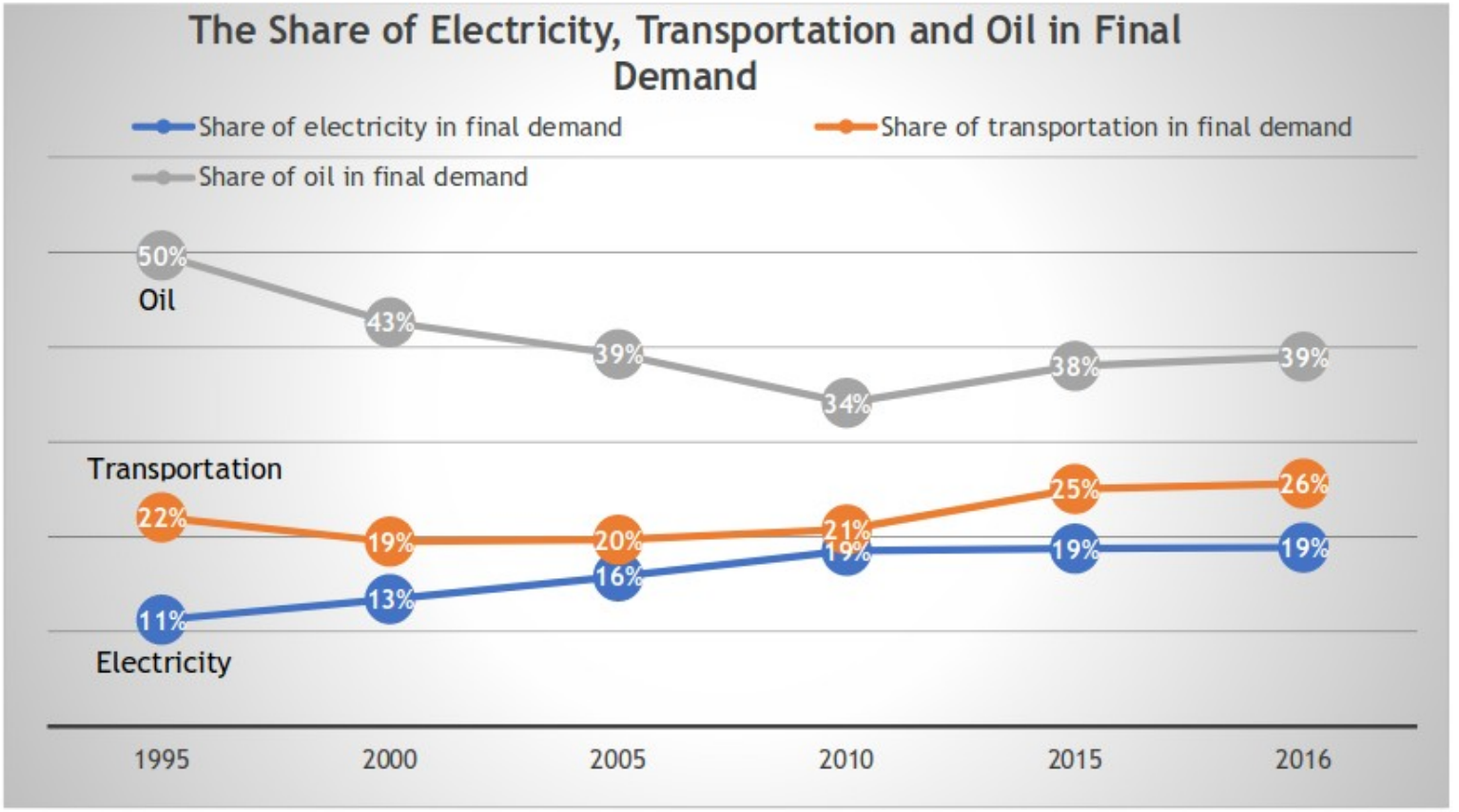
	Million tons of equivalent oil	Coal	Oil	Natural Gas	Renewable	Electricity	Total
SUPPLY	Production	15	3	0	17	0	35
	Import	24	51	38	0	1	113
	Export + Bunker Fuel	0	11	1	0	0	12
	Energy Supply	38	42	38	17	0	136
CONVERSION	Consumed in Conversion	-23	-1	-16	-11	19	-32
	Electricity Conversion	-22	-1	-15	-12	24	-26
	Refinery	0	2	-1	-0	-0	1
	Internal Consumption & Loss	-1	-3	-0	0	-4	-8
COMSUPTION	Final Consumption	16	41	22	6	20	105
	Industry	10	4	9	1	9	33
	Transport	0	26	0	0	0	27
	House	2	0	10	3	4	20
	Business	4	1	3	1	6	14
	Agriculture	0	3	0	1	1	4
	Raw Material	0	6	1	0	0	7

2017

	Kömür	Petrol	Doğal gaz	Yenilenebilir	Elektrik	Toplam
Yerli Üretim (+)	15,1	2,7	0,3	17,3	0,0	35,4
İthalat (+)	24,9	53,7	45,6	0,0	0,2	124,4
İhracat (-)	0,2	6,9	0,5	0,0	0,3	7,9
İhrakiye (-)	0,0	4,6	0,0	0,0	0,0	4,6
Stok Değişimi (+/-)	-0,3	-0,7	-1,0	0,0	0,0	-2,0
Birincil Arz	39,5	44,3	44,3	17,3	-0,0	145,3
Çevrim	-23,8	-1,0	-19,9	-10,1	21,3	-33,5
Elektrik ve ısı	-23,0	-0,2	-18,1	-11,4	25,6	-27,1
Nihai Tüketim	15,7	43,3	24,4	7,1	21,3	111,8
Sanayi	9,6	4,3	9,0	2,5	9,9	35,3
Ulaştırma	0,0	27,8	0,4	0,1	0,1	28,4
Konut	3,4	0,2	11,1	3,4	4,7	22,9
Ticaret ve Hizmetler	2,7	0,9	3,1	0,5	5,9	13,1
Tarım ve Hayvancılık	0,0	2,9	0,1	0,6	0,6	4,3
Enerji dışı(hammadde)	0,0	6,8	0,6	0,0	0,0	7,4

http://www.worldenergy.org.tr/wp-content/uploads/2018/07/QR29ENG.pdf

Changes in energy usage



http://www.worldenergy.org.tr/wp-content/uploads/2018/05/QR22ENG.pdf

5. Energy technology policies

Domestic manufacturing

- Govt enterprises
  - TEMSAN – 1975
    - 1974 – Cyprus operation
  - Hirfanlı 4th Turbine (1979-1983)
- Private sector investments (mostly Özal period)
  - Foreign companies' domestic factories & licensing

https://enerjigunlugu.net/icerik/18831/bir-baska-devrim-otomobili-hirfanli-hes-4-haluk-direskeneli.html

R&D policy

- EMRA in 2010, has given R&D budget to Electricity Distribution Companies
- Process design & stakeholder discussions (2013-2014)
- 28 May 2014 – ArGe Usul ve Esasları
- Every year January-July

https://www.dunyaenerji.org.tr/enerjide-yerli-ve-milli-politikada-son-gelismelerin-tarihsel-onemi/

Localization support

- 2005 (Law) Domestic renewable resource usage (domestic resource)
- 2010 (Law) Resource + domestic component (resource + component)
- 2010 (EMRA Decree) R&D support
- 2013 (Decree) 5 year extension to renewable support mechanisms
- 2016 (Law & Tender) YEKA (Ren. Energy Zones), domestic compenent, R&D facility and personnel (resource+component+R&D)

6. How Electricity Market Works?

Electricity is strange

- Not storable
- At every instant supply matches demand
- Demand is estimated, supply is dispatched/manages
  - Frequency drops with demand+,supply-
  - Frequency accelerates with demand-, supply +
- Real time, no storage market

To deal with uncertainity

- Planning for 10 years, 5 years, 1 year, monthly, day ahead
- System operator (Controller of the physical system-TEİAŞ)
  - Makes a day ahead planning
  - Hour-by-hour
    - Demand estimation, supply schedule, reserve estimation, contingency planning
- Market operator (Controller of the money flows-EPİAŞ)
  - Takes the bids
  - Runs the optimization
  - Solves for market clearing price and publishes

Market works

- System operator announces the demand forecast day ahead (previous day)
- All players make their own forecasts, customer schedules, generation schedules and bid to Market operator
- Market operator runs the optimization software and announces the hour-by-hour Day Ahead Price

Simple Example: Demand 100MW

System Operator:
My forecast of tomorrow's demand=100

Market operator calls for bids

Price	Amount
198 TL	34 MW
220 TL	25 MW
270 TL	20 MW
200 TL	13 MW
234 TL	42 MW
180 TL	37 MW
171 TL	8 MW

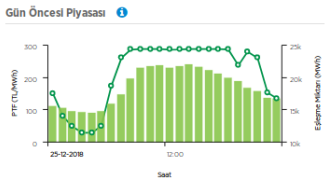
Market operator sorts the bids from cheapest to most expensive
Finds the "Marginal price" matching Demand-> "Market clearing price"

270 TL	20 MW
234 TL	42 MW
220 TL	25 MW
200 TL	13 MW
198 TL	34 MW
180 TL	37 MW
171 TL	8 MW

Market Clearing Price 220 TL

100 MW

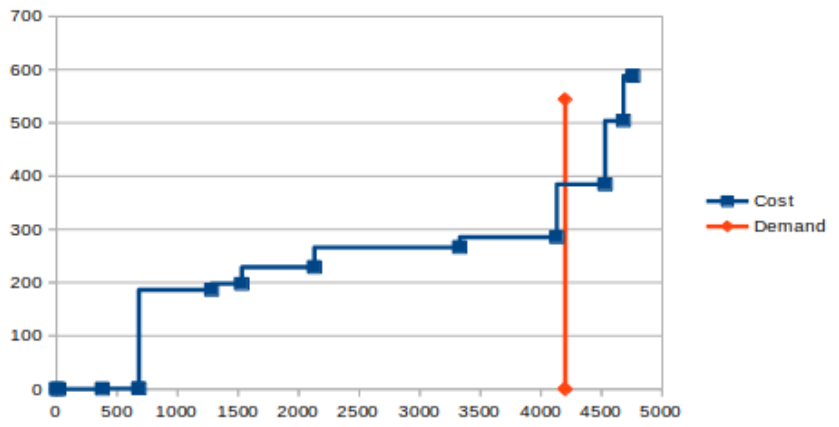
Market operator announces prices



EXIST ŞEFFAFLIK PLATFORMU

Example – 11 Gen.s/Inflexible Demand

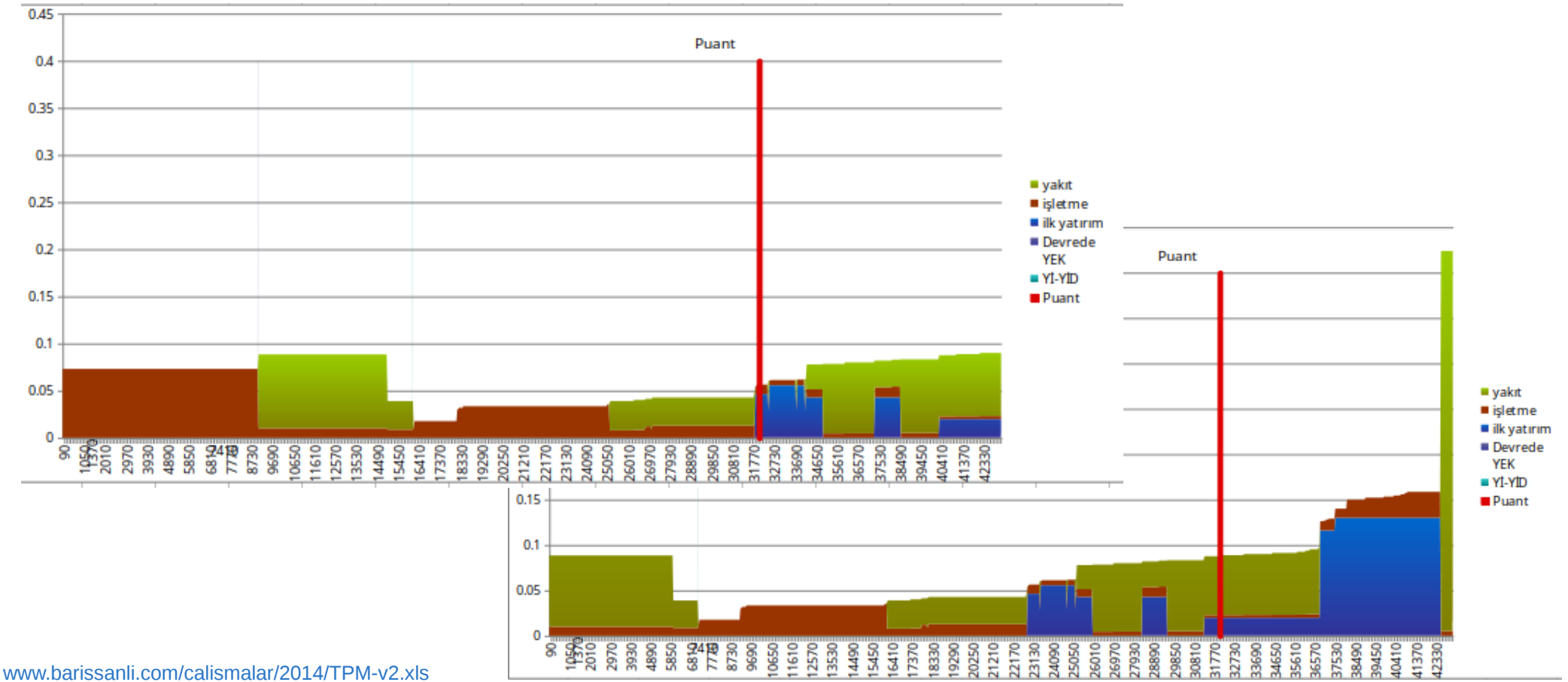
	Natgas	NG		Demand	4200		
	Coal	C		Price	*285*	TL/Mwh	
	Fuel oil	FO					
	Hydro	H					
						SRMC	LTMC
			Fuel cost	Efficiency	Capacity	Costs(TL/Mwh)	Costs(TL/Mwh
1	NG1	TL/1000m3	1700	56.00%	800	285.3	335.3
2	NG2	TL/1000m3	1700	60.00%	1200	266.3	306.3
3	NG3	TL/1000m3	1800	44.00%	400	384.5	414.5
4	C1	TL/ton(6000k	600	38.00%	600	228.8	288.8
5	C2	TL/ton(2000k	120	28.00%	600	186.3	266.3
6	C3	TL/ton(4000k	300	33.00%	250	197.6	277.6
7	FO1	TL/barrel	300	35.00%	150	504.2	544.2
8	FO2	TL/barrel	300	30.00%	80	588.2	628.2
9	H1	TL	0.1	100.00%	20	0.1	140.1
10	H2	TL	0.2	100.00%	1200	0.2	200.2
11	H3	TL (SKHA)	1	100.00%	300	1.0	251.0



	Merit Order		Availability	Capacity	SRMC		List MW	Cost	Value	Demand
1	9	H1	100.00%	20	0.1		0	0.1		
2	10	H2	30.00%	360	0.2		20	0.1		
3	11	H3	100.00%	300	1.0		380	0.2	4199.99	0
4	5	C2	100.00%	600	186.3		680	1.0	4200	544.2016807
5	6	C3	100.00%	250	197.6		1280	186.3	4200.01	0
6	4	C1	100.00%	600	228.8		1530	197.6		
7	2	NG2	100.00%	1200	266.3		2130	228.8		
8	1	NG1	100.00%	800	285.3		3330	266.3		
9	3	NG3	100.00%	400	384.5		4130	285.3		
10	7	FO1	100.00%	150	504.2		4530	384.5		
11	8	FO2	100.00%	80	588.2		4680	504.2		
							4760	588.2		

http://barissanli.com/calismalar/dersler/etm521/etm521-05-exercise.ods

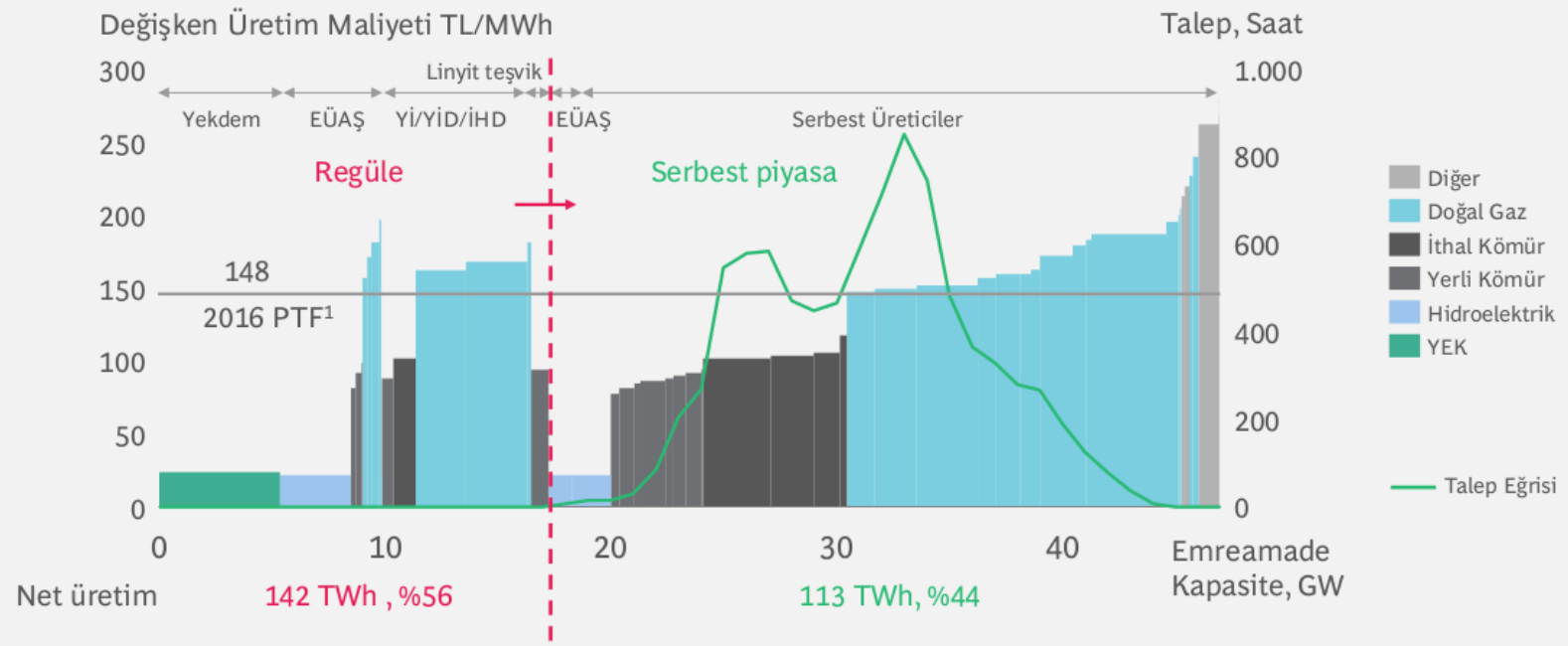
How solar and wind depress prices?



www.barissanli.com/calismalar/2014/TPM-v2.xls

Supply Curve

ŞEKİL 5 | TÜRKİYE ELEKTRİK PİYASASI ÜRETİM MALİYET EĞRİSİ

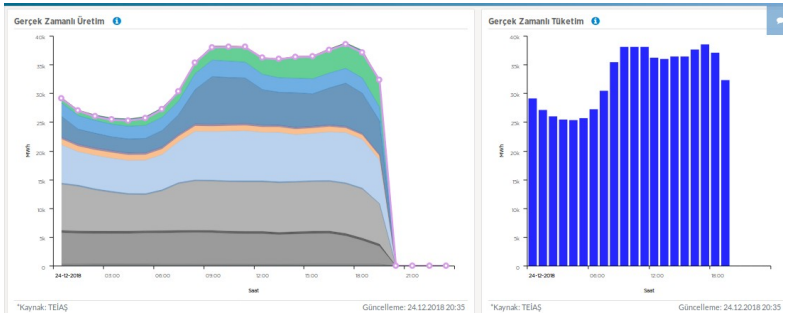


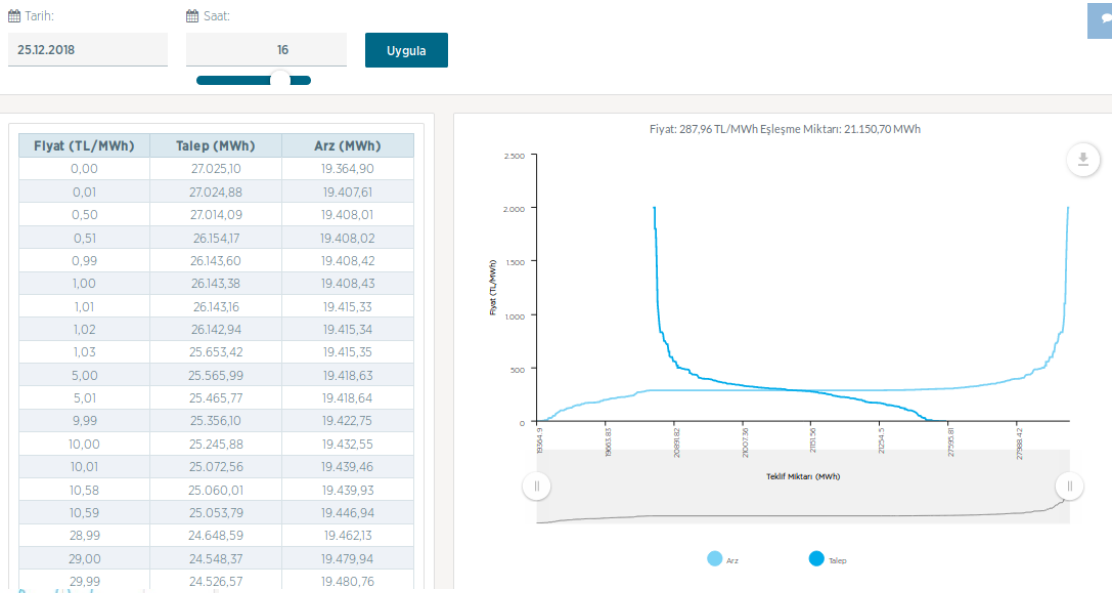
1. Ağırlıklı ortalama
Not: 2016 yılı içindir. Talep eğrisi saatlik talebin 1.000 MW'ın en yakın katına yuvarlanarak gösterimidir. Örneğin talep bir yıl içerisinde toplam 850 saat boyunca 33.000 MW seviyesindedir.
Kaynak: TEİAŞ, EPDK, EPİAŞ, BCG Power Generation Model

https://tusiad.org/tr/yayinlar/raporlar/item/9978-surdurulebilir-gelecek-icin-surdurulebilir-enerji-raporu

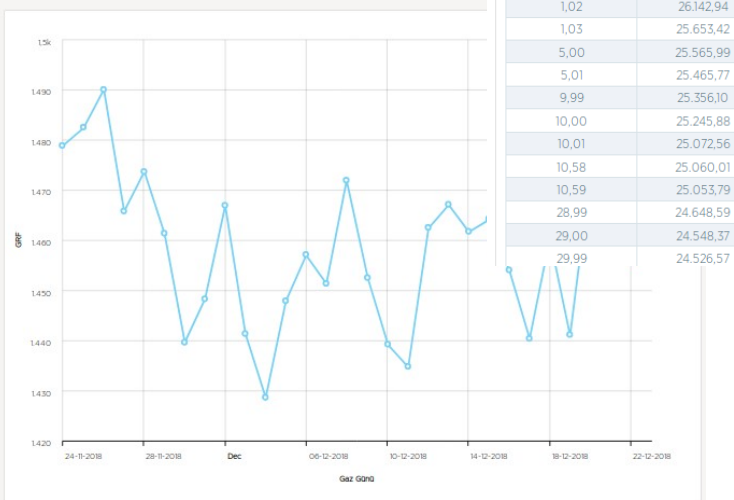
Reality is more complex

Market Data





Gaz Günü	GRF
24/11/2018	1.478,80
25/11/2018	1.482,43
26/11/2018	1.490,07
27/11/2018	1.465,79
28/11/2018	1.473,72
29/11/2018	1.461,32
30/11/2018	1.439,69
01/12/2018	1.448,36
02/12/2018	1.466,95
03/12/2018	1.441,34
04/12/2018	1.428,70
05/12/2018	1.447,95
06/12/2018	1.457,04
07/12/2018	1.451,38
08/12/2018	1.471,96
09/12/2018	1.452,49
10/12/2018	1.439,18
11/12/2018	1.434,73
12/12/2018	1.462,41



https://seffaflik.epias.com.tr/transparency/piyasalar/gop/arz-talep.xhtml
https://seffaflik.epias.com.tr/transparency/

Thank you /Questions

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WEC Turkey Quant reports:

https://www.dunyaenerji.org.tr/quant-calisma-grubu/