The OSCE Secretariat bears no responsibility for the content of this document and circulates it without altering its content. The distribution by OSCE Conference Services of this document is without prejudice to OSCE decisions, as set out in documents agreed by OSCE participating States.

EEF.DEL/60/22
12 September 2022

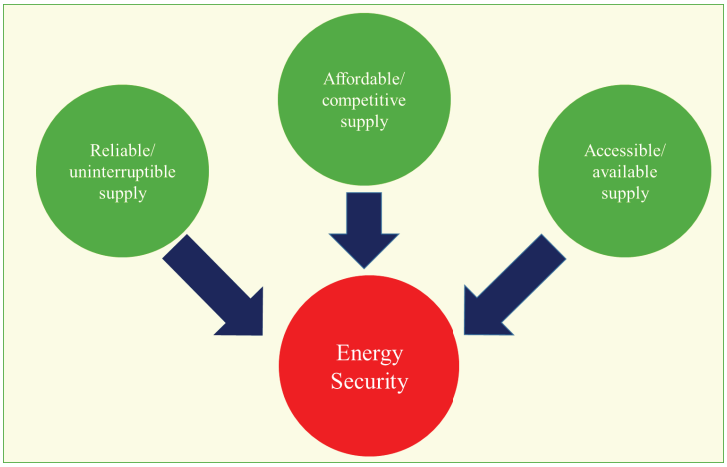
ENGLISH only

30th Economic and Environmental Forum
Concluding Meeting
Prague, 8-9 September 2022
Session 3

Energy Security vs Energy Transition

Özgür SARHAN
Head of Energy Security of Supply, Markets and Statistics Department
Republic of Türkiye, Ministry of Energy and Natural Resources

Energy Security



The IEA defines energy security as the uninterrupted availability of energy sources at an affordable price. Energy security has many aspects: **long-term energy security** mainly deals with timely investments to supply energy in line with economic developments and environmental needs. On the other hand, **short-term energy security** focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance.

Source: https://www.iea.org/topics/energy-security

Energy System Resilience

Number of entry points	Diversity in the energy production mix
Number of electricity points	Diversity in installed energy capacity
Number of energy generators	Largest single source of energy supply/production
Capacity of transmission pipelines	**Import dependency**
Capacity of transmission lines	Share of renewable energy sources in energy production
Length of the transmission pipelines	Energy reserves
Length of the transmission lines	Spare capacity
Number of connections in the energy system	Ratio of total installed capacity to energy demand
Configuration of the energy system	**Energy cost stability**
Modularity of the energy system	Energy demand
Percentage of distributed energy technologies	Unserved energy
Number of spare parts	Time of unserved energy
Diversity of primary energy sources or fuels	**Cost change**

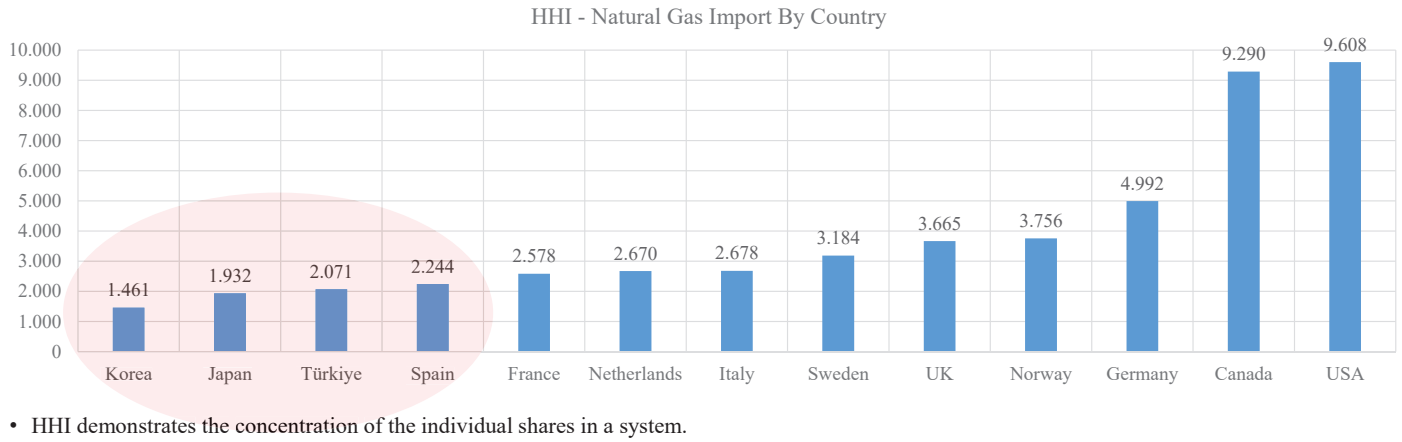
According to the IEA:

Energy system resilience is defined as the capacity of the energy system or its components to cope with a hazardous event or trend, responding in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

Latest shock examples:
- Drought in Europe and Türkiye
- COVID-19 Pandemic
- Russia – Ukraine War
- Chip Shortage
- Nuclear shortage in France
- Natural gas supply problems

Source: Martišauskas, Linas, et al. "A Framework to Assess the Resilience of Energy Systems Based on Quantitative Indicators." *Energies* 15.11 (2022): 4040.

Energy System Resilience
Example: Herfindahl-Hirschman Index

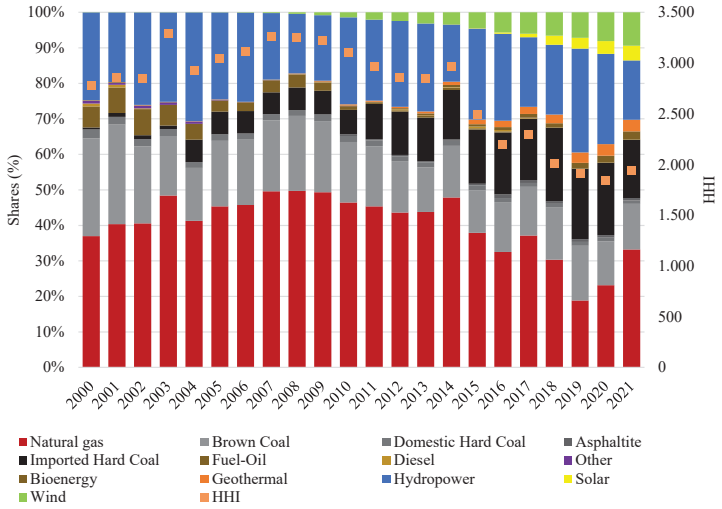


- HHI demonstrates the concentration of the individual shares in a system.
- Natural gas infrastructure is important to diversify natural gas supply.
- Türkiye has:
  - 2 LNG gasification and 2 FSRU terminals. (133 mcm/day gasification capacity)
  - 2 underground storage facilities. (5,8 bcm capacity)
  - 5 pipeline entrance. (Russia, Iran and Azerbaijan)
- Exploration works have been ongoing.

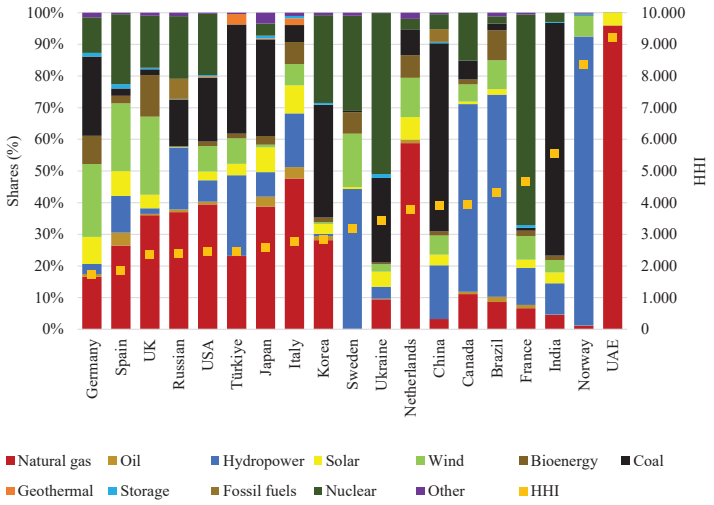
Source: Own calculations based on IEA database.

Energy System Resilience
Example: Herfindahl-Hirschman Index

Türkiye - Electricity Generation by Technology and HHI



Electricity Generation by Technology and HHI (2020)*



- Türkiye has one of the lowest HHI among various countries, which indicates a large diversity of primary energy source in terms of electricity.
- Although there is a high demand increase and relatively low electricity import/export capacity, Türkiye has achieved well-diversified energy mix.

Source: Own calculations based on IRENA database.

World has been changing very fast!

1999 IEA World Energy Outlook

	Levels			
	1971	1997	2010	2020
Electricity Generation (TWh)	**5224**	**13949**	**19989**	**25881**
Coal	2103	5337	7467	9763
Oil	1095	1282	1442	1498
Gas	692	2159	4698	7745
Nuclear	111	2393	2647	2369
Hydro	1208	2566	3341	3904
Other Renewables	14	211	395	603
Capacity (GW)	**n.a.**	**3221**	**4386**	**5515**
Coal	n.a.	1030	1311	1677
Oil	n.a.	410	466	474
Gas	n.a.	643	1226	1822
Nuclear	n.a.	352	366	323
Hydro	n.a.	738	926	1078
Other Renewables	n.a.	48	91	142

2009 IEA World Energy Outlook

	Electricity generation (TWh)					
	1990	2007	2015	2020	2025	2030
Total generation	**11 814**	**19 756**	**24 352**	**27 232**	**30 670**	**34 292**
Coal	4 424	8 216	10 461	11 744	13 457	15 259
Oil	1 332	1 117	859	776	717	665
Gas	1 727	4 126	4 982	5 620	6 270	7 058
Nuclear	2 013	2 719	3 107	3 263	3 532	3 667
Hydro	2 144	3 078	3 692	4 027	4 352	4 680
Biomass and waste	131	259	408	522	654	839
Wind	4	173	678	1 010	1 289	1 535
Geothermal	36	62	97	121	146	173
Solar	1	5	67	146	248	402
Tide and wave	1	1	2	3	5	13

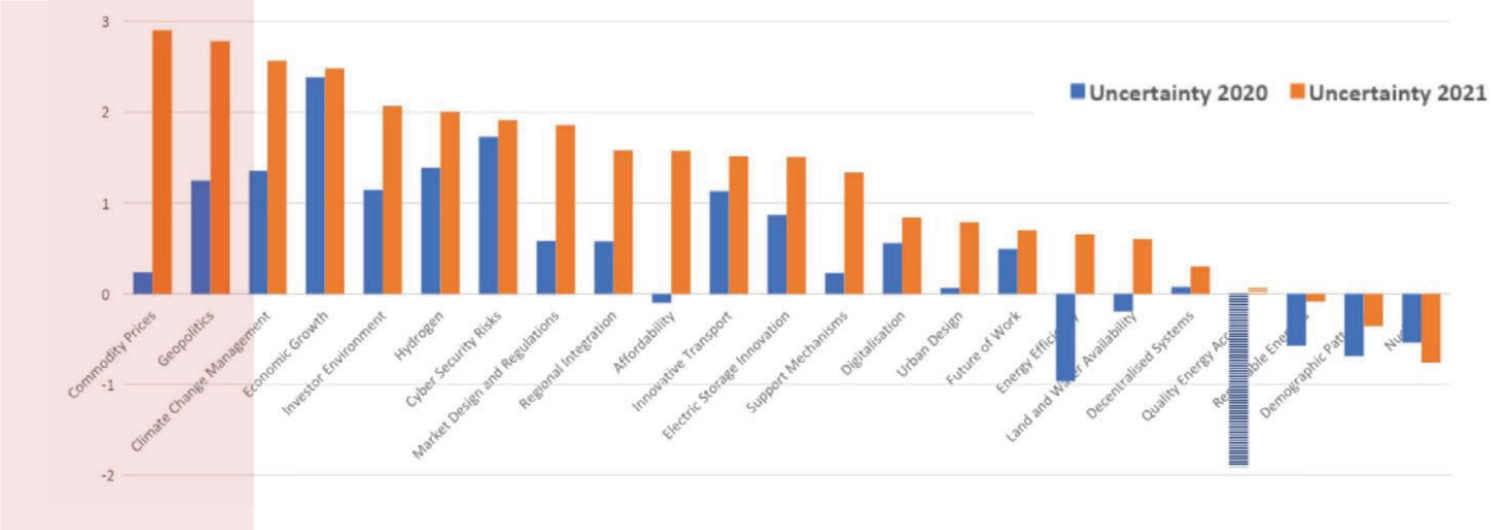
	Capacity (GW)				
	2007	2015	2020	2025	2030
Total capacity	**4 509**	**5 728**	**6 284**	**7 026**	**7 821**
Coal	1 440	1 897	2 108	2 408	2 705
Oil	445	422	345	300	268
Gas	1 168	1 464	1 573	1 749	1 972
Nuclear	371	411	427	459	475
Hydro	923	1 099	1 196	1 289	1 382
Biomass and waste	46	71	91	114	146
Wind	96	295	422	522	600
Geothermal	11	16	19	22	26
Solar	9	53	102	162	244
Tide and wave	0	1	1	1	3

What happened in 10 years?

2020
Wind: 731 GW
Solar: 716 GW
Hydro: 1211 GW
Bioenergy: 109 GW

Source: https://ember-climate.org/data/data-explorer/, IEA World Energy Outlook 1999 and 2009.

Uncertainty increased!



- The most striking finding of the latest Global Energy Issues Map is the enormous degree of uncertainty ascribed to almost all the issues energy leaders were asked to assess.
- Commodity Prices appears as the clearest critical uncertainty globally.
- The Geopolitics of energy routinely scores highly on the critical uncertainty list.

Source: https://www.worldenergy.org/assets/downloads/World_Energy_Issues_Monitor_2022_-_Global_Report.pdf?v=1647603169

Conclusion

- Post COVID
- Russia – Ukraine War
- Zero Emission Targets
- Localization
- Distributed Generation
- Storage
- Electric Vehicles
- New Technologies

«Energy transition should be smart. We need to take into account a sustainable energy transition. It should be responsive, rational, flexible and digital. But more importantly, we need to have political consistency.»

Source: https://www.energydialogue.berlin/speaker/dr-alparslan-bayraktar/

THANK YOU FOR YOUR ATTENTION

osarhan@enerji.gov.tr