"Renewable Energy Sources in Cyprus: Challenges and Prospects"

5th Energy Symposium: "Cyprus: The New Energy Gate of Europe"

Hilton Hotel, Nicosia, November 1, 2017

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Presentation Outline

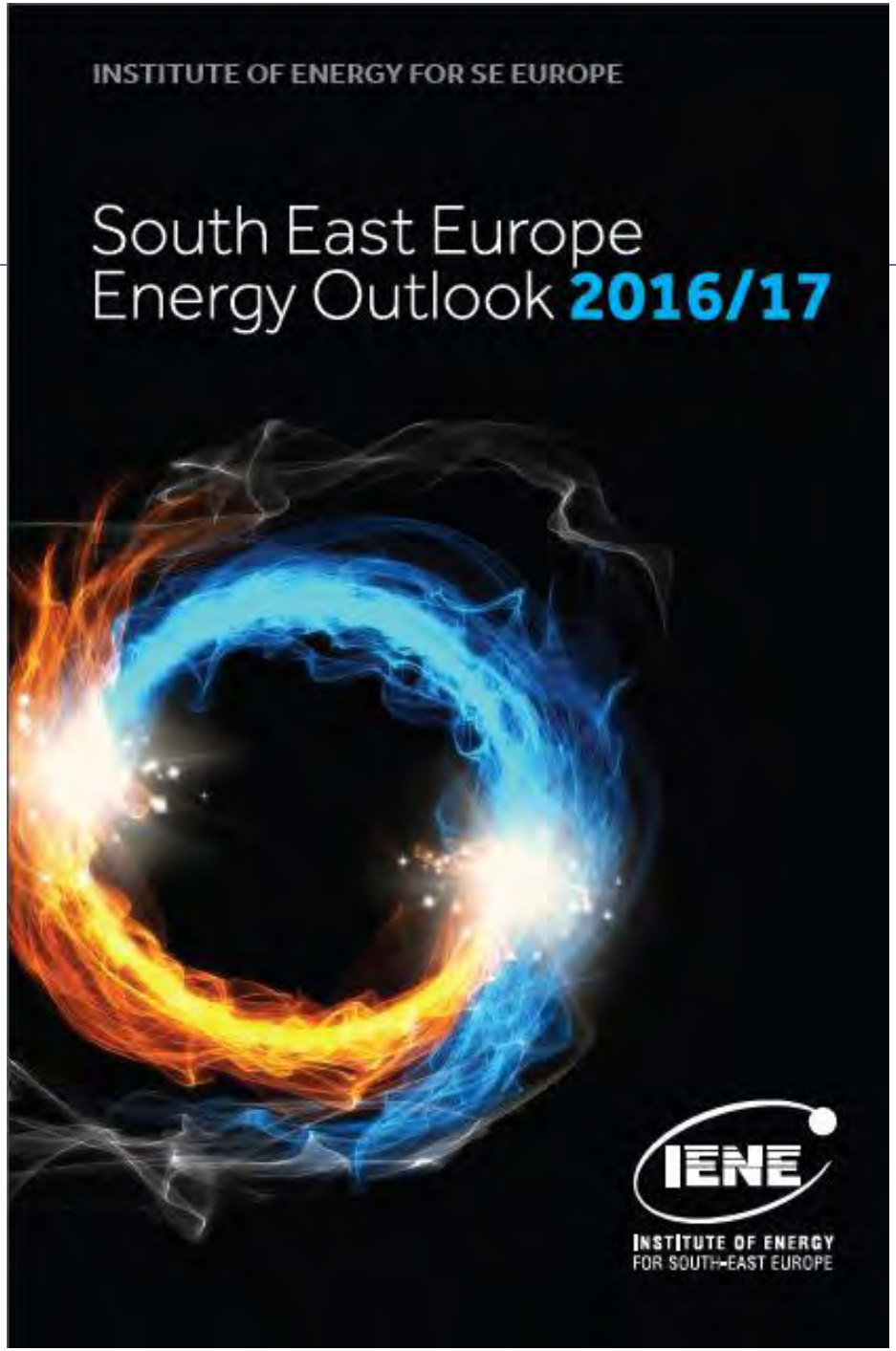
1. Raison d' Être of IENE's "SE Europe Energy Outlook 2016/2017" Study
2. The SE European Region Defined
3. The Economies of SE Europe
4. SE Europe: Gross Inland Consumption by Source (2005 and 2015)
5. Regional Energy Mix: What Lies Ahead?
6. 2016 RES Installed Capacity and Generation in Cyprus
7. EU RES Policy Framework (By 2020, 2030 and 2050)
8. Cyprus RES Framework – 2010 National Action Plan
9. Constraints for Further RES Development in Cyprus
10. SEE Energy Investment Outlook 2016-2025
11. Investment Prospects per RES sector in SE Europe (2016-2025)
12. Funding of RES Projects in Cyprus

Raison d' Être of IENE's "SE Europe Energy Outlook 2016/2017" Study

- Why a regional approach?

Because SE Europe, on the strength of its history, cultural background and current urban and industrial setting, constitutes a region both geographically and geopolitically and it has a strong impact on the rest of Europe and the East Med.

- The need to **understand** the geopolitical and geographical sphere within which IENE operates, but also to **define** and **evaluate** in an objective manner the major policy challenges of the energy sector of the region.
- To **study, analyse** and **understand** the region's energy market structure and associated energy flows.
- To **identify** the important investment and business opportunities across the SE Europe area and assess the region's energy related investment potential within the given business climate.
- Energy Atlas of the region.
- An in-depth study of the energy prospects and perspectives of a particular geographic region, such as SE Europe, has an impressive cumulative effect, as the **sum often exceeds the value of its constituent parts**. Very much along the lines of Aristotle's logic when he proclaimed the *"The whole is greater than the parts"*.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The SE European Region Defined

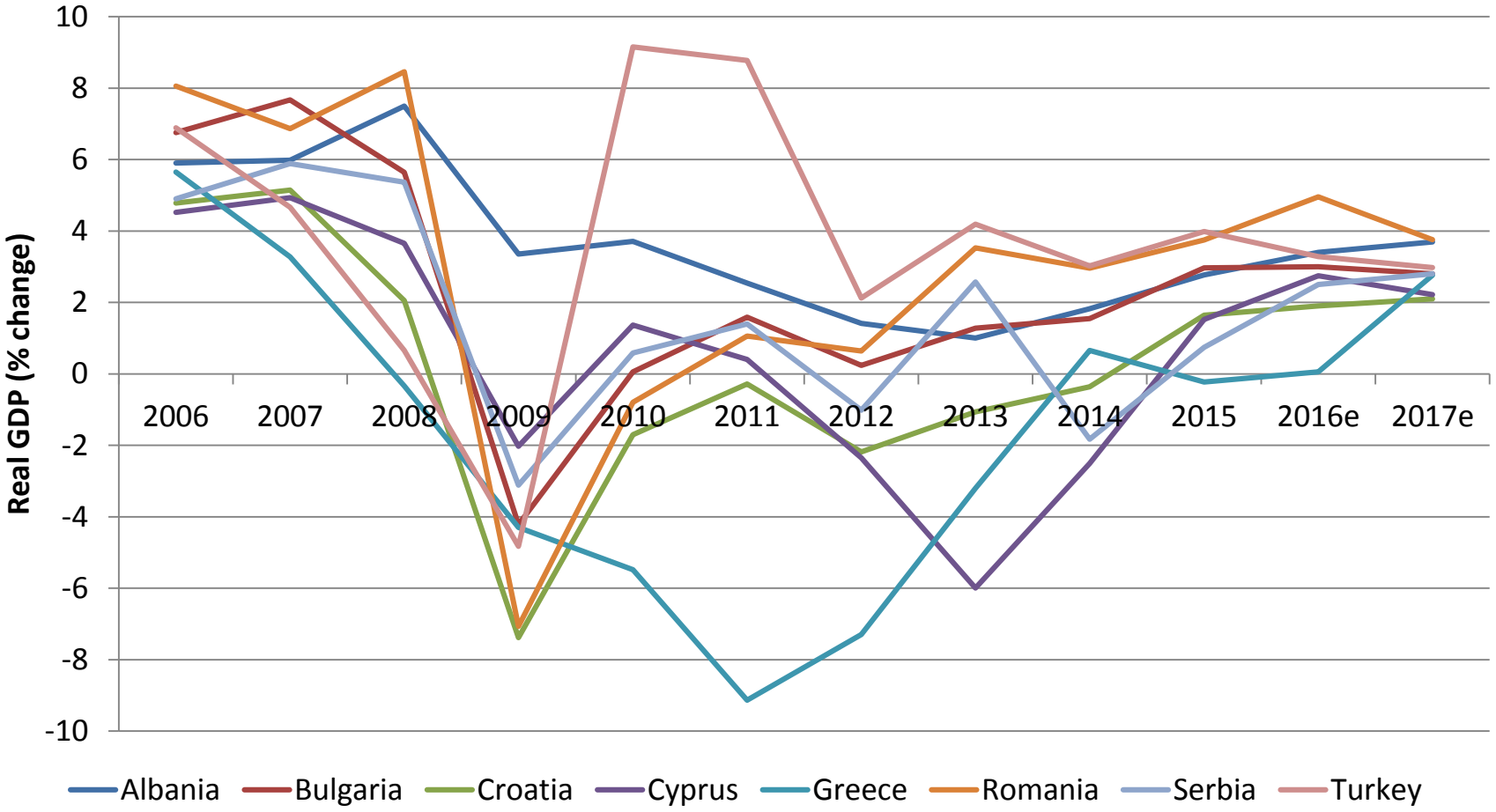
Core Countries

- Albania
- BiH
- Bulgaria
- Croatia
- Cyprus
- FYROM
- Greece
- Kosovo
- Montenegro
- Romania
- Serbia
- Slovenia
- Turkey

Peripheral Countries

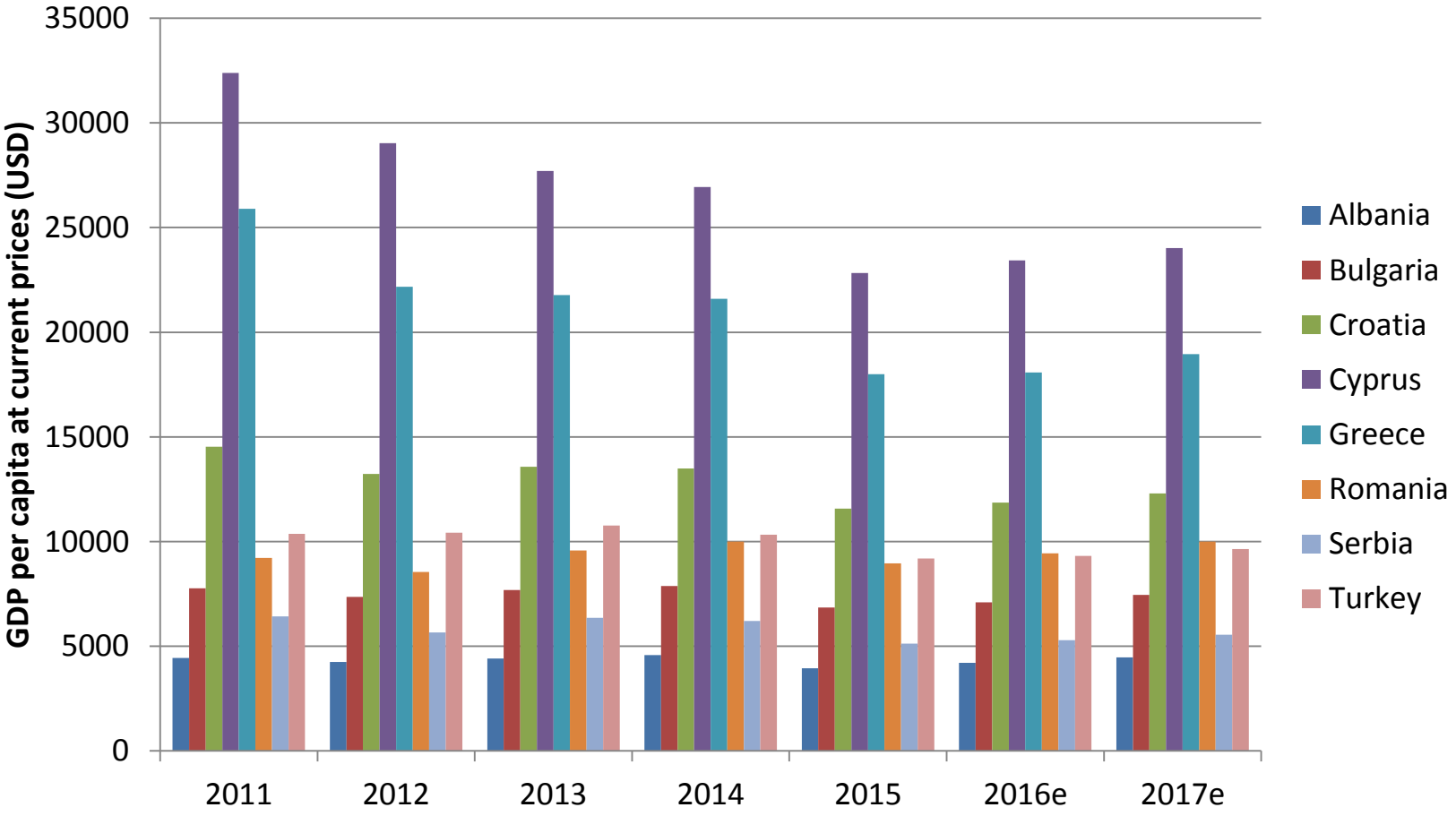
- Egypt
- Hungary
- Israel
- Italy
- Lebanon
- Moldova
- Syria
- Ukraine

The Economies of SE Europe – Real GDP



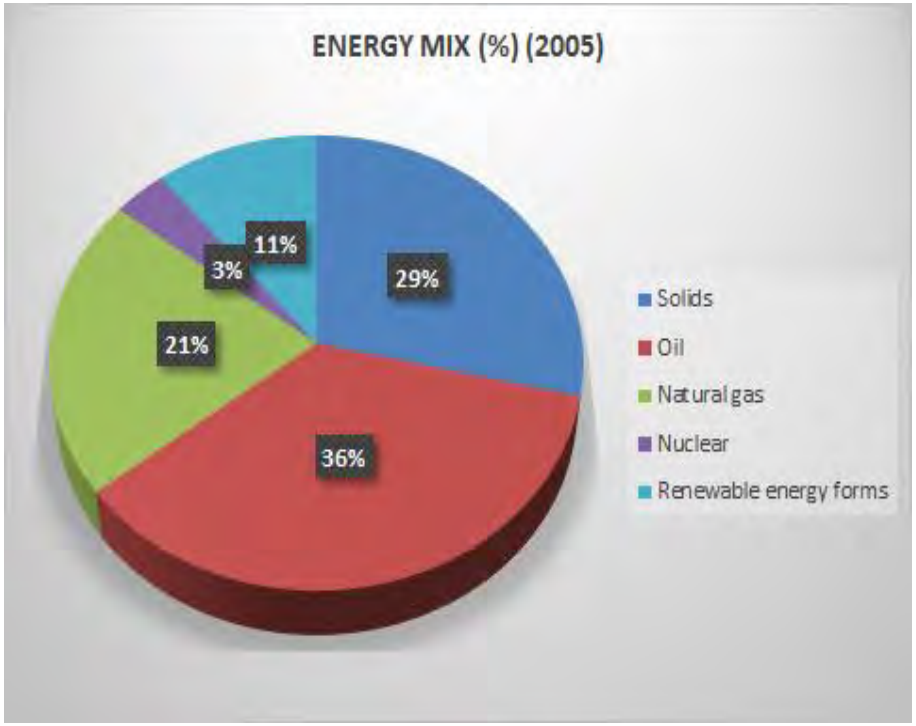
Source: World Economic Outlook Database (IMF, October 2016) and IENE

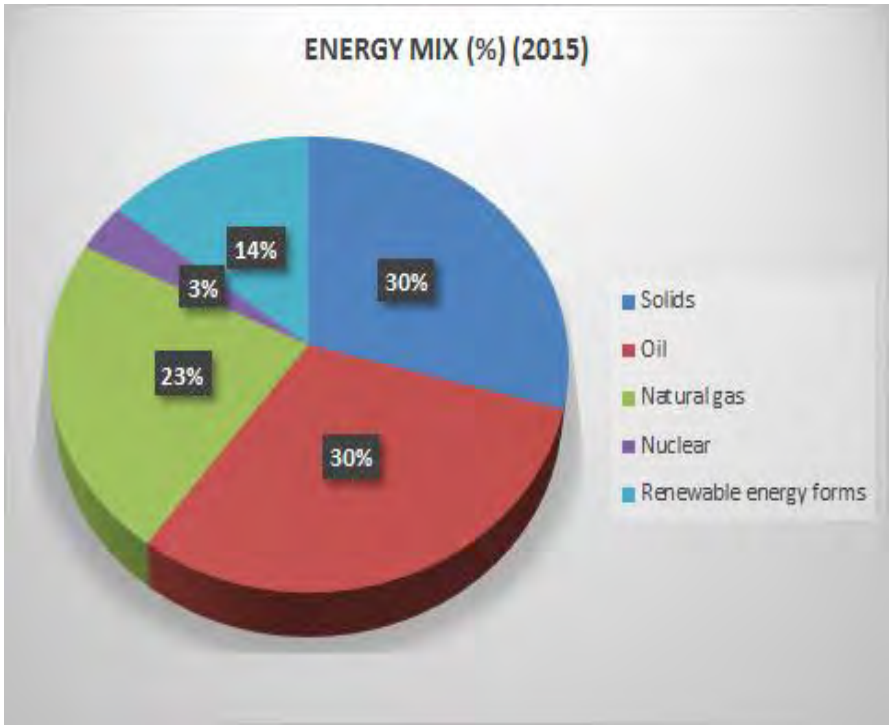
The Economies of SE Europe – GDP per Capita



Source: World Economic Outlook Database (IMF, October 2016) and IENE

SE Europe: Gross Inland Consumption by Source, **Including Turkey** (2005 and 2015)

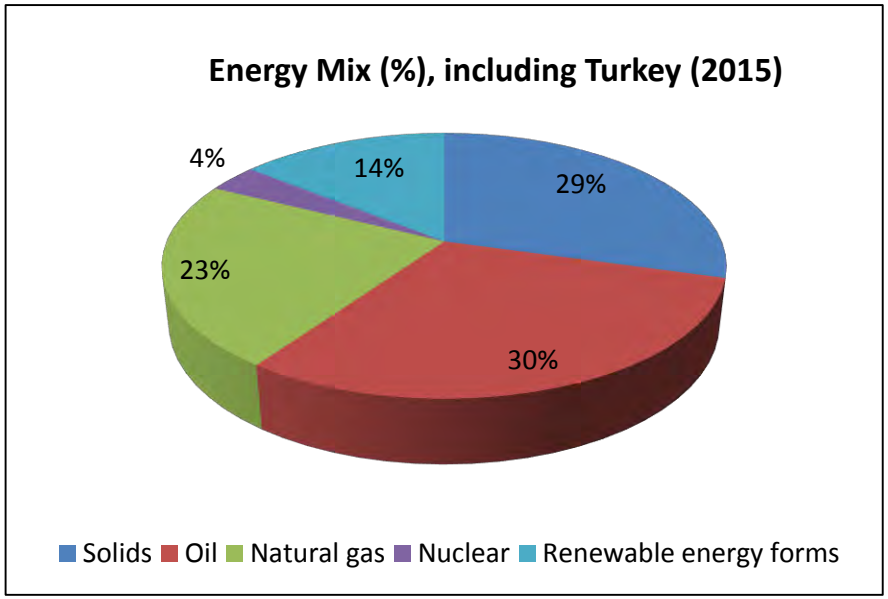


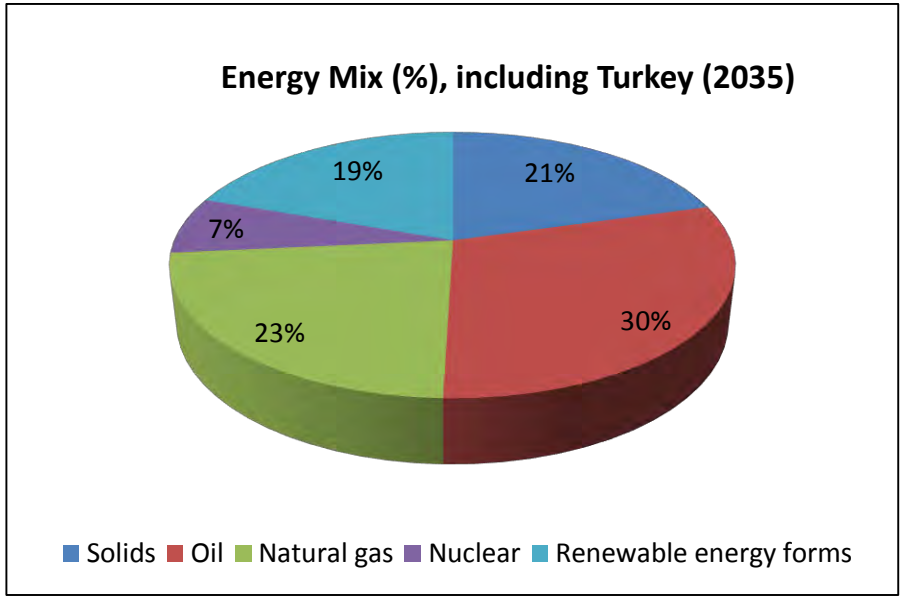


Source: IENE study "South East Europe Energy Outlook 2016/2017", Athens, 2017

Regional Energy Mix: What Lies Ahead?

- The region's changing energy mix (Comparison between 2015 and 2035)
  - Substantial changes are foreseen over next 20 years with lower use of coal (lignite), stable contribution of gas and oil, more RES penetration and higher use of nuclear power.





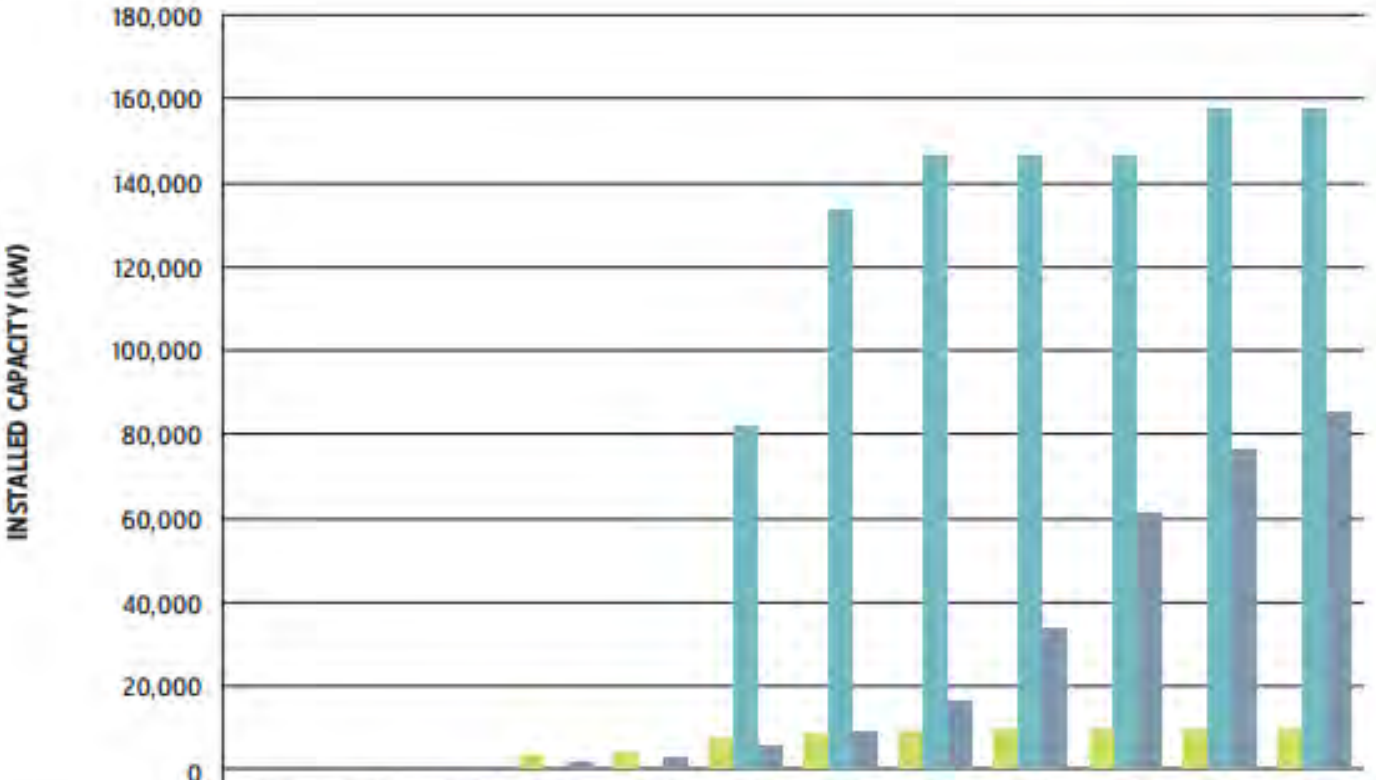
Source: IENE study "South East Europe Energy Outlook 2016/2017", Athens, 2017

Installed RES Capacity (MW) in SE Europe (2015)

Countries	Wind	PV	Small and Large Hydro	Deep Geothermal	Biomass	Total RES Installed Capacity (1)	Total Installed Power Generation Capacity (2)	(1)/(2) as a percentage
Albania	0	0	1,800	0	0	1,800	1,878	96%
BiH	0	0	2,058	0	0	2,058	4,021	51%
Bulgaria	691	1,020	3,400	0	1.8	5,113	15,650	33%
Croatia	422.7	32.2	2,187	0	0	2,631	4,995	52%
Cyprus	157.5	85.7	0	0	9.7	252.9	1,740	14%
FYROM	37	0	581	0	0	618	1,987	31%
Greece	2,150	2,600	3,435	0	46	8,221	17,762	46%
Montenegro	0	0	660	0	0	660	886	74%
Romania	3,129	1,312	6,232	0.05	70	10,743	24,637	43%
Serbia and Kosovo	20	5	2,910	0	0	2,935	8,710	34%
Slovenia	3.4	257	1,270	0	0	1,530	4,183	36%
Turkey	4,718	54.8	23,661	600 (2016)	130	29,164	72,050	40%
Total	**11,328.6**	**5,366.7**	**48,194**	**600.05**	**257.5**	**65,725.9**	**158,499**	**41%**

Source: IENE study “South East Europe Energy Outlook 2016/2017”, Athens, 2017

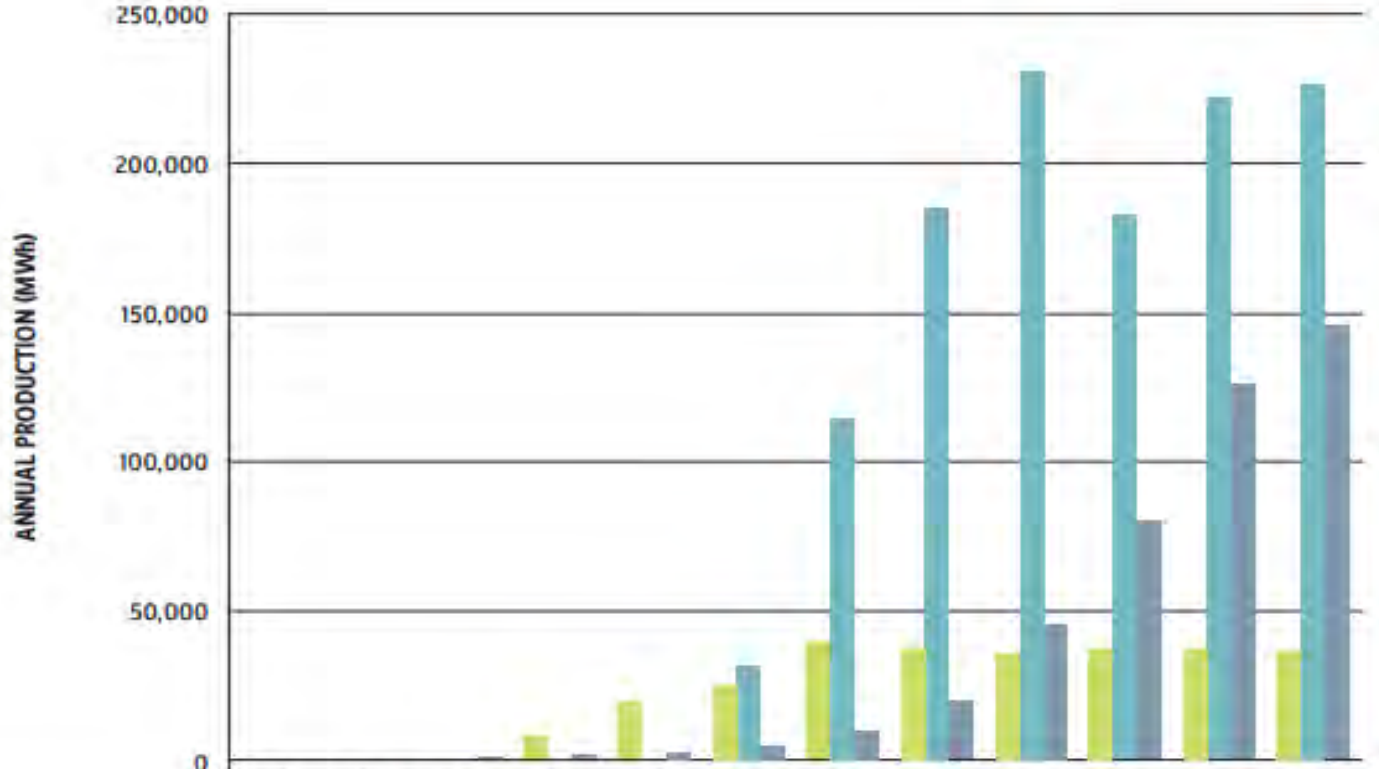
RES Installed Capacity in Cyprus



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
BIOMASS/ BIOGAS UNITS INSTALLED CAPACITY (kW)	0	0	250	3310	3555	7214	7964	8764	9700	9700	9700	9700
WIND TURBINES AND WIND FARMS INSTALLED CAPACITY (kW)	0	0	0	0	0	82000	133500	146700	146700	146700	157500	157500
PHOTOVOLTAIC SYSTEMS INSTALLED CAPACITY (kW)	155	578	843	1586	2695	5564	9319	16364	33900	61200	76500	85681

Source: 2016 Annual Report of Cyprus Energy Regulatory Authority

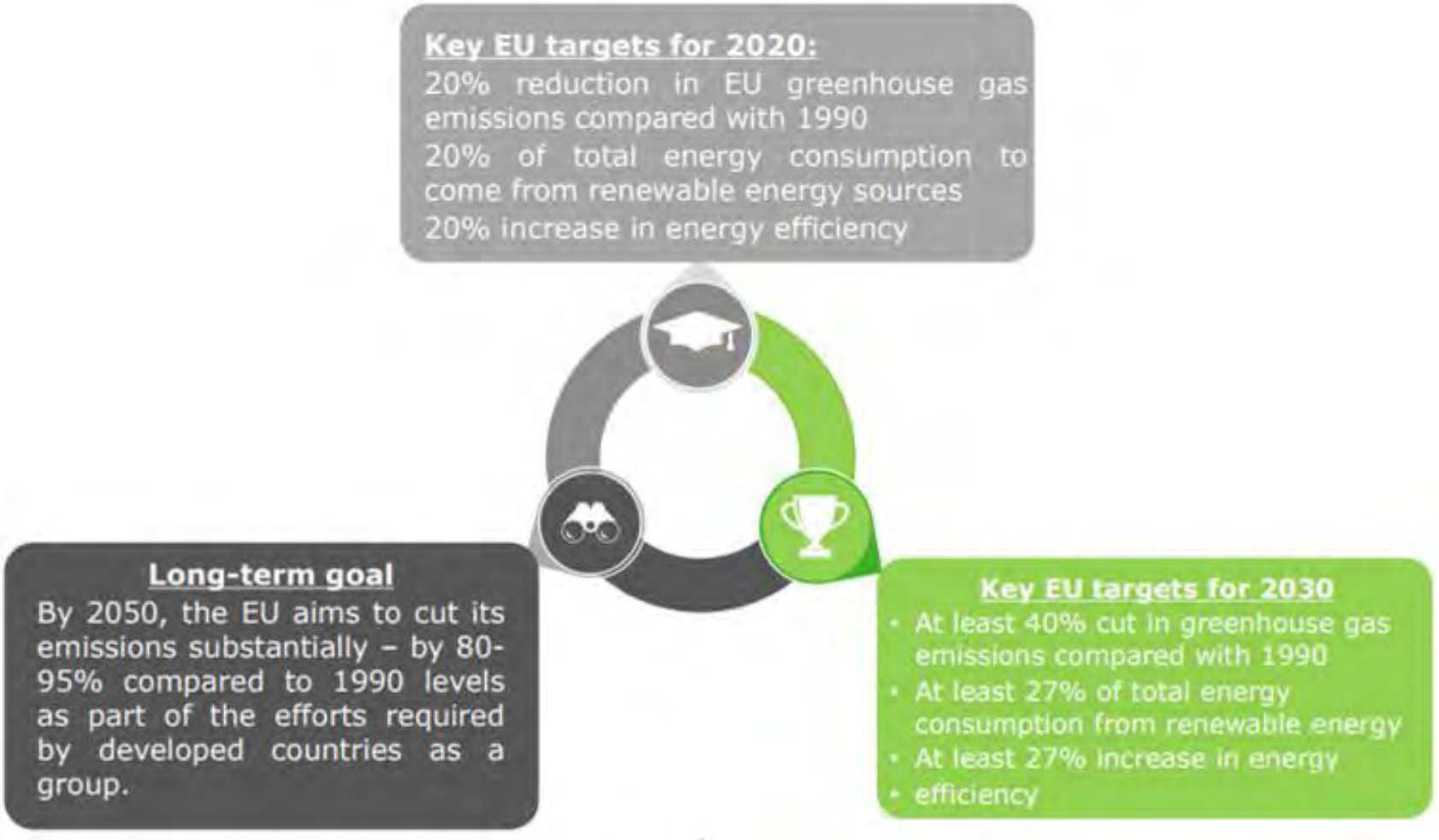
RES Generation in Cyprus



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
BIOMASS/ BIOGAS UNITS PRODUCTION (MWh)	0	0	37	7809	19850	24802	39712	37634	35831	37461	37408	36607
WIND TURBINES AND WIND FARMS PRODUCTION (MWh)	-	-	-	-	-	31370	114251	185149	230610	182418	221398	226267
PHOTOVOLTAIC SYSTEMS PRODUCTION (MWh)	66	322	933	1637	2909	4839	10232	19827	45349	79942	125920	145100

Source: 2016 Annual Report of Cyprus Energy Regulatory Authority

EU RES Policy Framework (by 2020, 2030 and 2050)



Source: European Commission

Cyprus RES Framework – 2010 National Action Plan

- The Government of Cyprus issued a National Action Plan in 2010 for the promotion of RES and Energy Saving

- Due to its isolation from the trans-European electricity networks, Cyprus was allowed to have only **13% of its gross final energy consumption coming from renewables (EU Target 20%) by 2020, while it is worth noting that this share reached 10.5% in 2016.**

- The National Action Plan is under implementation through various support schemes, some of which are the following:
  - Support Schemes for Electricity generation from RES installations. The schemes provide stable feed-in tariffs for 20 years (Wind, PVs, Biomass, CSP).
  - Support Scheme for heating/cooling from RES.
  - Support Scheme for Energy Conservation.

Constraints for Further RES Development in Cyprus

- The grid system of Cyprus has certain inherent and technical limitations that affect further RES penetration and the reliability of the country's energy system. Some of them include:
  - Lack of interconnections to the trans-European electricity networks
  - Lack of storage capacity for electricity generation from RES; there are no RES installations with storage capability
  - Limitation to the amount of intermittent RES that may be connected to the electricity system
  - Need to introduce smart grids in the national network
  - The installation of large conventional units at Vasilikos together with the minimum limit for stable generation of 50% per conventional unit, according to Deloitte Cyprus, are limiting RES penetration
  - Solutions that can offer baseload generation, including CSP, must be examined more closely

SEE Energy Investment Outlook 2016-2025

- The **investment prospects** in the energy sector of SE Europe over the next 10 years can only be described as **positive**.

- In terms of planned investments, a group of **five countries (i.e. Turkey, Bulgaria, Romania, Serbia, Greece)** appear to be moving **much faster than others** in attracting the needed investment for a variety of energy projects, while progress in the rest of the countries is moving more slowly.

- The region as a whole can be considered as presenting **attractive business opportunities in almost all branches of the energy sector**. The present analysis shows that investment in the energy sector will be spread as follows between countries and interregional projects. This analysis involves **two scenarios:**
  - An **optimistic one** (with an average real GDP growth of 3% over 2016-2025 and maximum investments) and
  - A **reference one** (with an average real GDP growth of 1% over 2016-2025 and substantial part of investments).

Findings of SEE Energy Investment Outlook 2016-2025 per country

SEE Countries	Scenario A: Total Investments (in million euros)	Scenario B: Total Investments (in million euros)
Albania	7,460	8,258
Bosnia & Herzegovina	8,722	10,060
Bulgaria	11,050	12,663
Croatia	8,525	9,178
Cyprus	7,350	8,769
FYROM	3,400	4,373
Greece	23,300	30,192
Kosovo	2,605	3,377
Montenegro	2,400	3,653
Romania	20,630	22,716
Serbia	11,260	13,527
Slovenia	3,185	4,891
Turkey	124,935	141,623
TOTAL	**234,822**	**273,280**

Source: IENE study "South East Europe Energy Outlook 2016/2017", Athens, 2017

Findings of SEE Energy Investment Outlook 2016-2025 per sector

Sector	Total Investment (in million euros)	
	Scenario A	Scenario B
Oil Upstream (Research, Exploration and Production)	25,450	32,288
Oil Downstream/Midstream (Incl. liquid biofuels)	13,340	18,757
Electricity		
Thermal Plants		
Nuclear Plants	139,473	146,369
Lignite Mine Development		
Grids - Upgrade and Expansion		
HV Transmission Lines		
Gas		
Main and branch gas pipelines		
Gas Storage	16,550	26,460
Town grids		
LNG Terminals and Liquefaction plants		
RES (Wind, PV, Biomass, Mini Hydro, Geothermal)	40,009	49,406
TOTAL	**234,822**	**273,280**
Intraregional Mega Projects		
Oil Pipelines	-	1,000
Gas Pipelines	33,350	51,361
Electricity Interconnectors	4,700	7,150
Grand Total	**272,872**	**332,791**

Source: IENE study “South East Europe Energy Outlook 2016/2017”, Athens, 2017

Investment Prospects per RES sector in SE Europe over 2016-2025 (in Million Euros) (Reference Scenario)

	Hydro	Wind	PV	CSP	Biomass (including liquid biofuels)	Geothermal	**Total**
Albania	3,120	250	250	-	260	-	**3,880**
BiH	2,190	632	935	-	160	-	**3,917**
Bulgaria	380	300	200	-	120	-	**1,000**
Croatia	750	500	50	-	60	85	**1,445**
Cyprus	-	250	350	200	300	-	**1,100**
FYROM	1,150	90	10	-	20	-	**1,270**
Greece	500	5,500	2,000	200	700	300	**9,200**
Kosovo	300	190	10	-	45	-	**545**
Montenegro	720	160	30	-	100	-	**1,010**
Romania	1,900	640	150	-	280	-	**2,970**
Serbia	1,340	665	150	-	30	10	**2,195**
Slovenia	325	50	70	-	15	-	**460**
Turkey	11,350	10,500	6,000, including CSP	-	3,200	1,200	**32,250**
Total	**24,025**	**19,727**	**10,205**	**400**	**5,290**	**1,595**	**61,242**

Source: IENE study “South East Europe Energy Outlook 2016/2017”, Athens, 2017

Funding of RES Projects in Cyprus

- The **main sources of finance** for planned RES projects in Cyprus include:
  - Government/own resources
  - International Financial Institutions (IFIs)
    - European Commission
    - European Bank for Reconstruction and Development (EBRD)
    - European Investment Bank (EIB)
    - World Bank
    - German government-owned development bank KfW
    - European Western Balkans Joint Fund (EWBJF)
    - International Development Association (IDA)
  - Commercial banks/private investors
  - Financial facilities for investments in energy efficiency and renewable energy

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Thank you for your attention

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