Global and Regional Energy Challenges

Joint ROEC/IENE Event in Bucharest

EC Representation in Bucharest

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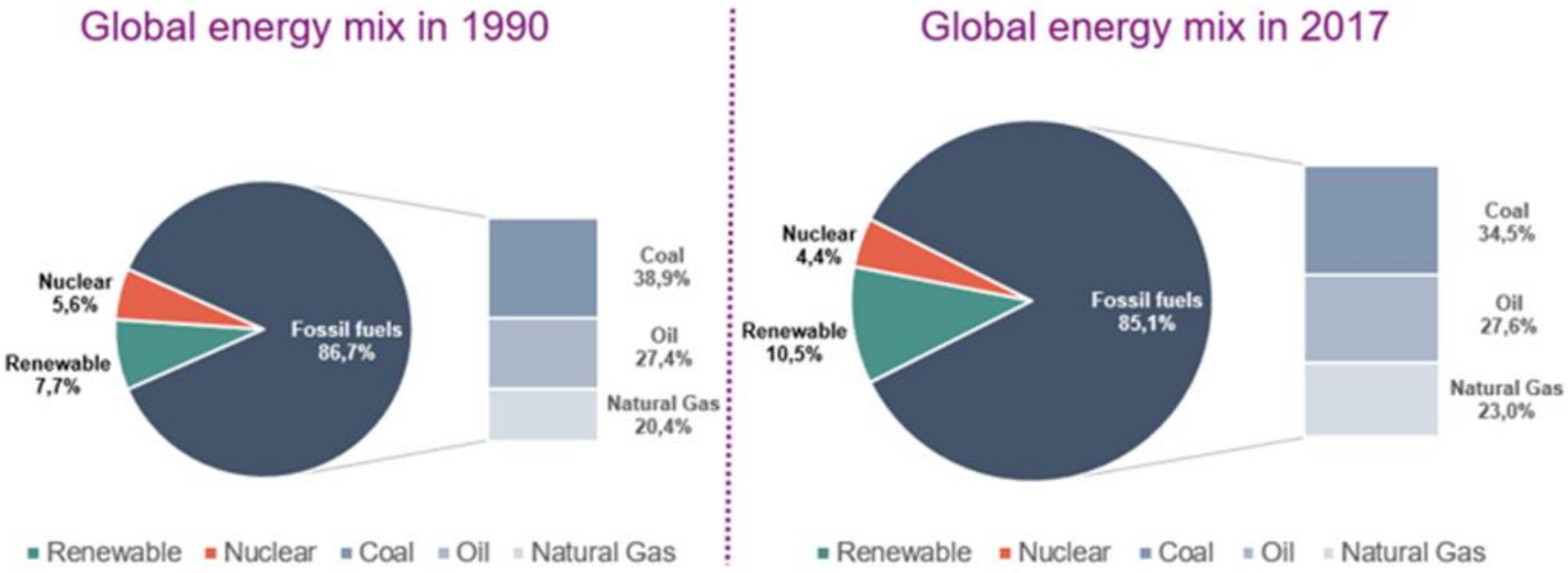
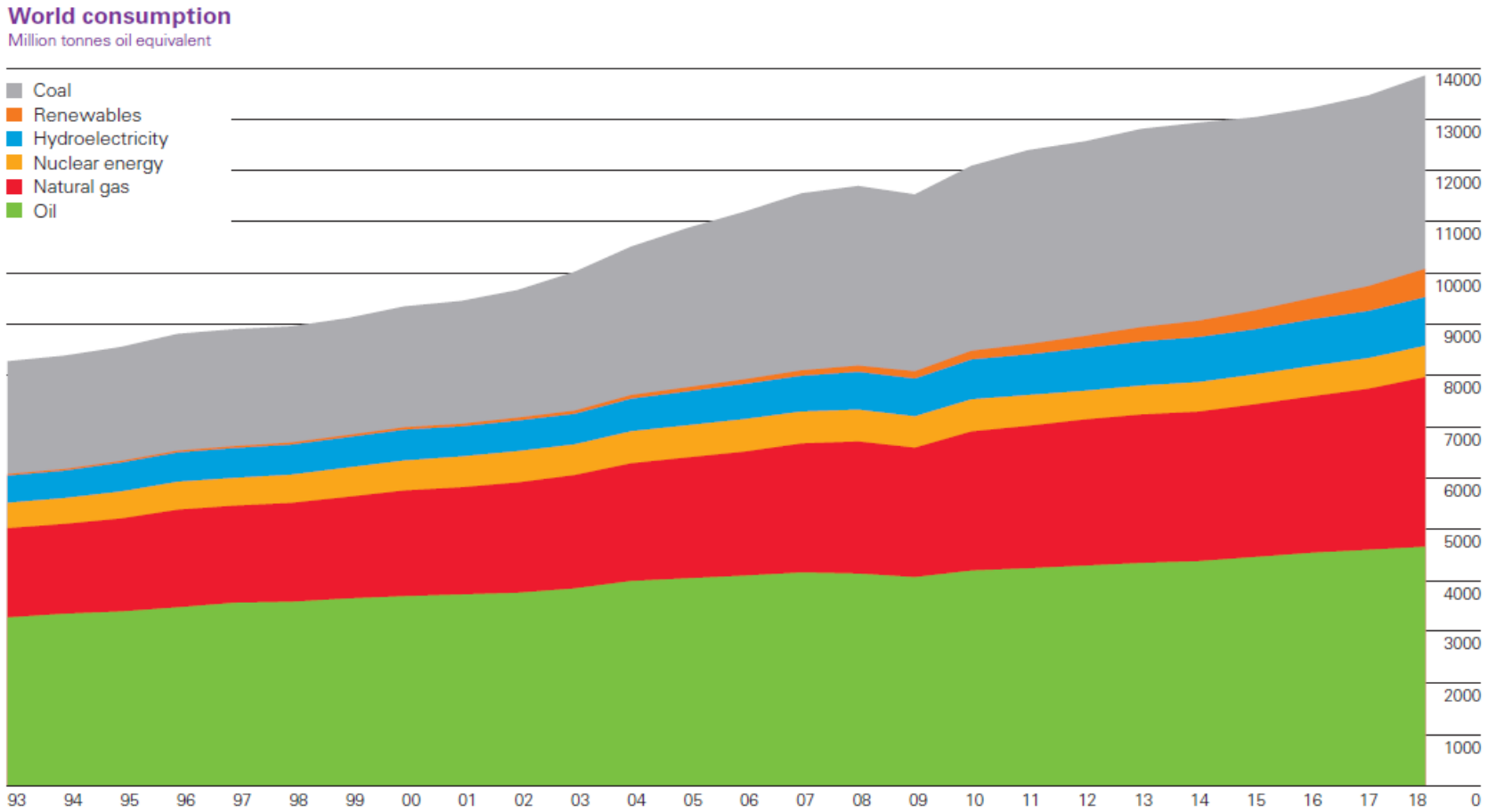
INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE

The Evolution of the Global Energy Mix (1990 and 2017)



Sources: Edmond de Rothschild Financial Group, IEA

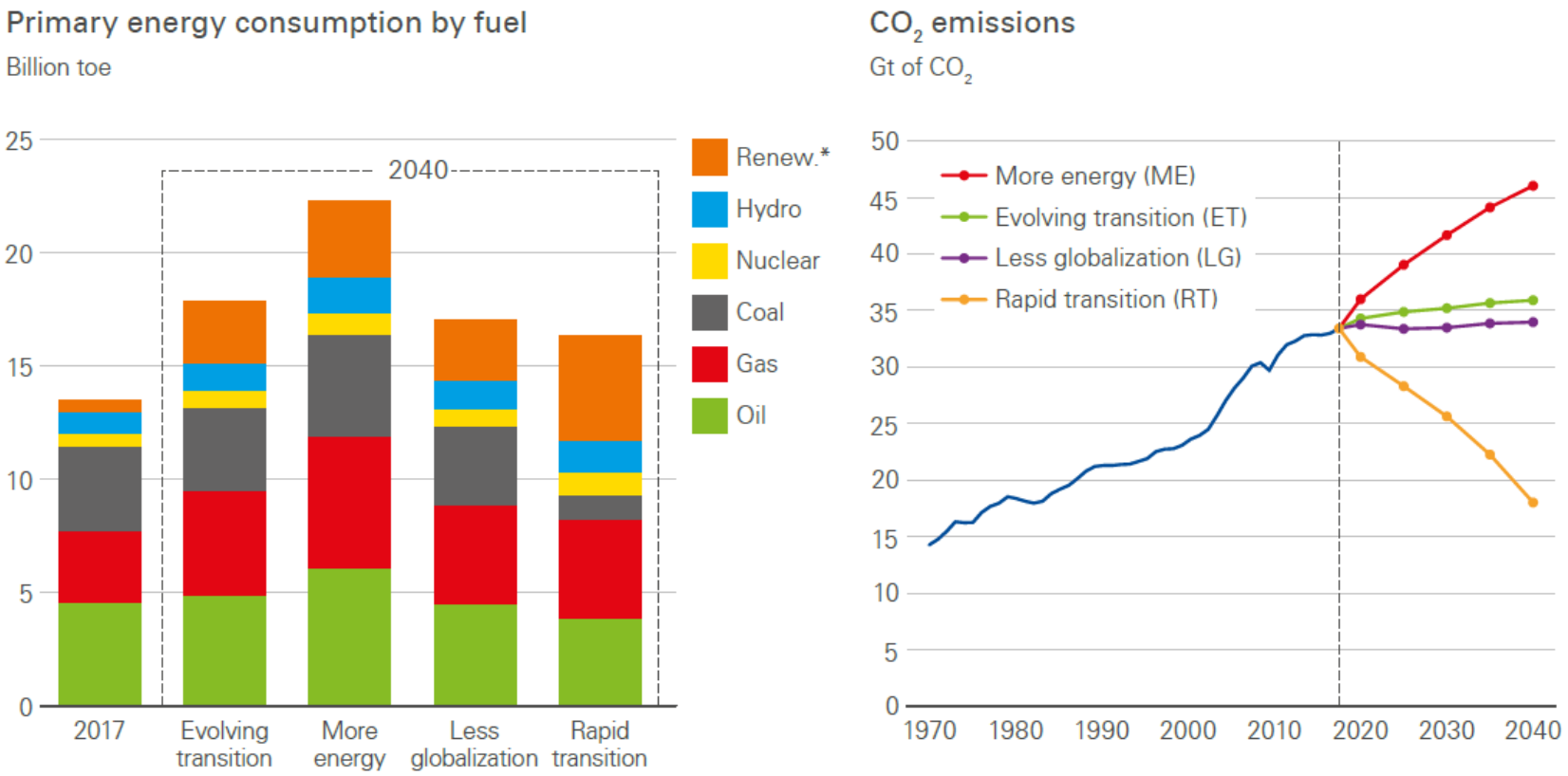
Global Energy Consumption (1993-2018)



Global energy consumption increased by 2.9% in 2018. Growth was the strongest since 2010 and almost double the 10-year average. The demand for all fuels increased but growth was particularly strong in the case of gas (168 mtoe, accounting for 43% of the global increase) and renewables (71 mtoe, 18% of the global increase). In the OECD, energy demand increased by 82 mtoe on the back of strong gas demand growth (70 mtoe). In the non-OECD, energy demand growth (308 mtoe) was more evenly distributed with gas (98 mtoe), coal (85 mtoe) and oil (47 mtoe) accounting for most of the growth.

Source: BP Statistical Review of World Energy 2019

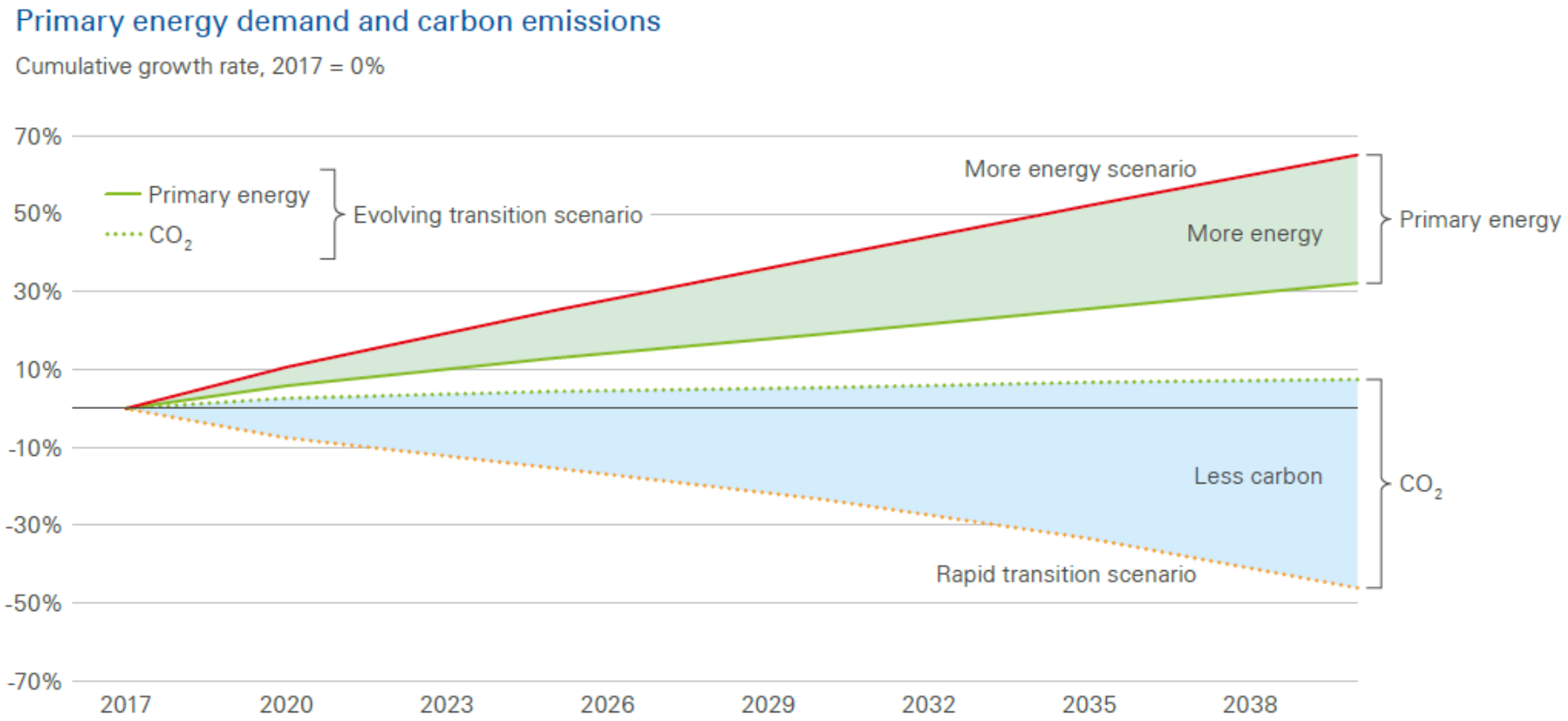
Primary Energy Consumption by Fuel and CO_2 Emissions



*Renewables includes wind, solar, geothermal, biomass, and biofuels. For full list of data definitions see p138

Source: BP Energy Outlook 2019

Primary Energy Demand and Carbon Emissions



Source: BP Energy Outlook 2019

World Primary Energy Demand by Fuel and Scenario (Mtoe)

			New Policies		Current Policies		Sustainable Development	
	2000	2017	2025	2040	2025	2040	2025	2040
Coal	2 308	3 750	3 768	3 809	3 998	4 769	3 045	1 597
Oil	3 665	4 435	4 754	4 894	4 902	5 570	4 334	3 156
Gas	2 071	3 107	3 539	4 436	3 616	4 804	3 454	3 433
Nuclear	675	688	805	971	803	951	861	1 293
Renewables	662	1 334	1 855	3 014	1 798	2 642	2 056	4 159
Hydro	225	353	415	531	413	514	431	601
Modern bioenergy	377	727	924	1 260	906	1 181	976	1 427
Other	60	254	516	1 223	479	948	648	2 132
Solid biomass	646	658	666	591	666	591	396	77
Total	**10 027**	**13 972**	**15 388**	**17 715**	**15 782**	**19 328**	**14 146**	**13 715**
Fossil fuel share	*80%*	*81%*	*78%*	*74%*	*79%*	*78%*	*77%*	*60%*
CO_2 emissions (Gt)	**23.1**	**32.6**	**33.9**	**35.9**	**35.5**	**42.5**	**29.5**	**17.6**

Notes: Mtoe = million tonnes of oil equivalent; Gt = gigatonnes. Solid biomass includes its traditional use in three-stone fires and in improved cookstoves.

Source: IEA World Energy Outlook 2018

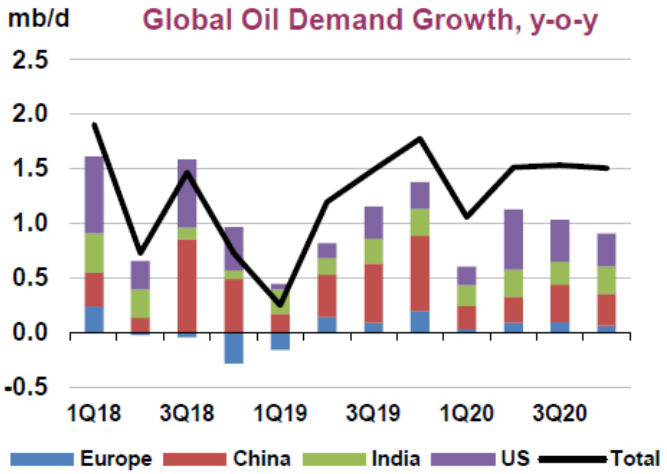
Global Oil Demand (2018-2020)

Global Oil Demand (2018-2020)

(million barrels per day)*

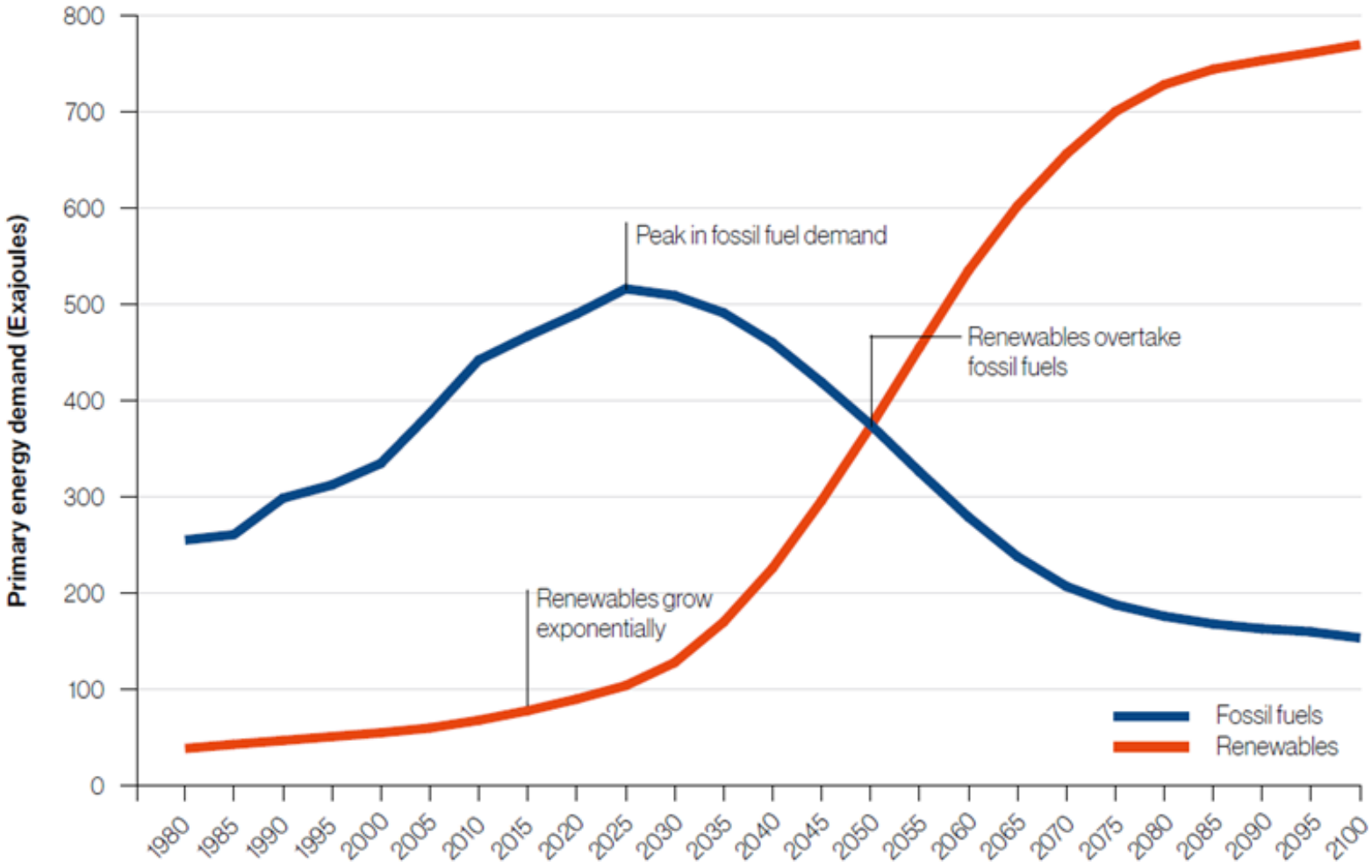
	1Q18	2Q18	3Q18	4Q18	2018	1Q19	2Q19	3Q19	4Q19	2019	1Q20	2Q20	3Q20	4Q20	2020
Africa	4.3	4.3	4.2	4.3	4.3	4.4	4.4	4.2	4.4	4.4	4.5	4.4	4.3	4.4	4.4
Americas	31.6	31.7	32.3	32.1	31.9	31.4	31.9	32.6	32.3	32.1	31.6	32.5	33.1	32.7	32.5
Asia/Pacific	35.0	34.7	34.3	35.1	34.8	35.4	35.2	35.2	36.1	35.4	36.0	35.9	35.9	37.0	36.2
Europe	14.8	15.0	15.5	14.9	15.1	14.7	15.2	15.6	15.1	15.2	14.7	15.3	15.7	15.2	15.2
FSU	4.5	4.6	4.9	4.8	4.7	4.7	4.8	5.0	5.0	4.9	4.8	4.8	5.1	5.0	4.9
Middle East	8.2	8.5	8.8	8.2	8.4	8.2	8.6	8.9	8.3	8.5	8.2	8.6	8.9	8.3	8.5
World	**98.5**	**98.8**	**99.9**	**99.4**	**99.2**	**98.7**	**100.0**	**101.4**	**101.2**	**100.3**	**99.8**	**101.6**	**102.9**	**102.7**	**101.7**
Annual Chg (%)	2.0	0.7	1.5	0.7	1.2	0.3	1.2	1.5	1.8	1.2	1.1	1.5	1.5	1.5	1.4
Annual Chg (mb/d)	1.9	0.7	1.5	0.7	1.2	0.2	1.2	1.5	1.8	1.2	1.1	1.5	1.5	1.5	1.4
Changes from last OMR (mb/d)	0.0	0.0	0.0	0.0	0.0	-0.4	-0.3	0.2	0.1	-0.1					

* Including biofuels



Source: IEA Oil Market Report, June 14, 2019

The Global Energy Transition Framework



Source: Shell Sky Scenario

The Future of Oil Companies and Stranded Assets

Investors and markets are at risk from $2.2 trillion of stranded fossil fuel assets

Carbon Tracker Initiative

Follow us @carbonbubble #strandedassets

Coal is the most carbon intensive fossil fuel. No new coal mines will be needed and nearly **$220bln** of projects are at risk.

Oil demand will peak around 2020 and more than **$1.4 trillion** of projects are at risk.

Growth in **gas** will disappoint industry expectations, especially in expensive LNG. Planned spending of more than **$520bln** is at risk.

Which are the companies with most financial exposure?

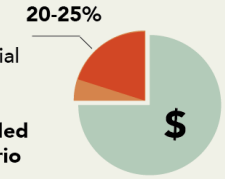
We identified the **20 companies** with most capex in the danger zone.

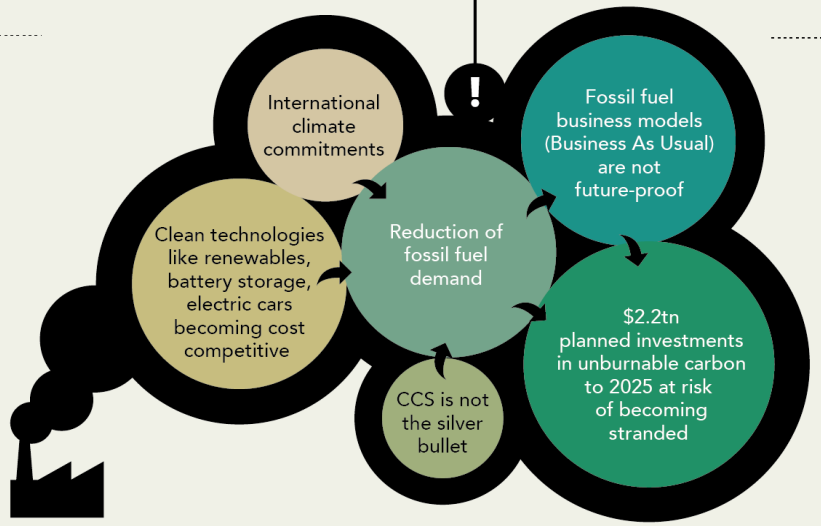
Top 3:

Shell
Exxon
Pemex

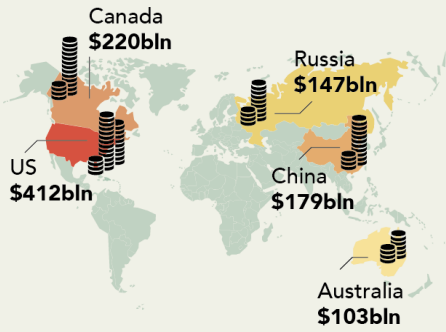
should each avoid potential investment of over **$70bln**

Oil and gas majors' potential investment on projects that **won't be needed in a 2°C scenario**





Which are the countries with most financial exposure?



Do the 2°C stress-test

Institutional Investors
Derisk portfolio by identifying companies aligned with a 2°C demand scenario or engaging with those that are not

Companies
Provide information on the decisions taken to align corporate strategy with a 2°C demand scenario

Governments
Stress test national resources, infrastructure and energy plans against a 2°C demand scenario

Analysts & Advisors
Provide sensitivity analysis of which stocks are more resilient to a 2°C demand scenario

Source: "The $2 trillion stranded assets danger zone: How fossil fuel firms risk destroying investor returns", Carbon Tracker 2015

The report can be downloaded at http://www.carbontracker.org/report/stranded-assets-danger-zone/

The SE European Region Defined

Core countries

- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Cyprus
- Greece
- Hungary
- Israel
- Kosovo
- Montenegro
- North Macedonia
- Romania
- Serbia
- Slovenia
- Turkey

Peripheral countries

- Austria
- Egypt
- Italy
- Lebanon
- Moldova
- Slovakia
- Syria
- Ukraine

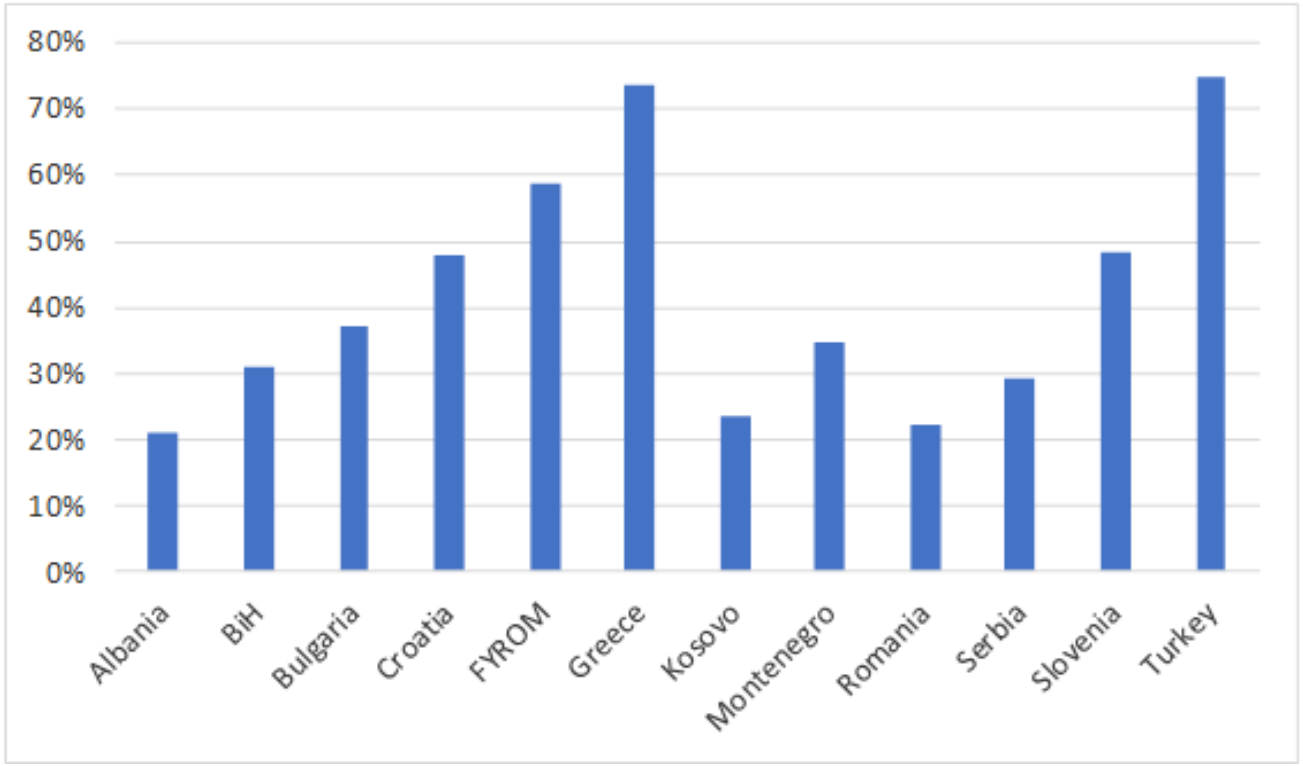
Source: IENE

Key Regional Energy Issues

- Marked divergence between EU and SEE energy strategies
- SEE is more energy security vulnerable than the rest of Europe
- Energy supply diversification in SE Europe is less important than security of energy transportation and transmission (oil, gas and electricity)
- SEE's high hydrocarbon dependence
- Electricity's newcomer gas alters supply balance
- Lack of adequate electricity and gas interconnections
- Coal is and will continue for sometime to be relevant
- SEE's path towards decarbonisation is difficult and uncertain
- Nuclear remains a viable option for SEE power generation
- RES growth impeded due to policy failures, financial and regulatory framework and electricity grid constraints
- Energy poverty is emerging as a regional concern mainly related to deteriorating social conditions

Key Regional Energy Issues – Energy Import Dependency

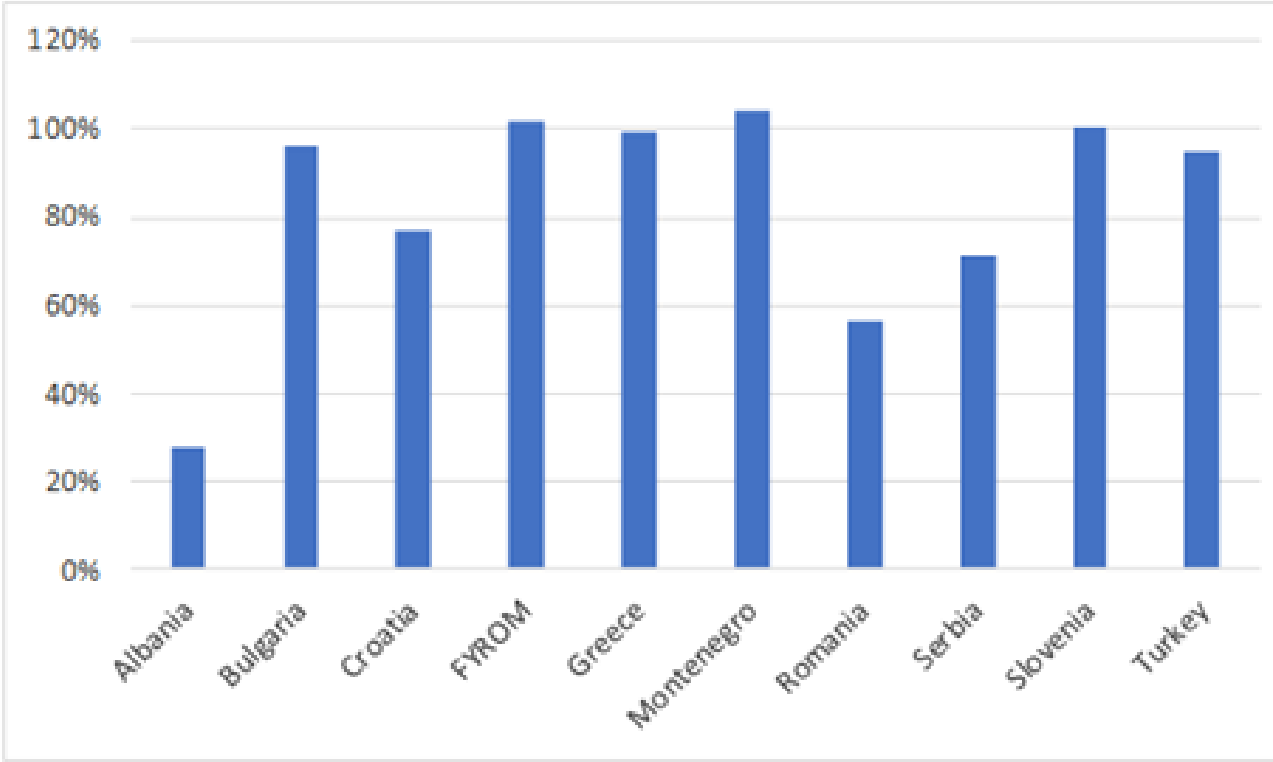
Energy Import Dependency (%) in SE Europe (2016)



Sources: Eurostat, IENE

Key Regional Energy Issues – Oil Import Dependency

Oil Import Dependency (%) in SE Europe (2016)

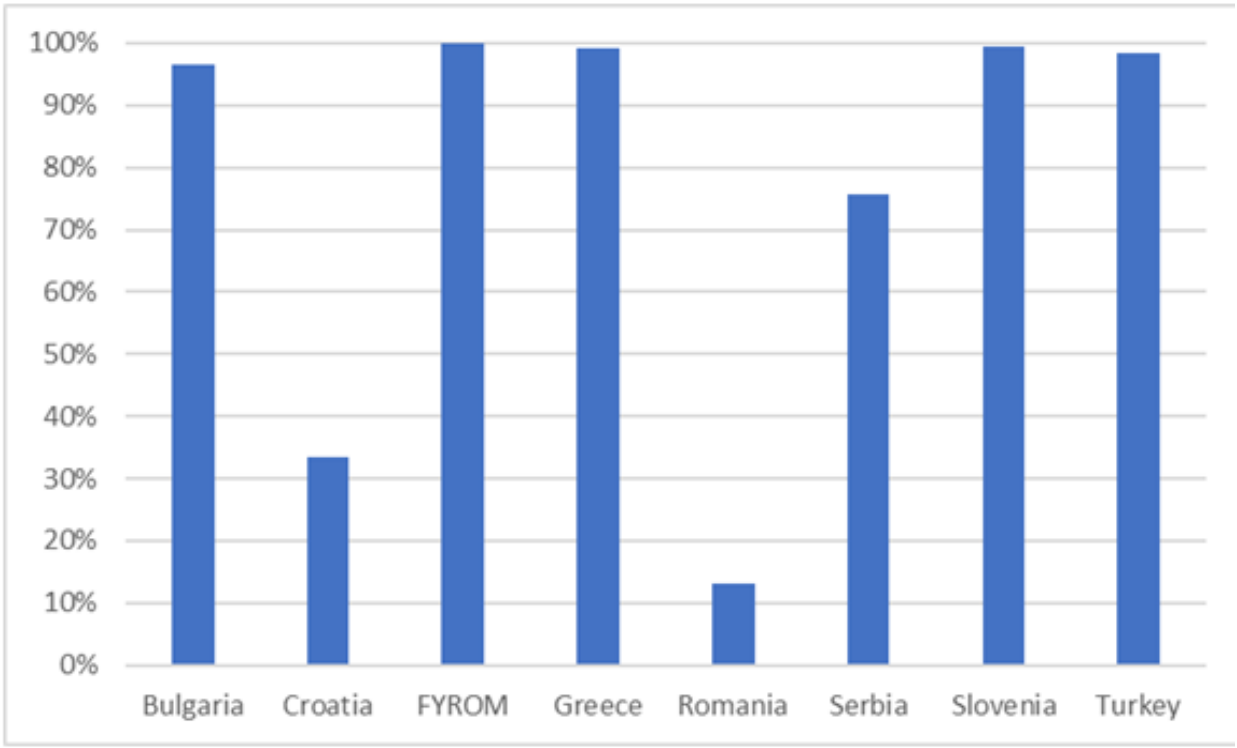


Note: A dependency rate in excess of 100% relates to the build-up of stocks. Eurostat provides no data for Bosnia and Herzegovina and Kosovo.

Sources: Eurostat, IENE

Key Regional Energy Issues – Gas Import Dependency

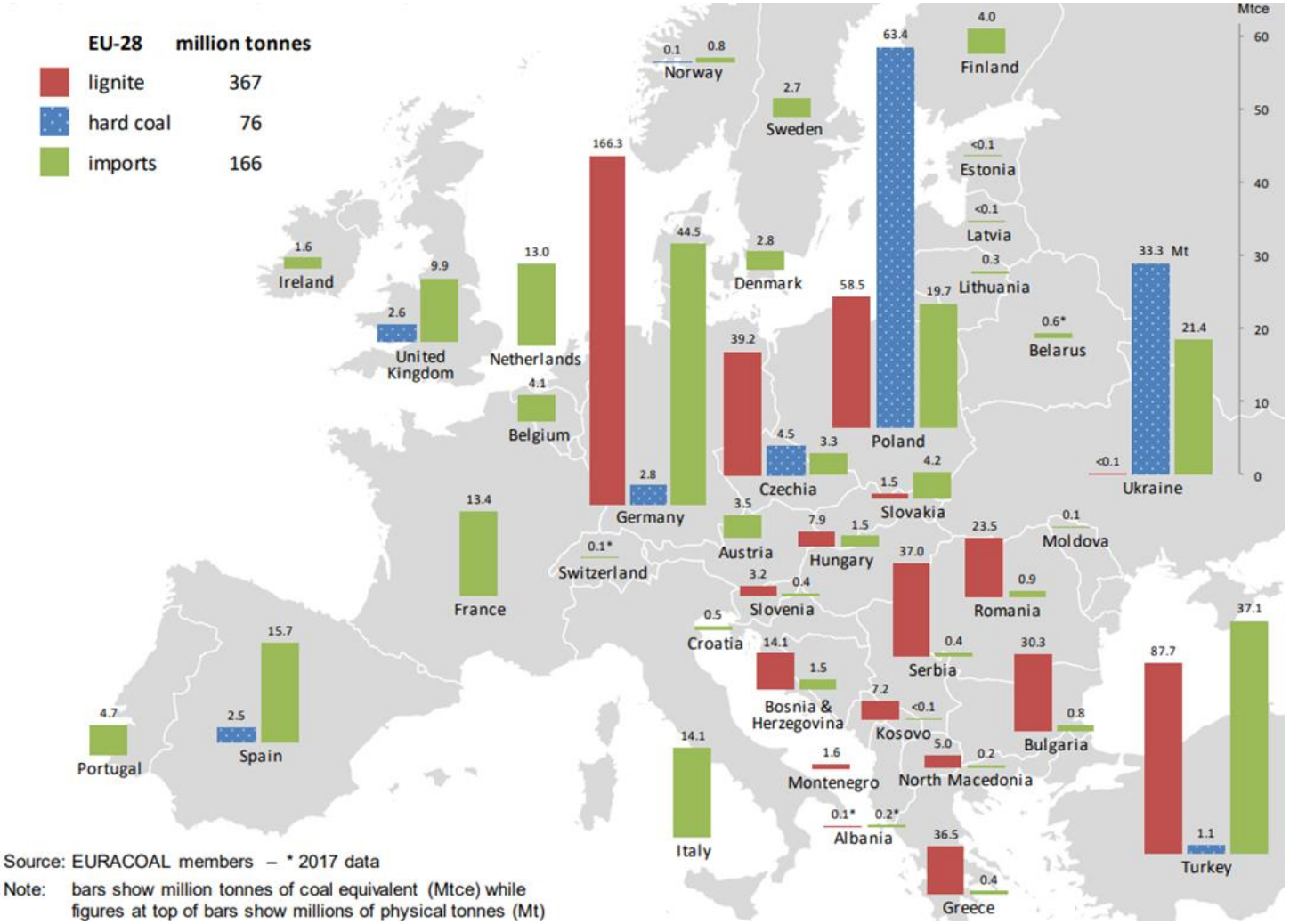
Gas Import Dependency (%) in SE Europe (2016)



Note: Albania, Cyprus, Montenegro and Kosovo do not import natural gas.

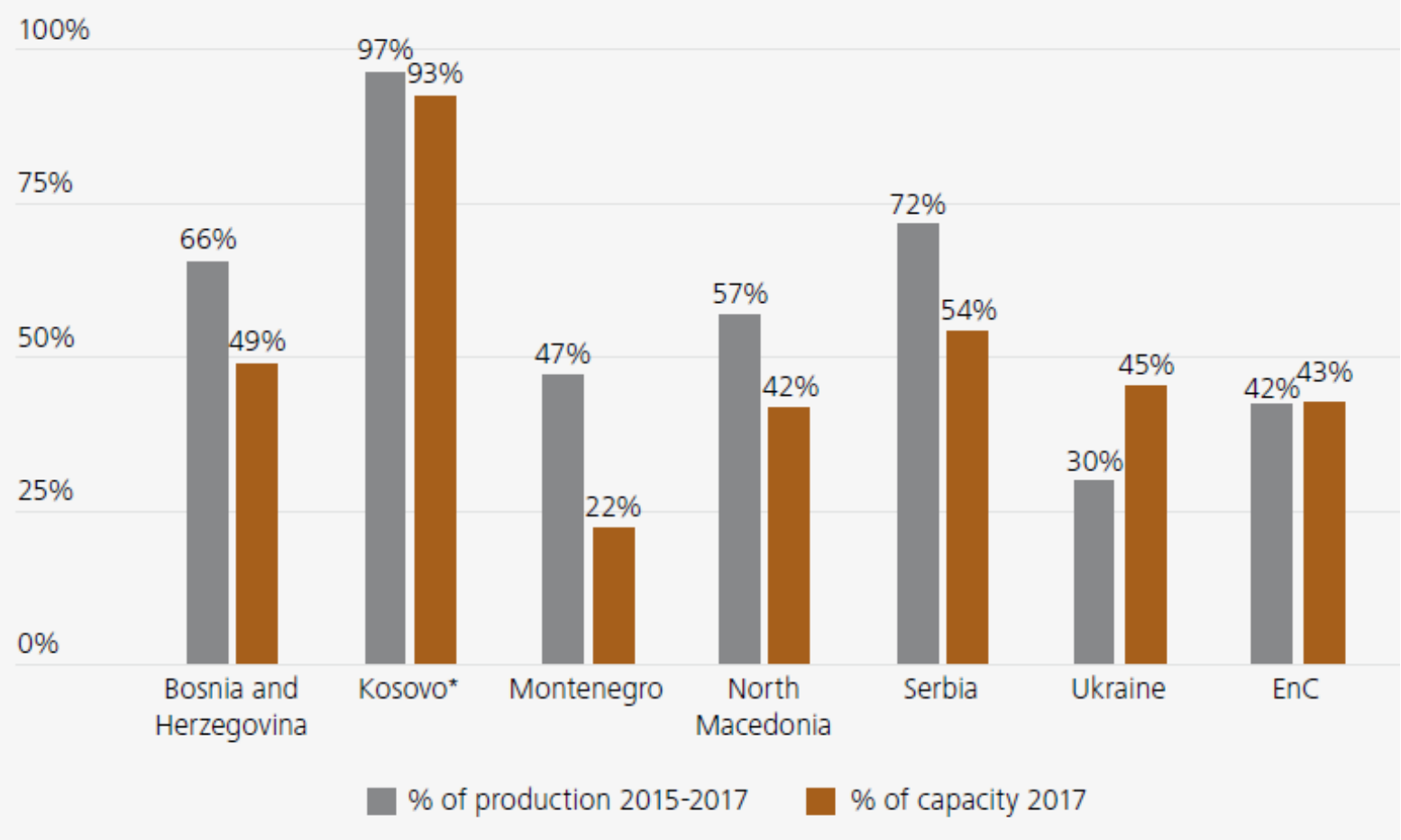
Sources: Eurostat, IENE

Production and Imports of Lignite and Hard Coal in Europe (2017)



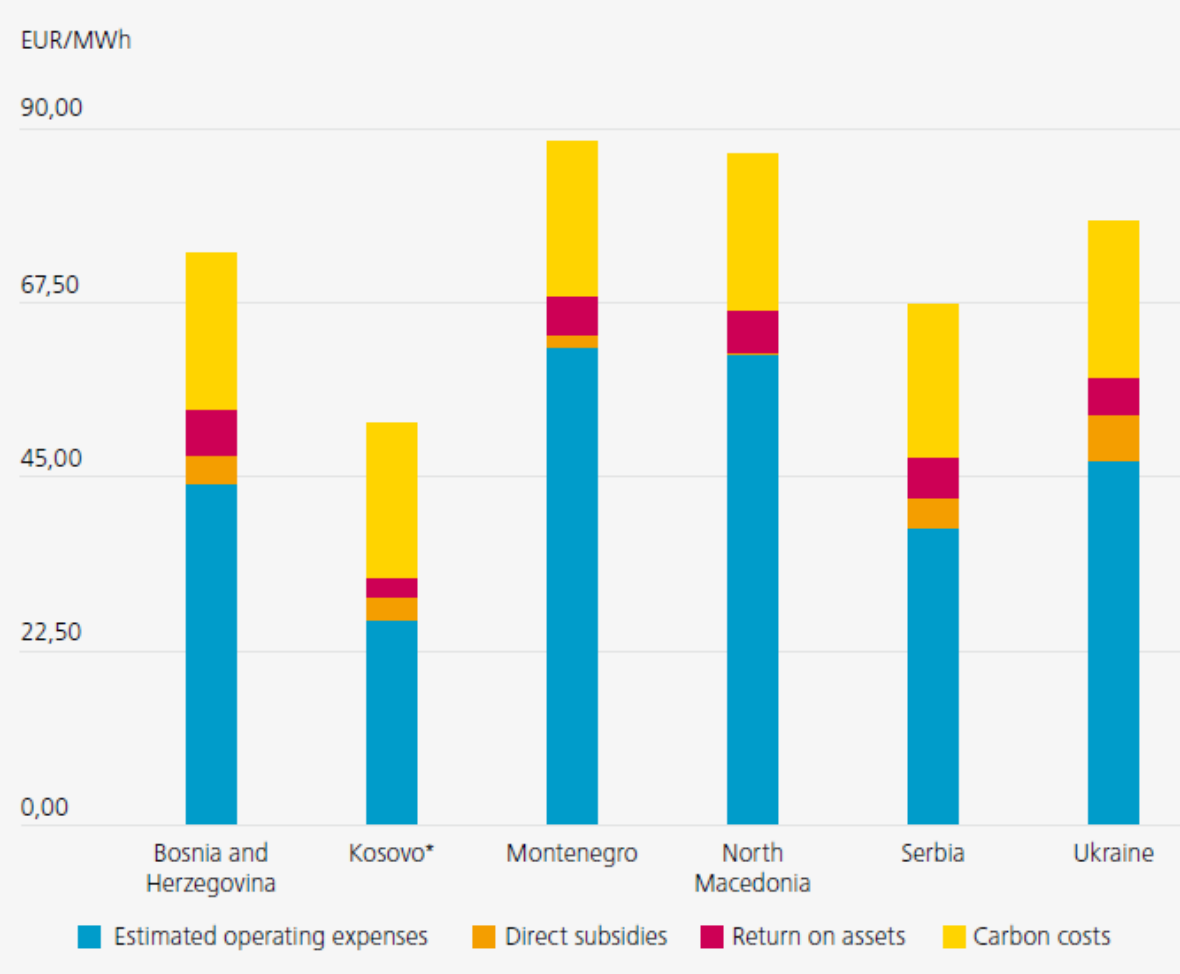
Source: EURACOAL

Electricity Share From Coal in the Generation Fuel Mix of the Western Balkans



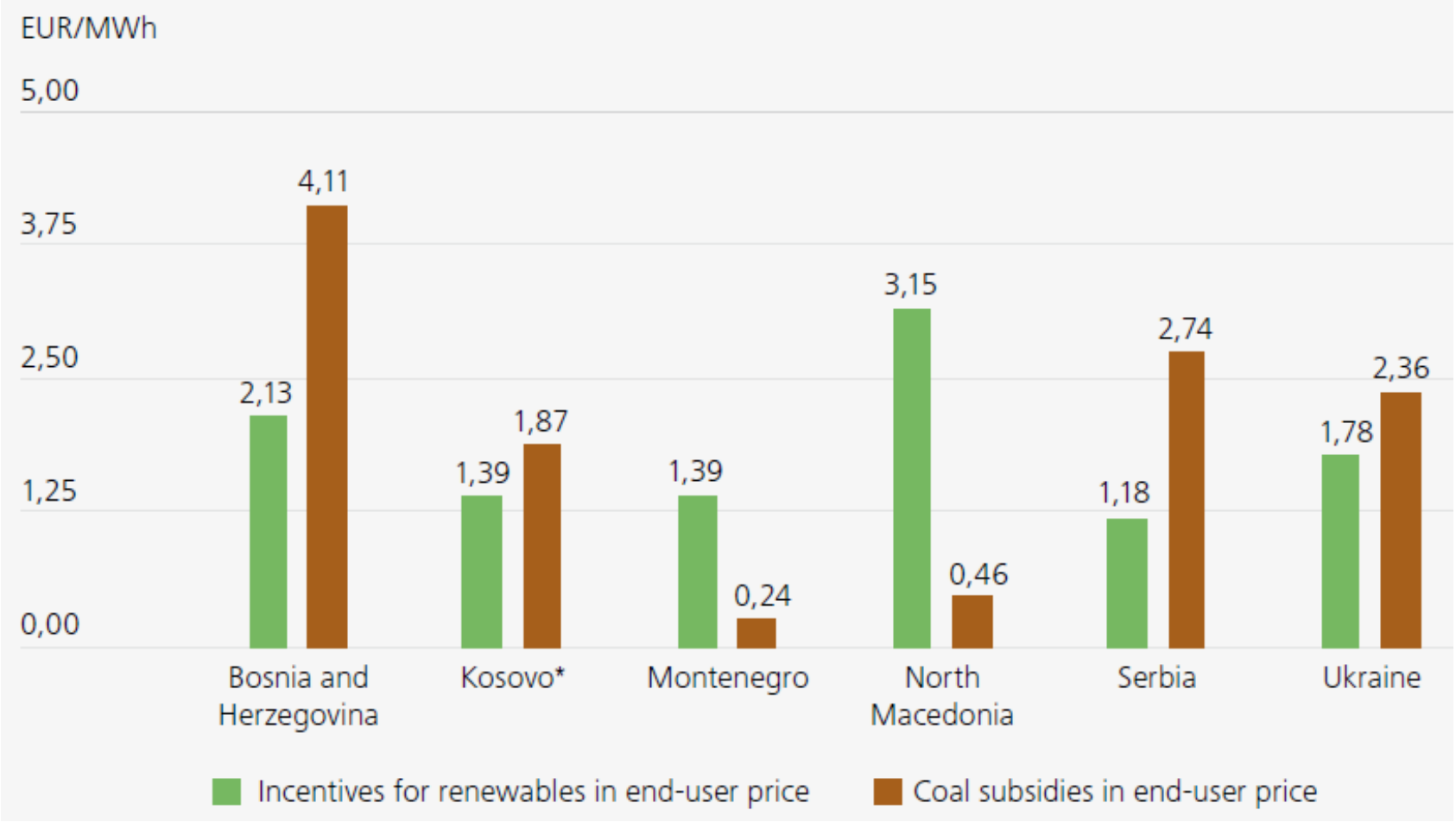
Source: Energy Community

Estimation of Full Costs of Current Electricity Production from Coal in the Western Balkans



Source: Energy Community

Incentives for Electricity Production from Renewables and Coal Subsidies in End-user Prices in the Western Balkans (2017)

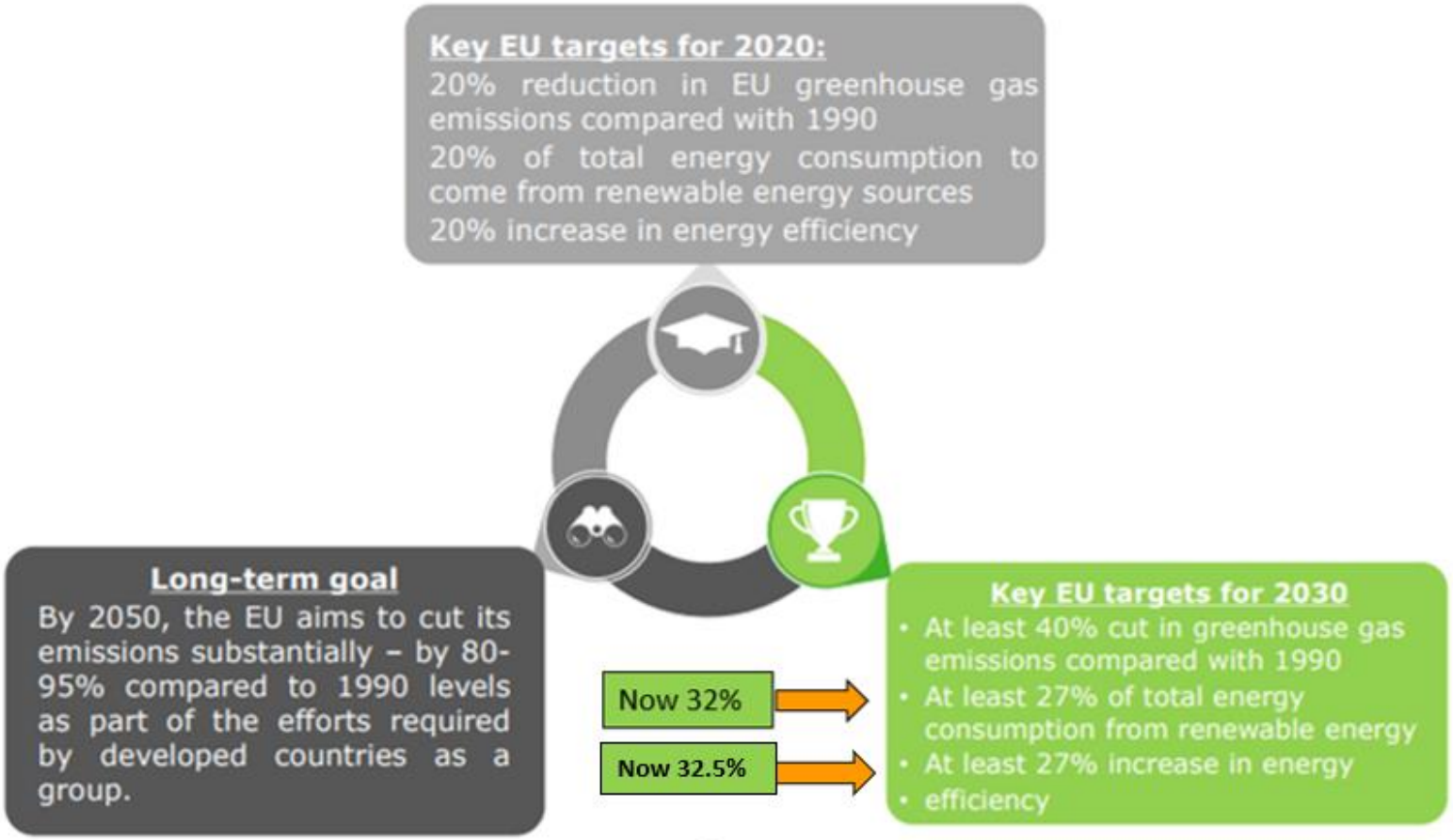


Source: Energy Community

Price of CO_2 European Emission Allowances (€ per tonne)

Source: Business Insider

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



Source: European Commission

EU Energy Policy Framework: How Does This Stand for SE Europe?

- It seems that an **inverted pyramid arrangement** has been developed in SE Europe, compared to pursued official Energy Union policies and stated targets as economic development at all costs remains number one priority for most countries.

- The energy policy priorities in broad terms for SEE would appear as follows:
  - Further large-scale development of **coal and lignite resources** without any real recourse CCS/CSU provisions and plans
  - Further development of **electricity and gas interconnections in order to maximise cross border trade**
  - Promotion of **oil and gas exploration activities (onshore and offshore)** aiming towards maximizing production in the mid- and long-term
  - Further development of **renewables** in all application areas (i.e. solar, wind, biomass, hydro and geothermal) without necessarily aiming to adhere to specific targets (set by the EU)
  - Promotion of **energy efficiency**, focusing primarily on the building sector, incentivized by EU and green fund financing facilities
  - **Diversification** of supply routes and suppliers in order to secure future gas supplies
  - Reduction of CO_2 emission levels (least of priorities)

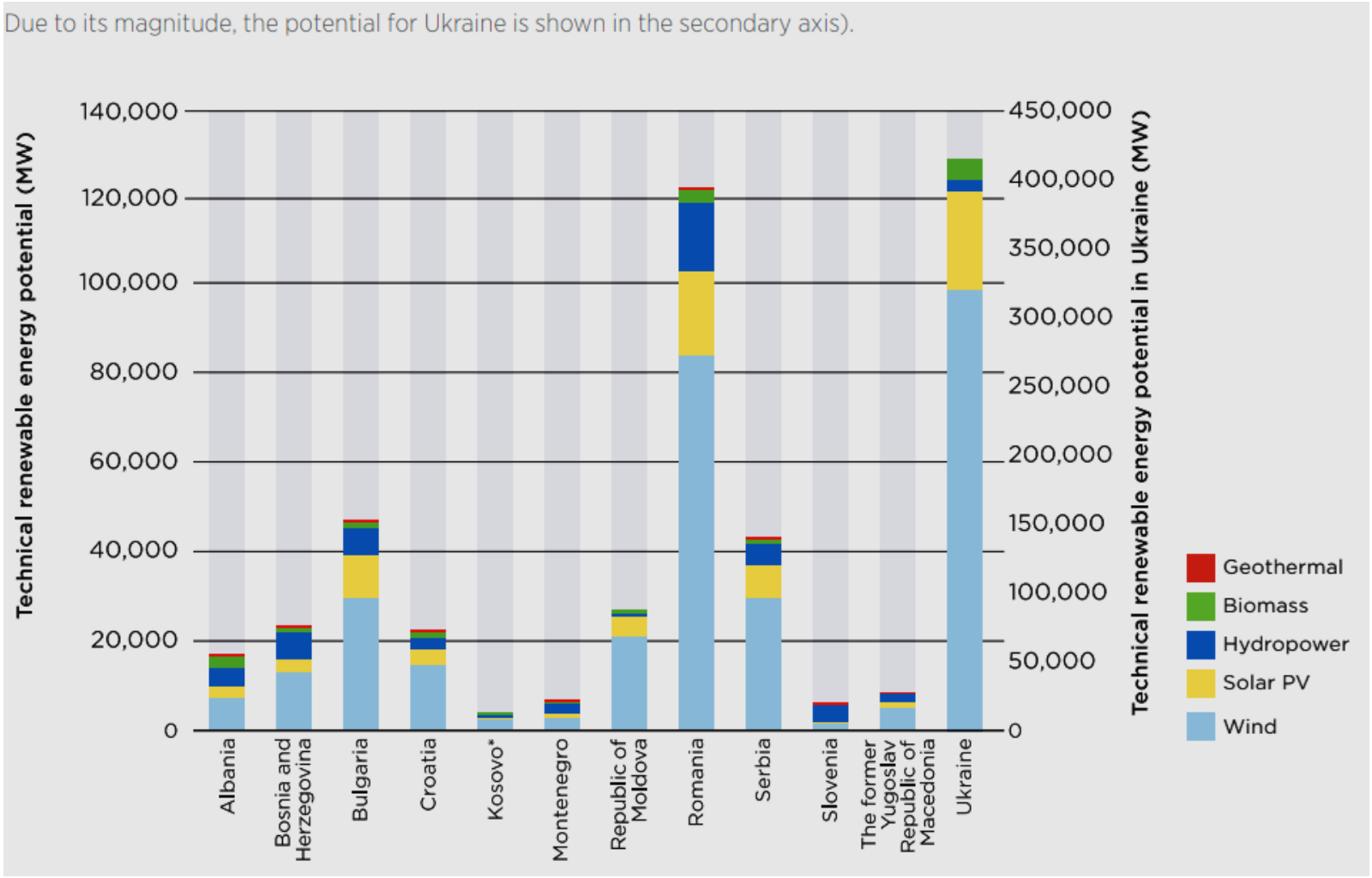
Under Construction and Planned Coal Plants in SEE Countries (MW)*, as of January 2019

Country	Announced New Plants	Pre-permit	Permitted	Announced + Pre-permit + Permitted	Under Construction	Shelved	Operating	Cancelled (2010-2018)
Turkey	12,8	17,311	6,555	36,666	800	24,554	18,826	41,031
Bosnia & Herzegovina	2,38	0	1,7	4,08	0	0	2,073	1,02
Serbia	1	0	350	1,35	0	0	4,405	1,82
Romania	0	600	0	600	0	0	5,305	5,105
Kosovo	0	450	0	450	0	0	1,29	330
Greece	0	450	0	450	660	0	4,375	800
North Macedonia	300	129	0	429	0	0	800	300
Montenegro	0	0	0	0	0	0	225	1,41
Bulgaria	0	0	0	0	0	0	4,889	2,66
Slovenia	0	0	0	0	0	0	1,069	0
Croatia	0	0	0	0	0	0	210	1,3
Albania	0	0	0	0	0	0	0	800

***Note:** Includes units 30 MW and larger

Sources: EndCoal, IENE

Technical RES Potential in SE Europe



Source: IRENA

Total Anticipated Energy Investments in Greece (2018-2027)

Sector - Fuel	Activities	Total Anticipated Energy Investments, in € million
Oil	Exploration and Production (E&P) activities (Upstream)	5,000
	Refining and marketing activities (Downstream)	2,000
Gas	Gas network	3,300
Electricity	Electricity generation (new power plants)	3,000
	Electricity grid	5,600
	RES	15,100
Energy Efficiency	Energy efficiency	11,000
Research and Development	Research and Development	500
	Total Anticipated Energy Investments by 2027	***45,500***

Note: Include gas pipelines of TAP, IGB and IGI Poseidon. Do not include East Med gas pipeline. They also include central autoproducer units, PV installations in the roofs and electricity storage systems.

Source: IENE

Total Anticipated Energy Investments in Romania (2016-2025)

	Project Sector	Description	Investment Estimate in Million Euros
OIL	Upstream	• Field Exploration and development of new oil and gas wells	6,500 (e)
	Downstream	• Refining	1,500
		• Loading Terminals	250 (e)
		• Storage facilities	120
		• Crude / Gas Pipeline(s)	80
GAS	Country Gas Network	• Grid development	150
		• Main intra country pipeline(s)	230
		• Storage facilities	85
		• FSRU Terminal	150
ELECT-RICITY	Power Generation (new plants)	• Lignite	525
		• Coal	-
		• Gas	210
		• Nuclear	6,500
		• Large Hydro	1,150
	Electricity Grid	• New H/V transmission lines	860 (e)
		• Upgrading and expansion of existing grid	500
	RES	• Small Hydro	750 (e)
		• Wind farms	640
		• Photovoltaics	150
		• Concentrating Solar Power	-
		• Biomass (including liquid biofuels)	280
		• Geothermal	-
	Total Anticipated investments by 2025		**20,630**

Source: IENE

Conclusion (I)

- In addition to market integration and market liberalization requirements, COP 21 targets and commitments are now complicating further the energy issues in SE Europe. EU member countries in the region (i.e. Bulgaria, Croatia, Cyprus, Greece, Romania and Slovenia) have no great difficulty in abiding to EU Directives and targets, in comparison with the Western Balkans.
- The transition to decarbonized power generation is not an easy regional issue, as in most of the SEE countries electricity generation, which is mainly based on coal and lignite, supports thousands of jobs while it forms the basis of an extensive industrial base.
- Although all countries in the region to a larger or to a smaller extent are committed to gas, RES and energy efficiency programmes and specific targets, at the same time, they are pursuing a parallel carbonization agenda as we have a number of coal-fired power plants under construction or at an advanced planning stage. In short, carbon-based power generation is also moving ahead, adding substantial capacity from now until 2025 (1.5 GW per year for SEE and 2.5 GW for Turkey, i.e. total 4 GW per year over the next 7-8 years).
- While new RES capacity over the last three-year period is less than 500 MW per year of installed capacity and approximately 1.5 GW, including Turkey. As a result, a substantial gap is foreseen between new coal-fired power plants and anticipated RES and gas installations.
- In addition to this supply gap, between coal and RES, the likehood of a power generation shortfall, as early as 2027, must be considered. In such an eventuality the region's electricity balance will be seriously disrupted as it will transform the region from an exporter of electricity to a net importer. This will drive up electricity prices and will affect negatively economic growth. Underinvestment today and higher electricity prices in the near future will act as a brake to economic growth.
- The arduous and rather complex decarbonization process, which SEE countries have to go through, is further burdened on account of their strong coal/lignite legacy, while they also have to deal with serious social and energy security issues.

Conclusion (II)

- We should also point out that RES development can contribute towards improving the energy security situation of SEE countries. However, the degree to which RES can bolster energy security depends greatly on the type RES used, their connectivity to the national grid, their synchronicity to consumption patterns and their storage capability (For a detailed discussion, please see IENE's Working Paper No. 1917). If RES development is to be pursued on a large scale, then emphasis will have to be placed on dispersed and pumped storage schemes so as to overcome the drawback from the intermittent nature of RES, notably wind and solar.

- Energy efficiency applications can also help lessen a country's dependence on fossil fuels and/or imported fuels. However, considerable work is still required if one is to assess with any precision their potential impact in terms of improving energy security.

- In conclusion, the SE European region needs a well-defined and pragmatic strategy for energy security in tandem with decarbonization policies, which will promote resilience to shocks and disruptions of energy supplies in the short-term, and reduced dependency on particular fuels, energy suppliers and specific routes in the long-term. Consequently, policy makers at national and regional level are faced with huge and complex challenges as they must be prepared to inform the citizens of the available hard choices that reducing this dependency means while making the move to cleaner fuels.

INSTITUTE OF ENERGY
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Thank you for your attention

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