Analysis of future common strategies between the South and East Mediterranean area and the EU in the energy sector

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Current situation

- The South-East Mediterranean countries (SEM) have particularly low energy and electricity consumption per capita (except Israel)
  - Macroeconomic growth will highly increase domestic energy demand and carbon emissions in the next two decades
  - Domestic energy consumption rises also as a result of persisting energy inefficiencies which are incentivised by low energy prices owing to extensive subsidization
  - However, energy subsidies are part of economic and social policies
- Business as usual leads to lower hydrocarbon exports due to internal demand in exporting countries and extreme dependence of importing countries
- The SEM-EU cooperation is currently hampered by the lack of common energy and regulatory framework, the persistence of energy subsidies in most SEM countries and the lack of infrastructure

Elements of an alternative energy strategy

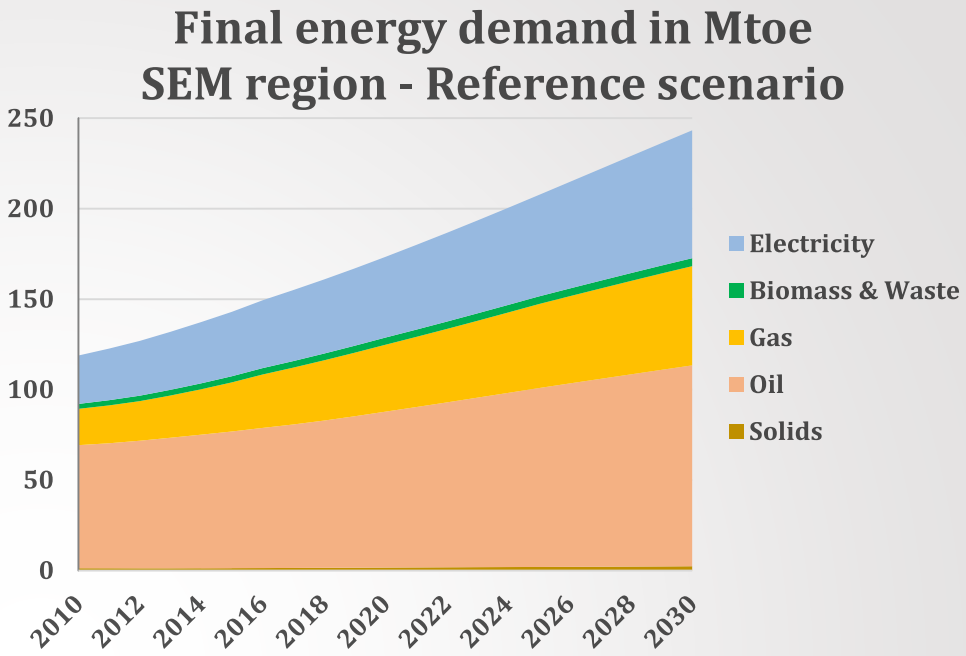
- Exploit the vast potential of renewables resources in South East Mediterranean (SEM) region to:
  - Substitute hydrocarbons in power generation, allowing higher exports in hydrocarbon-rich countries and lower dependence in importing countries
  - Support higher access to energy services enabled by decentralised RES
  - Avoid financial and other risks of coal or nuclear proposed to substitute hydrocarbon in power generation
- Exploit the potential of energy efficiency in SEM for all uses of energy to:
  - Moderate the trend towards high energy demand growth
  - Improve quality and abundance of useful energy
  - Boost domestic activity supporting implementation of energy efficiency
- Attract foreign investment from the EU for both the above targets based on a long-term cooperation strategy with the EU in three areas:
  - RES potential of SEM helps achieving EU climate and RES targets in more cost-effective way based on a broadening of market-based mechanism over the entire Med region
  - Interconnecting infrastructure allows common RES exploitation in the broad Med region
  - EU-SEM cooperation in exploitation of hydrocarbons is enhanced providing benefits for security of supply

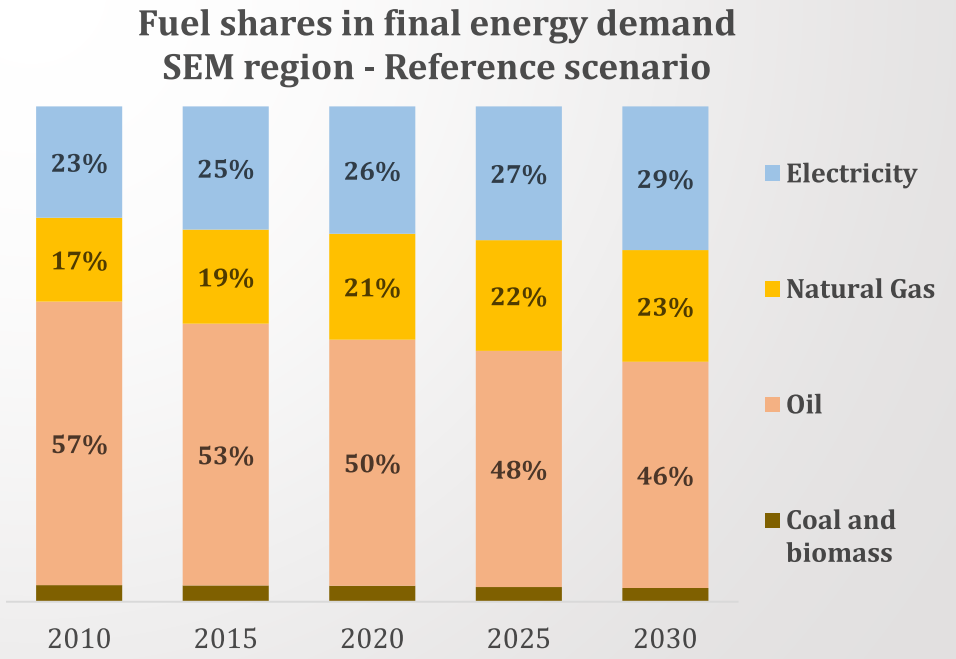
Assessing the alternative energy strategy

- A large-scale technology-rich energy system model is used to quantify alternative scenarios for the SEM-EU energy sector
- The model:
  - Covers in detail energy demand and energy supply sectors and their interactions
  - Addresses energy demand welfare improvement and access to energy services
  - Simulates market-based formation of energy prices includes assumptions about subsidies and calculates cost and financial viability indicators
  - Covers the power sector technologies, investment and infrastructure in detail
  - Produces annual projections of the energy balances, costs/prices, emissions and security of supply indicators until 2030.
  - Is linked with the EU PRIMES energy model in order to assess the implications of joint EU-SEM action in the power sector and the broadening of the ETS market
  - Countries covered: Algeria, Egypt, Tunisia, Morocco, Libya, Israel, Lebanon and Jordan
- The Reference scenario explores business as usual trends and the Policy scenarios explore two main alternative strategies, namely centralised and decentralised, which both are based on EU-SEM cooperation

The Reference scenario- Energy demand

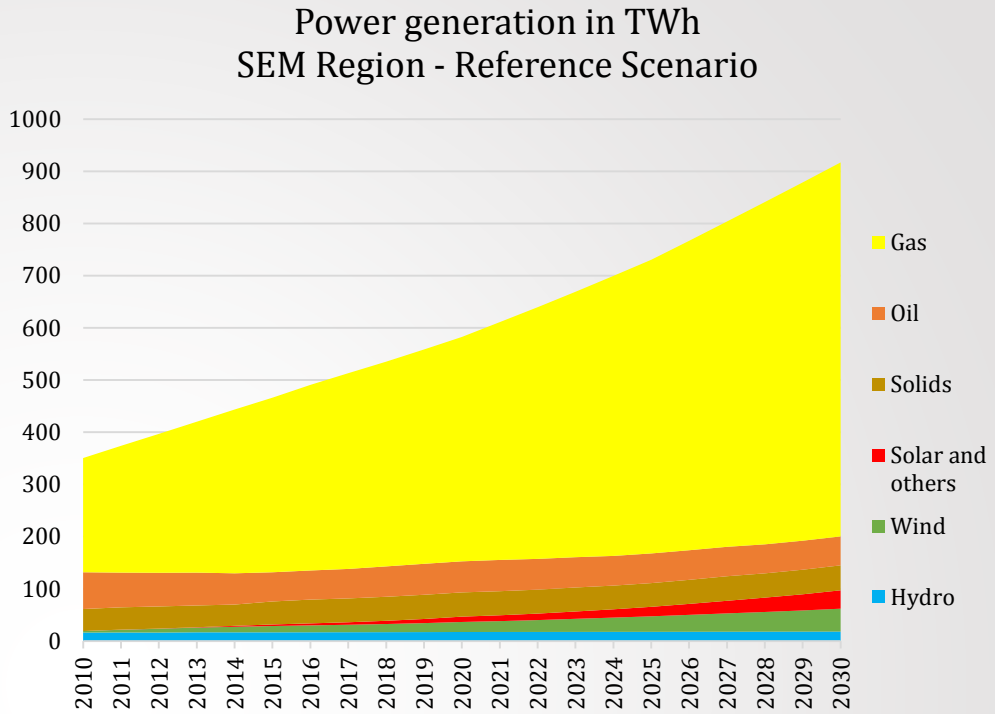
- Increase of energy demand is mainly driven by GDP growth, urbanization prospects, higher access to energy services and evolution of energy prices
- Increased penetration of gas and electricity in industrial uses and in household energy demand, at the expense of oil and traditional biomass
- Motorization increases rapidly (the stock of passenger cars increases by a factor of 2.5 between 2010 and 2030)
- Oil consumption is increasingly concentrated on the transport sector

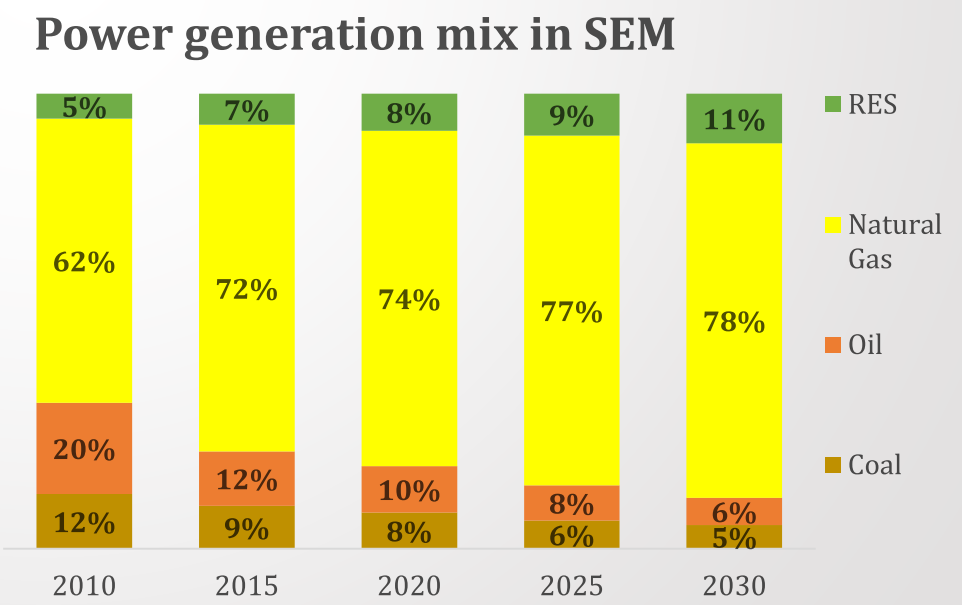




The Reference scenario-Power sector

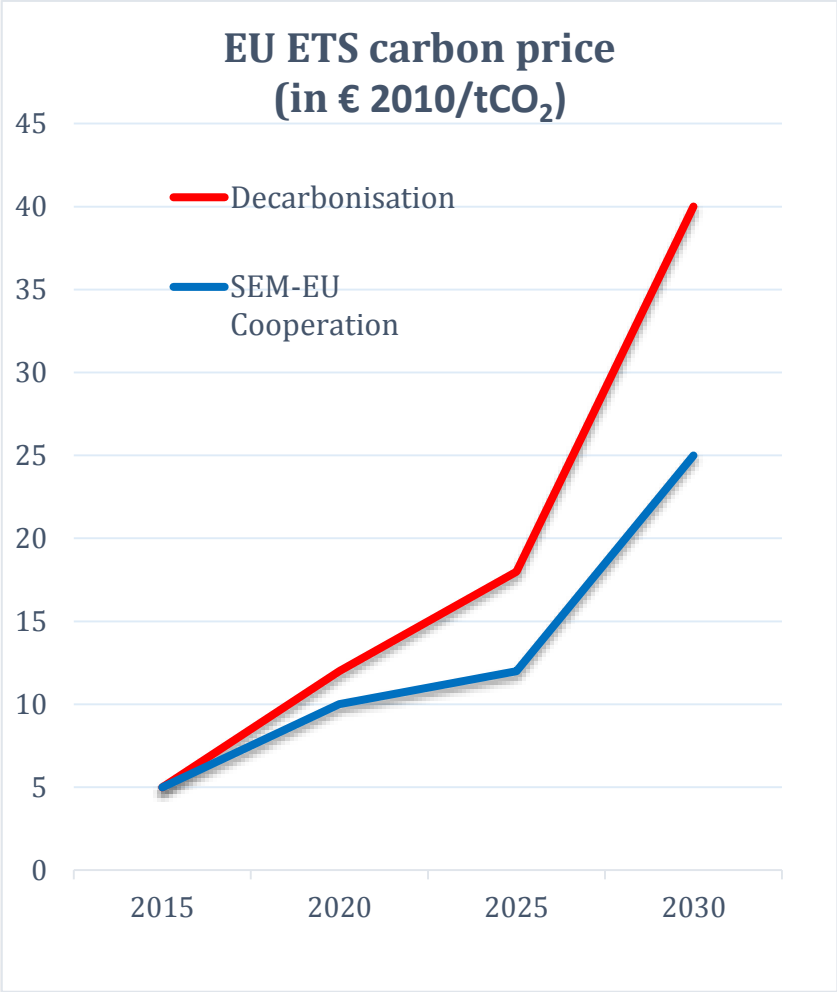
- Annual growth of electricity demand in SEM is 5% on average during 2010-2030
- Demand for electricity increases faster than economic growth
- Natural gas is likely to dominate power generation, reaching 78% in 2030 up from 62% in 2010
- Oil and coal are increasingly substituted by gas
- RES moderately penetrate in power generation attaining a 11% share in 2030, much below potential
- Solar power and on-shore wind are the main RES technologies





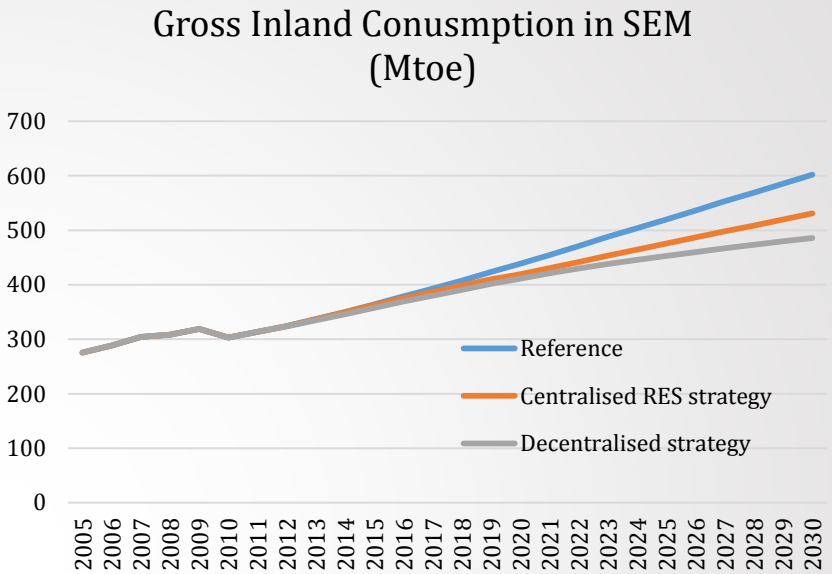
SEM-EU cooperation- centralized RES

- EU-ETS expands to include SEM countries with free allocation of emissions permits to SEM
- RES exploitation in centralized applications (CSP) with mainly export orientation and concentration on specific geographical areas backed by long-term PPA contracts
- Extensive infrastructure interconnecting South to North sides of the Med also backed by the PPA contracts
- RES electricity exports from SEM to the EU amount to 235 TWh in 2030 (they cover about 7% of EU-28 power requirements)
- The EU benefits from RES electricity exports from SEM and reduces more expensive domestic resources and reaches 2030 targets more economically
- Therefore within 2030 package projections including the MSR, the ETS carbon price is projected to decrease to 26 €/tCO2 in 2030 from 40 €/tCO2 when only domestic EU resources are used



SEM-EU cooperation- decentralized RES

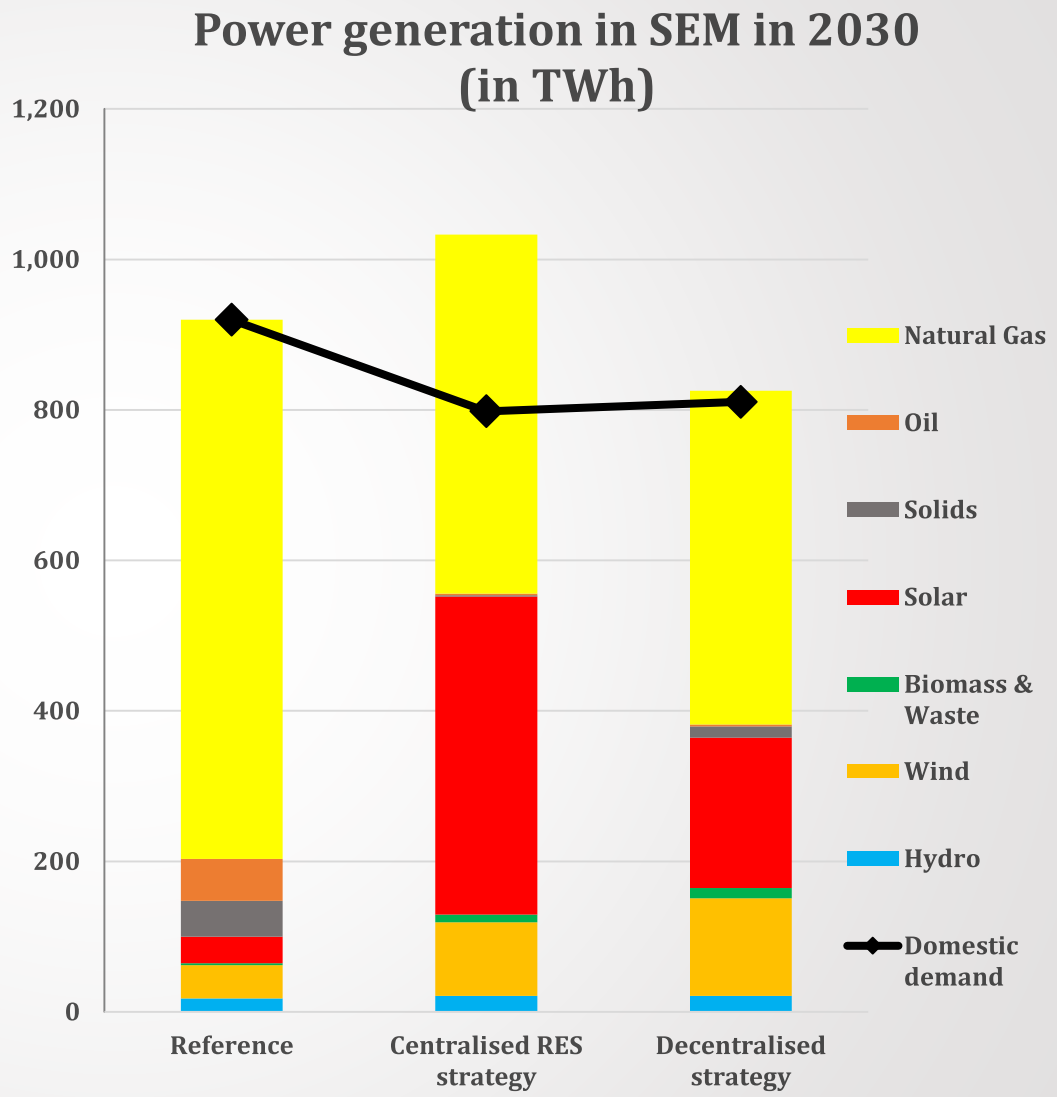
- Priority on developing decentralised RES at large scale (photovoltaic, wind and fewer CSP)
- Enhancement of domestic grids allowing RES and larger access to electricity
- Support by feed-in tariff schemes financially backed by phasing-out subsidisation of fossil fuels
- EU foreign investment in RES promoted by allowing EU companies to get ETS emission credits and RES credits when investing in SEM
- Standards for energy efficiency, SEM-EU common investment programs in energy efficiency based on subsidised ESCO-type schemes



SEM region in 2030	Reference	Centralized RES strategy	Decentralized strategy
Share of RES in domestically consumed electricity	11%	39%	42%

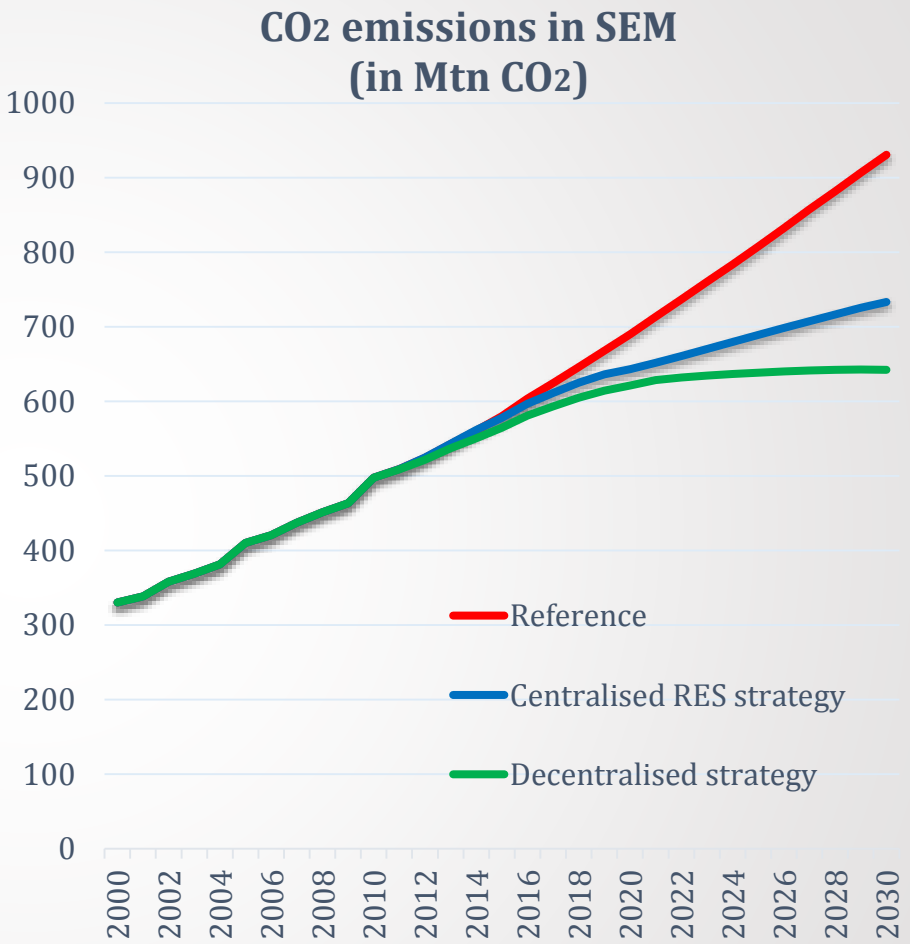
Power sector

- Both alternative strategies show shifts away from fossil fuels and towards massive expansion of RES
- RES share in SEM power requirements increases from 11% in Reference to 40% in both scenarios (in 2030)
- Both alternative scenarios help the EU to reach the 2030 goals more economically
- Higher benefits for SEM under decentralized strategy from higher access to electricity services, better local grids and direct uses of RES by consumers
- Also, higher domestic economic activity under decentralised strategy
- From a financial perspective, foreign direct investment have more chance to materialise under centralised RES strategy



CO_2 Emissions

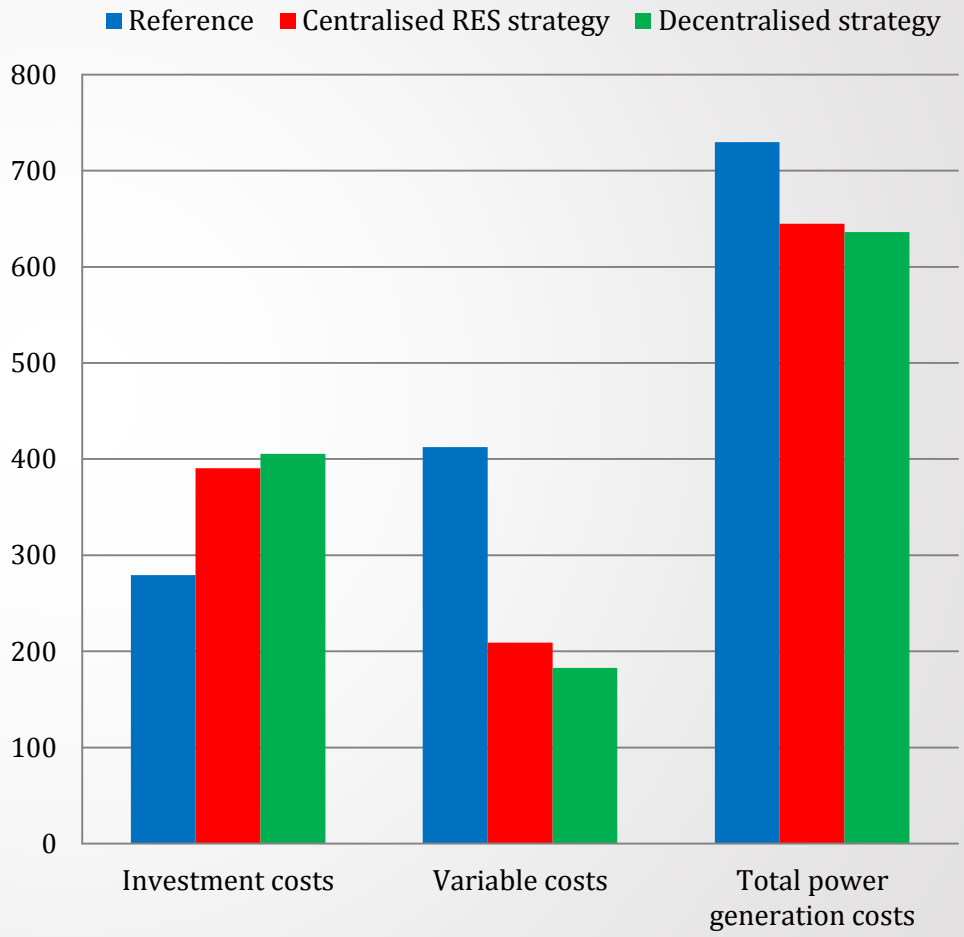
- Carbon emissions of SEM in Reference scenario are likely to increase by 90% by 2030 following historical trends
- The two alternative strategies project lower carbon emissions due to increased penetration of RES technologies and energy efficiency improvements
- In the "Decentralised strategy", CO_2 emissions stabilise after 2020 at a level 30% below Reference projection
- In all scenarios, emissions per capita in SEM are much lower compared to the EU average by 2030



Electricity Costs

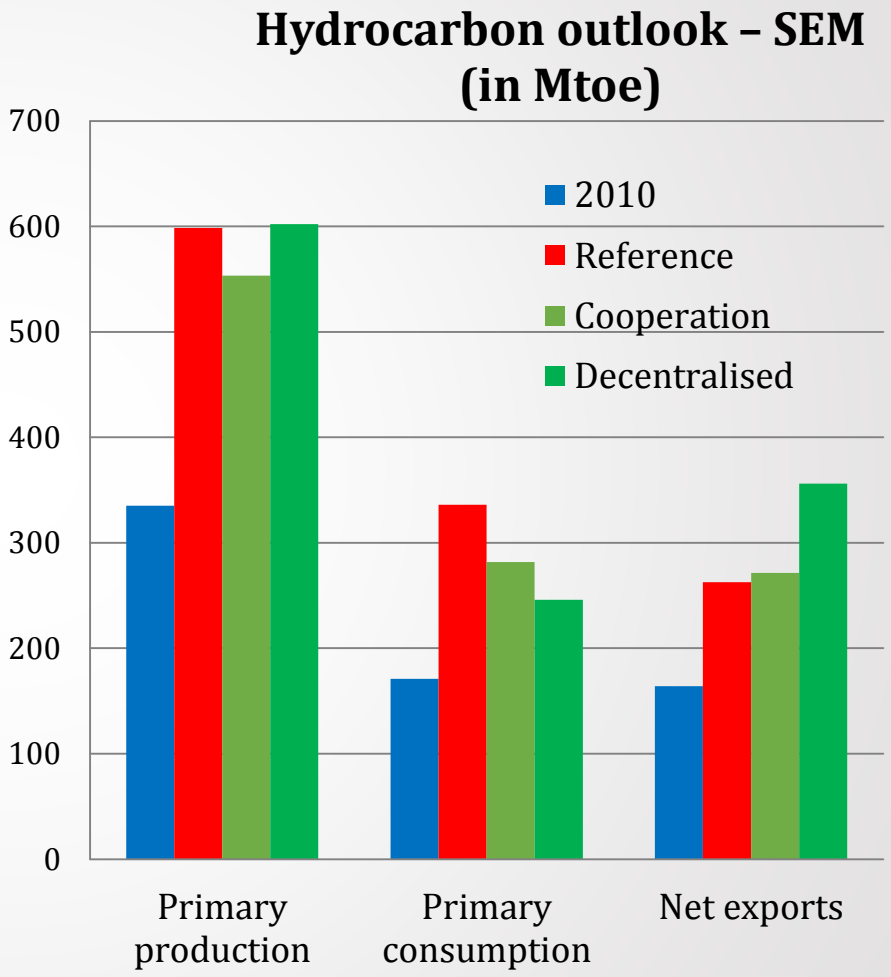
- The substitution towards capital intensive RES leads to an increase in cumulative investments costs relative to the Reference levels (despite lower domestic electricity demand)
- On the other hand, fuel costs decline significantly as fossil fuel based power generation declines
- The net overall impact is a 12% reduction in total power generation costs
- Levelized electricity costs are calculated using fuel prices prevailing in global markets without subsidies although they exist in SEM countries

Cumulative power generation costs (in bn €)



Impacts on Hydrocarbons

- Production of fossil fuels increases in all scenarios from 330 Mtoe in 2010 to 600 Mtoe in 2030
- However, in Reference about 2/3 of the increase are absorbed by increasing domestic demand
- In alternative strategy scenarios exportable hydrocarbon surpluses increase by 30% compared to the Reference in 2030
- The increase is much lower in the “centralised” scenario due to lower efficiency improvements compared to the decentralized scenario



Overall costs-benefits

Benefits from the alternative energy strategies

- Penetration of RES and accelerated energy efficiency improvements allow increased hydrocarbon exports in some countries and lower dependency on hydrocarbon imports in other countries
- Both energy and carbon intensity indicators of SEM are highly improved
- Larger access to energy services and higher quality
- Power generation costs are reduced due to lower power needs and reduced fuel costs
- Reduced expenditures for energy purchases partly offset additional costs for energy efficiency investments
- The EU benefits from lower ETS prices more than offset the costs for RES electricity exports, by about 40 bn. € cumulatively

In constant billion EUR Cumulatively over 2010 2030	***Centralised RES Strategy***	***Decentralised strategy***
Oil export revenues	94.3	212.1
Natural Gas export revenues	-14.7	168.0
Power generation cost savings	84.9	93.8
Value of granted carbon allowances	24.3	–
Net outcome of Energy efficiency investments		-90.0
Total	***188.9***	***383.9***
Total (as % of GDP)	***0.9%***	***1.8%***

Conclusions

- EU-SEM cooperation helping SEM to tap onto vast RES and efficiency potentials provides significant benefits for both parties
- Benefits for SEM arise from lower energy and electricity costs, environmental benefits, wider access to electricity and energy services as well as from higher hydrocarbon exports (for energy exporters) and lower energy import bills (for hydrocarbon importers)
- In the centralised strategy the EU-SME cooperation can be achieved by extending EU ETS to SEM countries and by developing large scale RES infrastructure to export green electricity from SEM to the EU
- In the decentralized strategy the EU-SME cooperation facilitates RES and efficiency direct investment, backed financially by a shift from subsidy costs to feed-in-tariffs and third party financing schemes
- The benefits of the alternative strategies range between 0.9% and 1.8% of SEM's GDP cumulatively until 2030
- The "Decentralised" strategy is inscribed in a very optimistic hypothesis framework about overall political, economic and social normalization of SEM economies, favourable investment climate for local investors and FDI, extensive reforms of energy subsidization schemes and investments in infrastructure
- Therefore, despite the higher benefits projected for the "Decentralised" strategy (1.8% of cumulative GDP by 2030), the chances for its materialisation are lower relative to the centralised strategy which financially is more realistic.