KUALA LUMPUR 2012 WORLD GAS CONFERENCE

25th world gas conference

"Gas: Sustaining Future Global Growth"

CCS Options for Electricity Generation in South Eastern Europe

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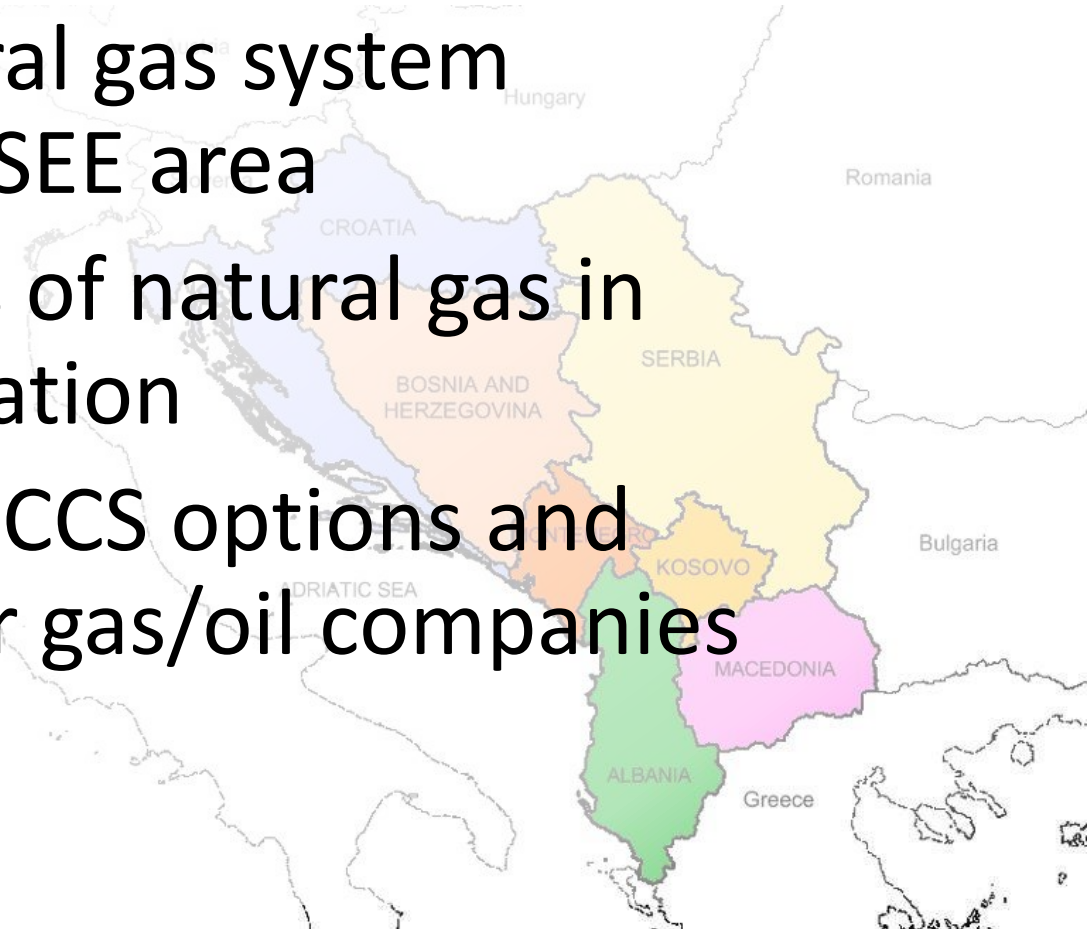
Objectives

- Natural gas supply options for South Eastern Europe
- Viability of natural gas system development in SEE area
- Competitiveness of natural gas in electricity generation
- GHG regulation, CCS options and opportunities for gas/oil companies

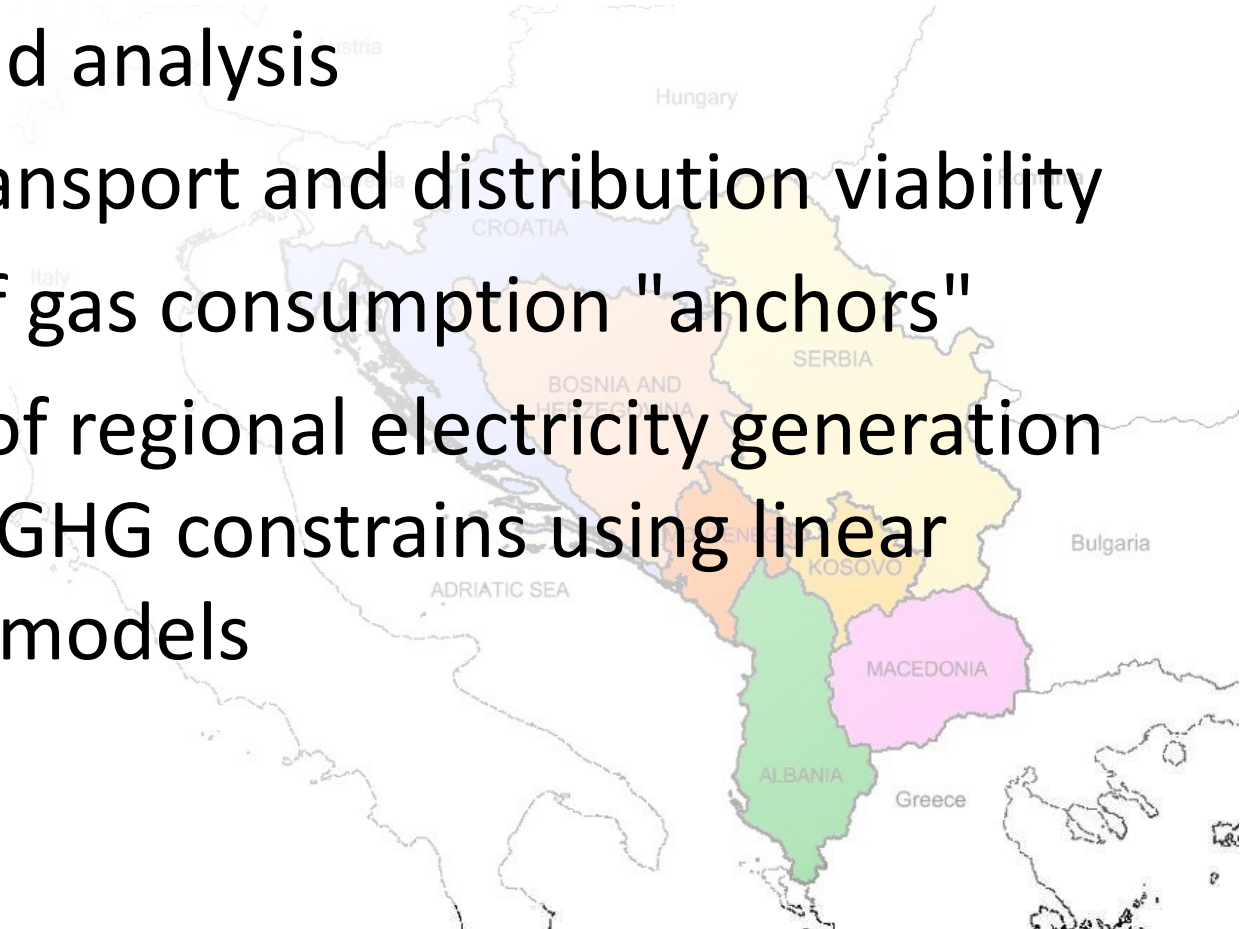


South Eastern Europe

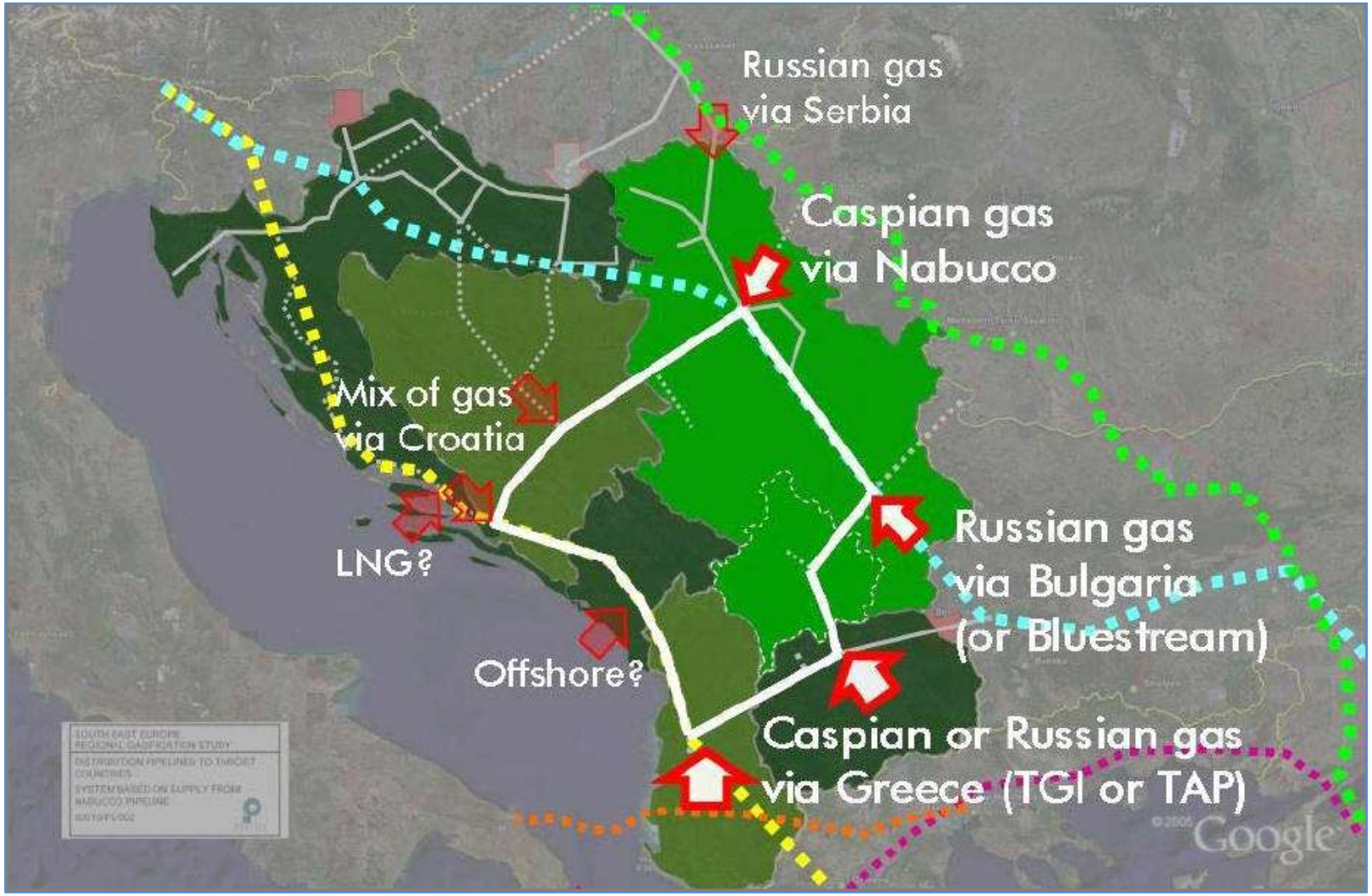
- Integration into European Union
- Transit area for Western Europe
- Small markets and difficult infrastructure financing
- Local gas "anchor" load needed
- Competition in electricity generation
  - Local coal (lignite), Hydro, Natural Gas, Nuclear
- GHG (Greenhouses Gas) regulation

Approach

- Integrated gas-electricity-environment planning and space/location considerations
- Energy demand analysis
- Natural gas transport and distribution viability
- Localisation of gas consumption "anchors"
- Optimisation of regional electricity generation system under GHG constrains using linear programming models

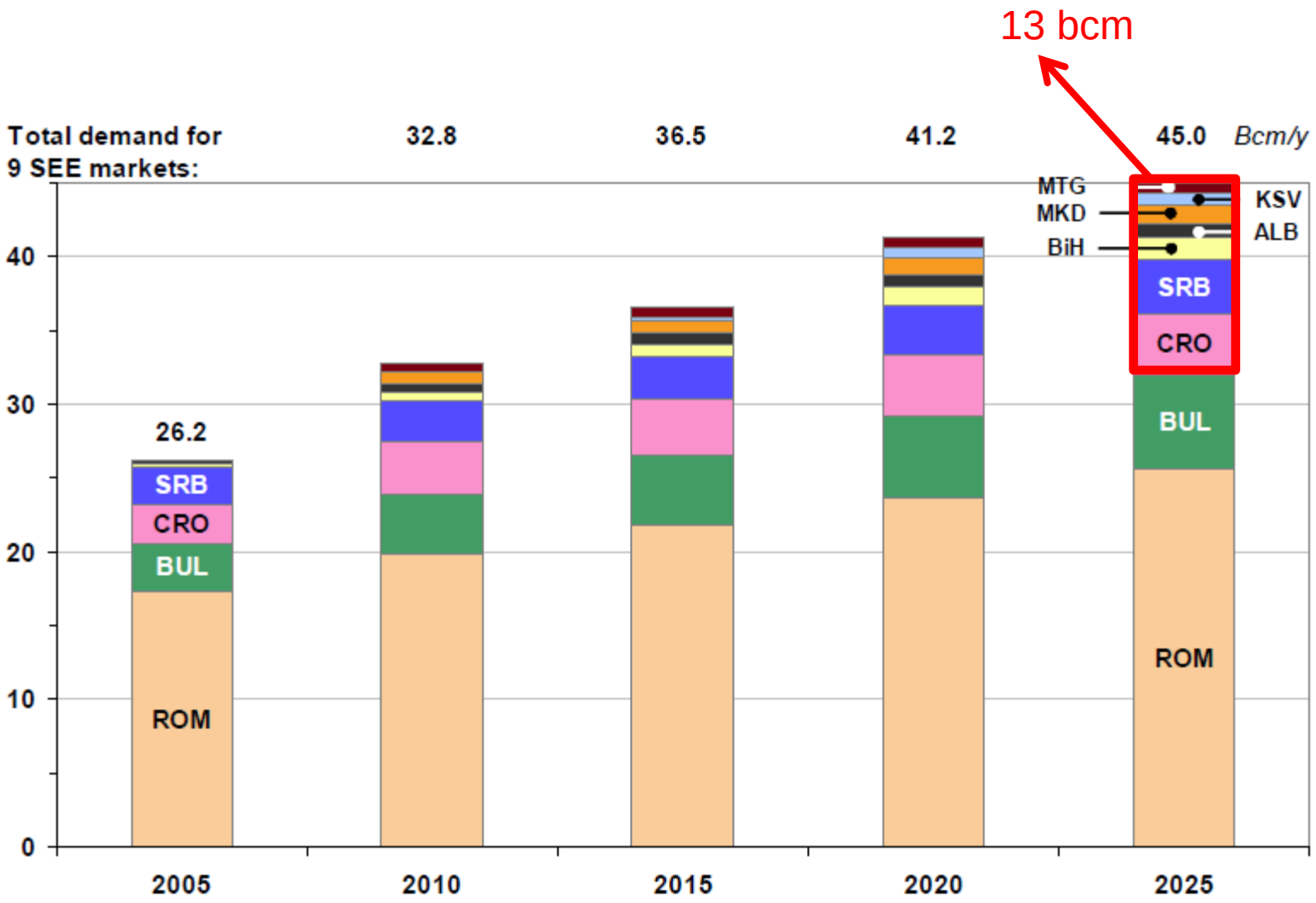


SEE Gas Ring



Source: SEE Regional Gasification Study - Economic Consulting Associates, Penspen, EIHP

Projected Gas Demand



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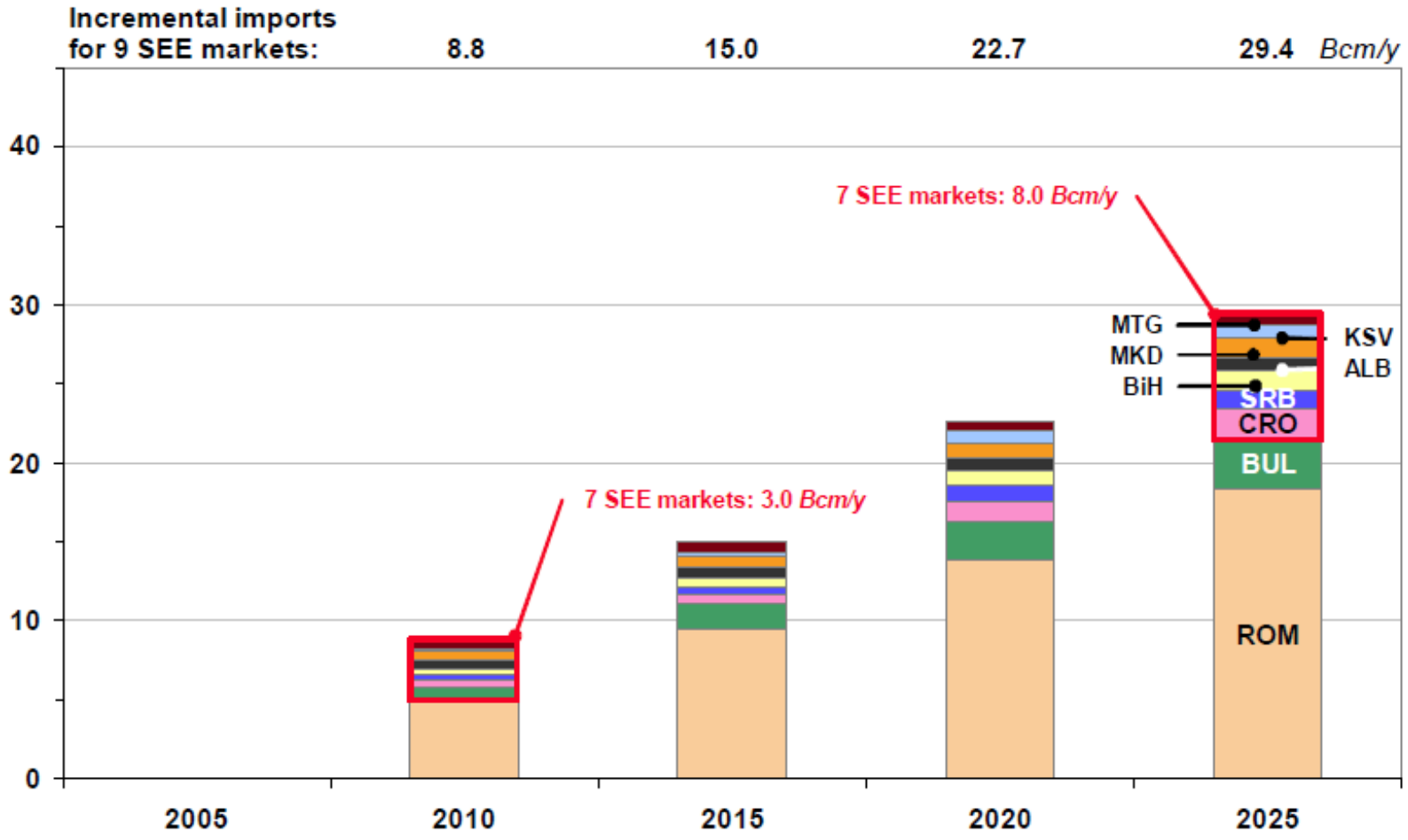
Projected Supply Gap



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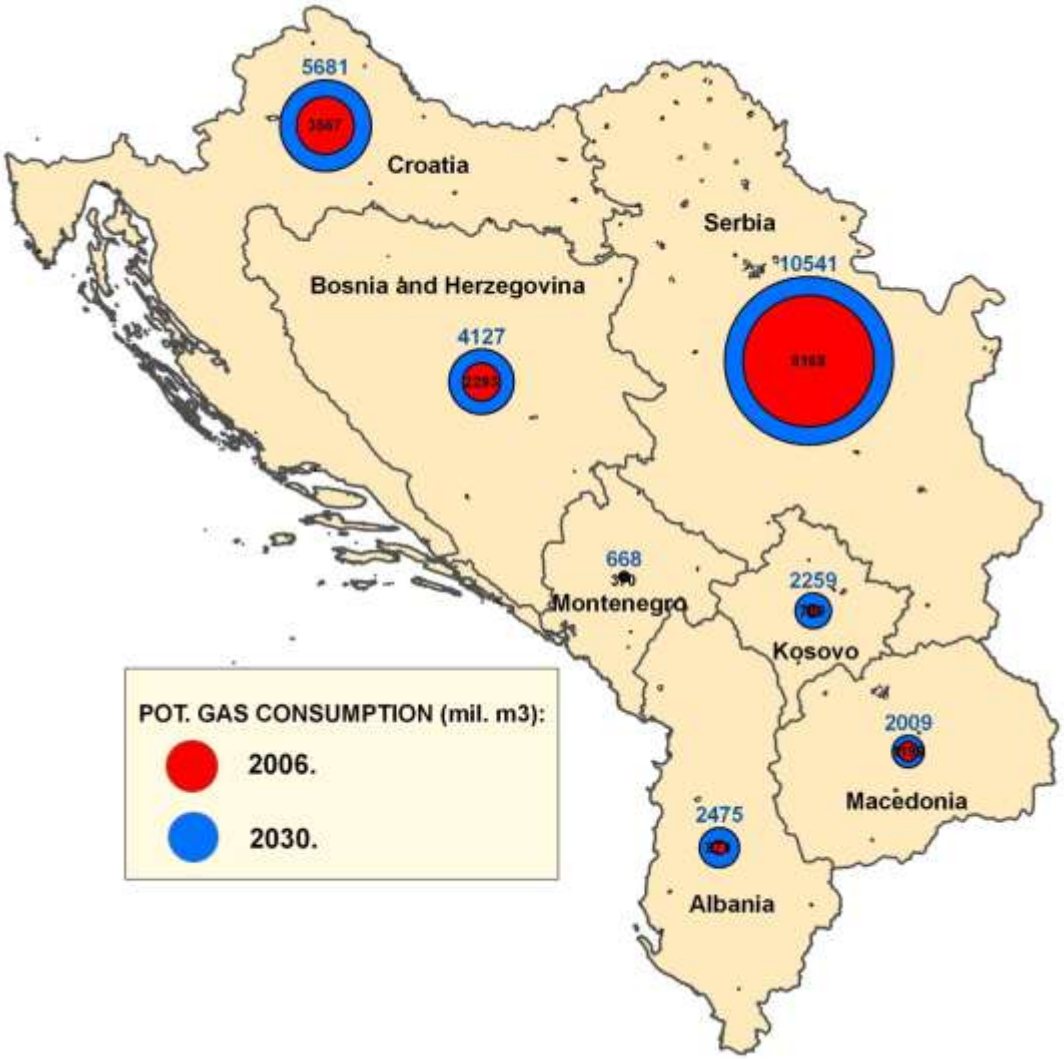
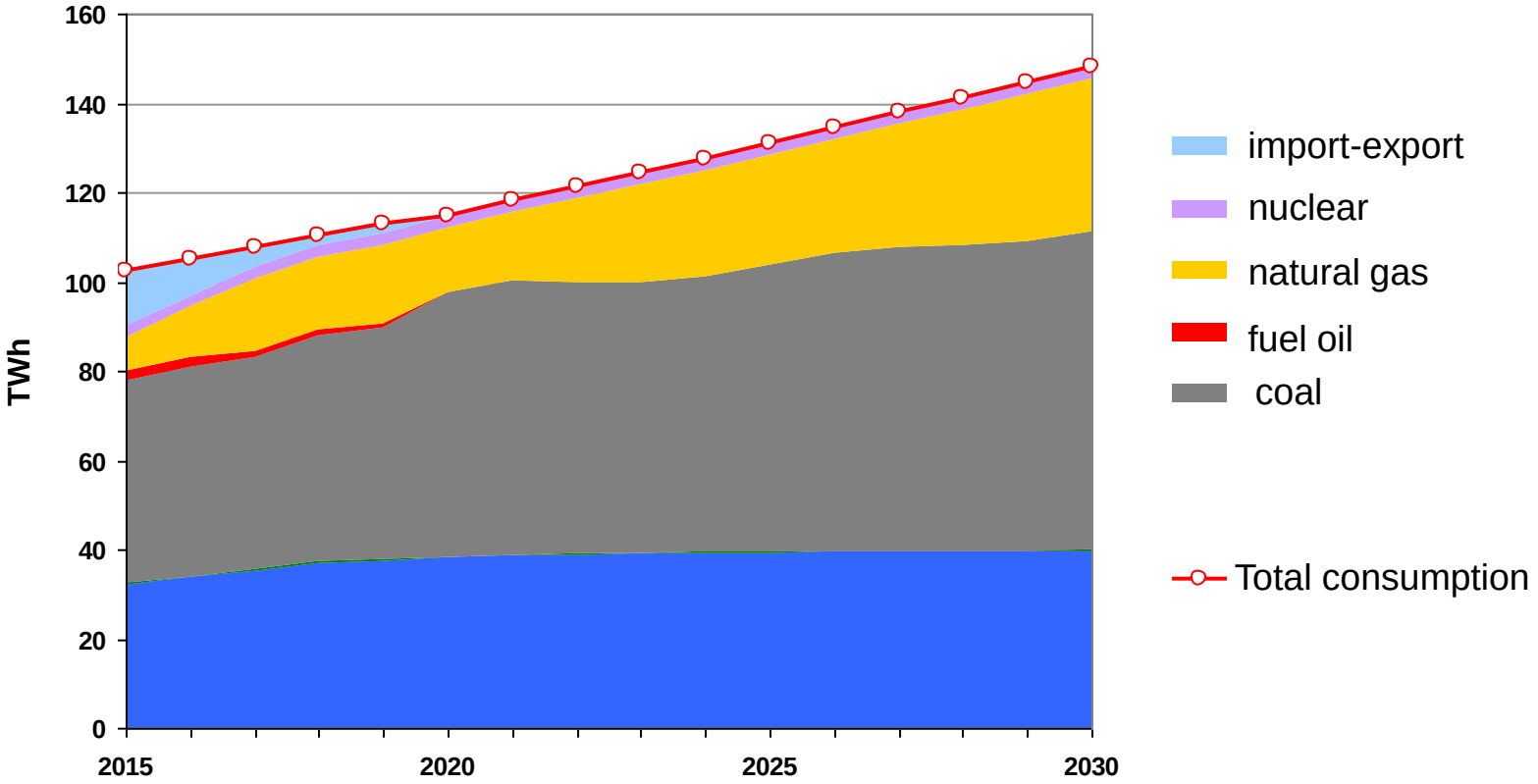
Heat market

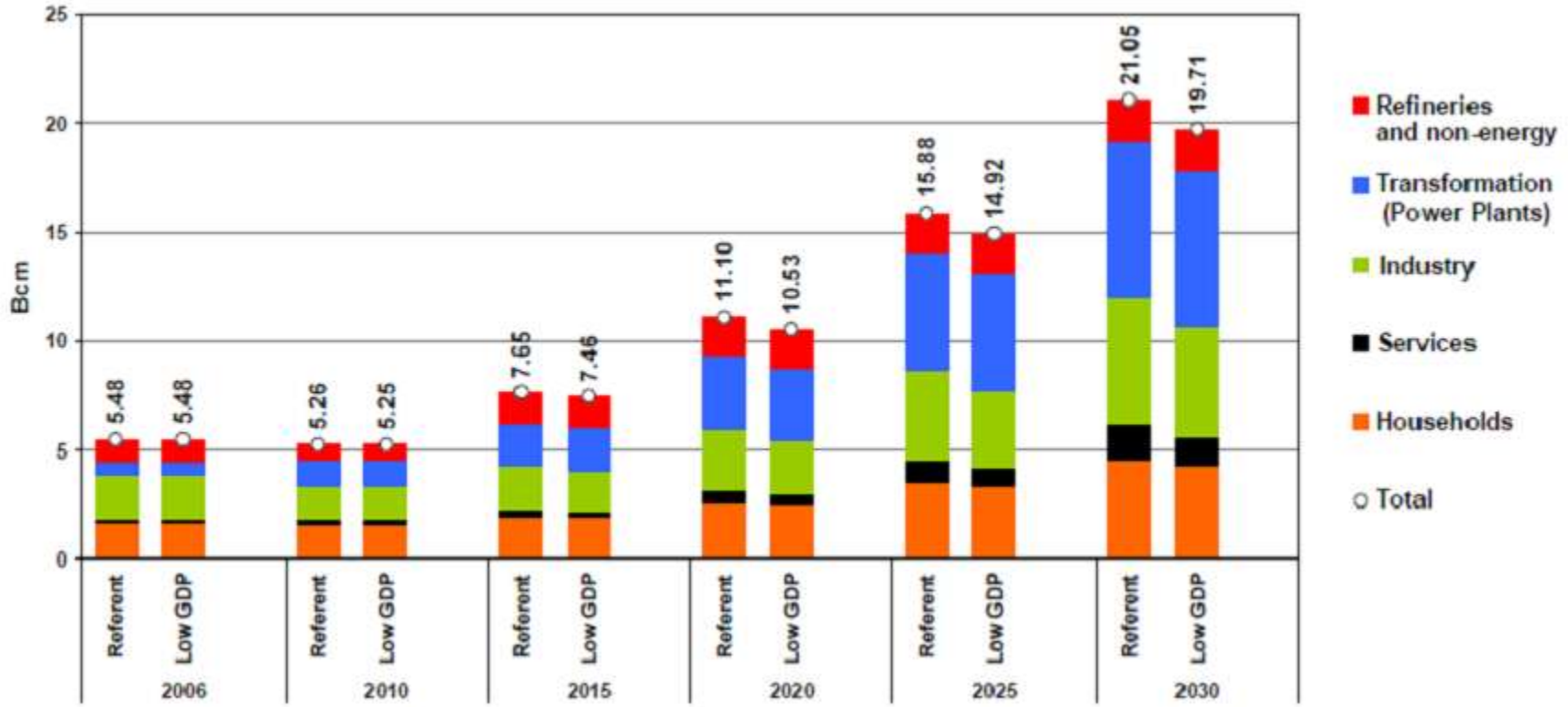


27 760

Electricity demand and supplay

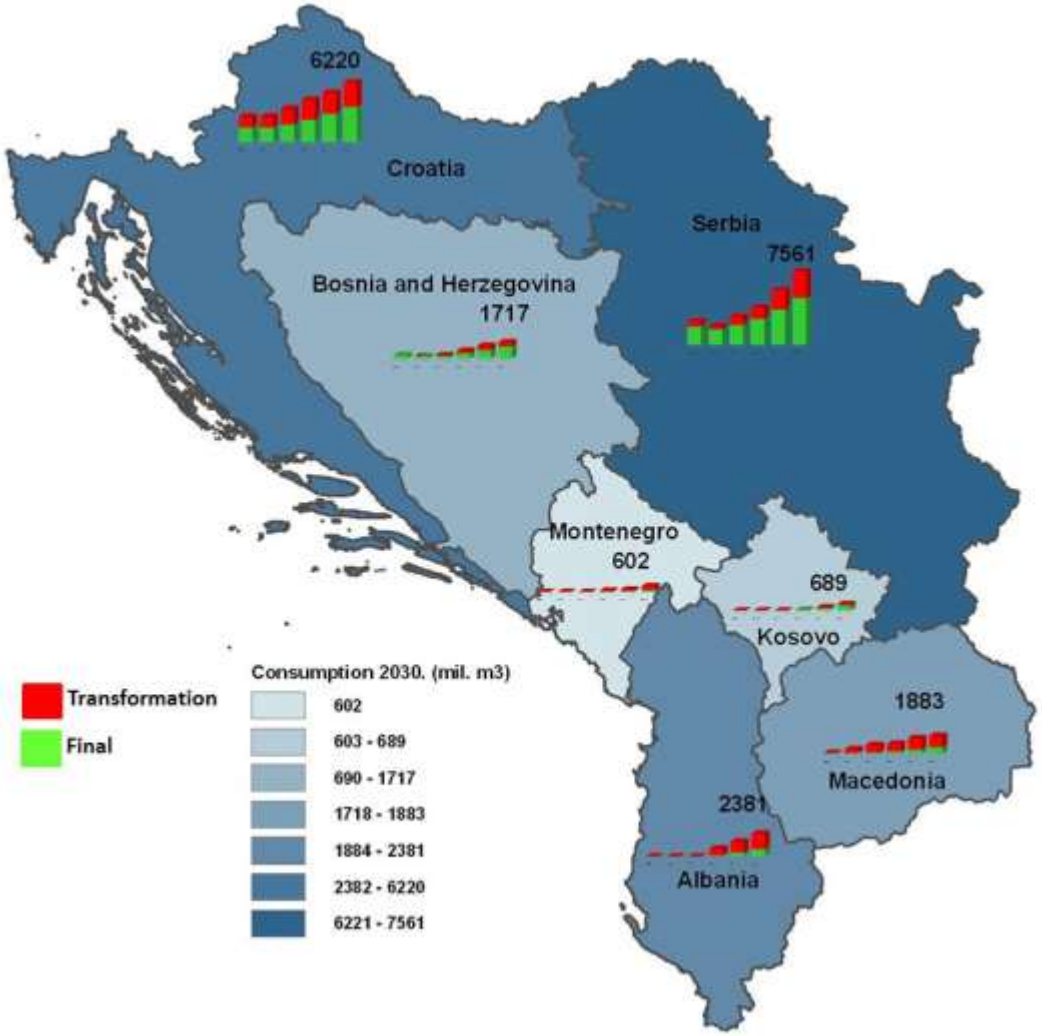


Total Gas Demand



Source: EIHP

Gas Demand by Location



Source: EIHP

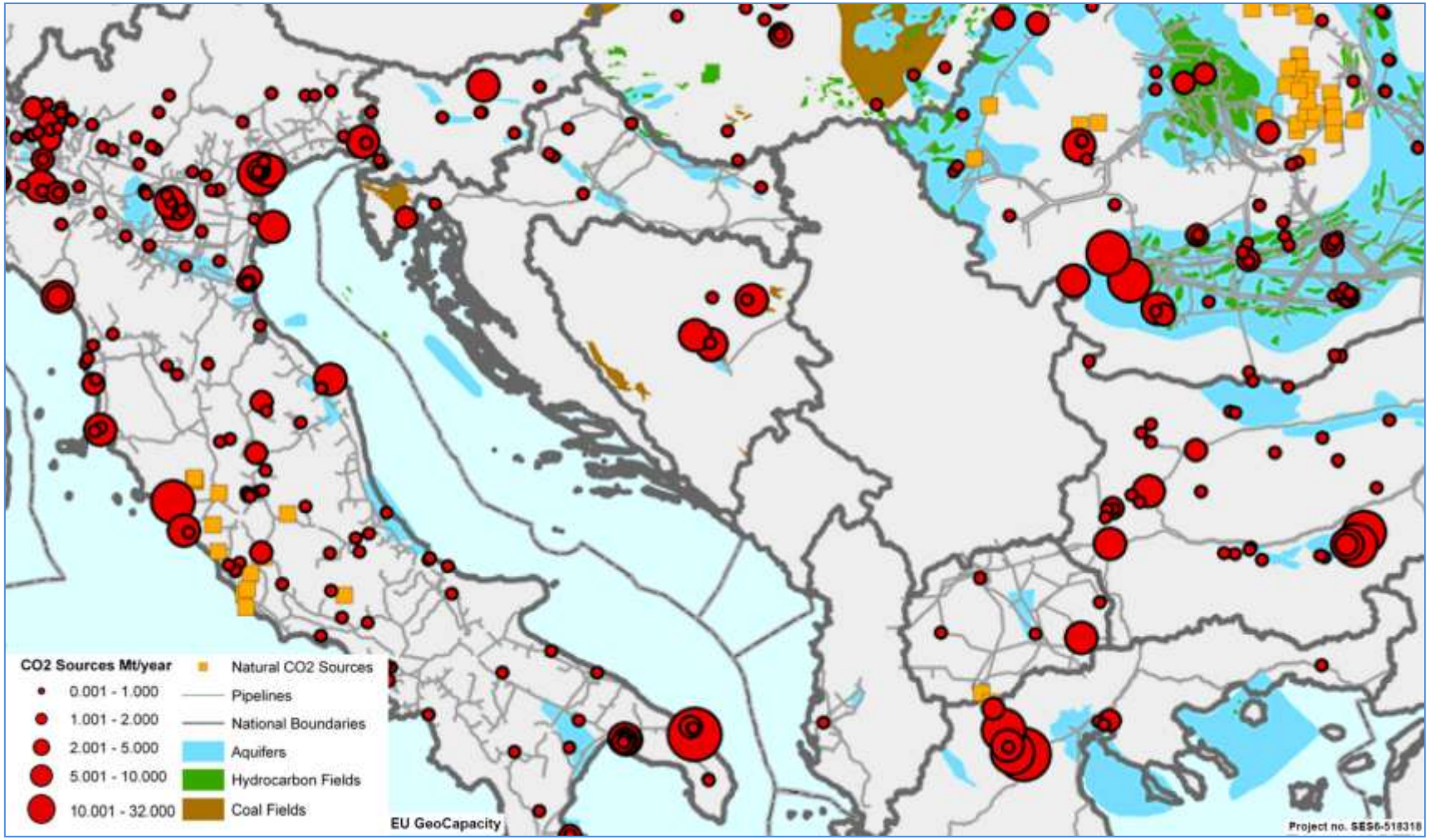
Feasible Future Gas Network

Source: EIHP

GHG Constrained Development

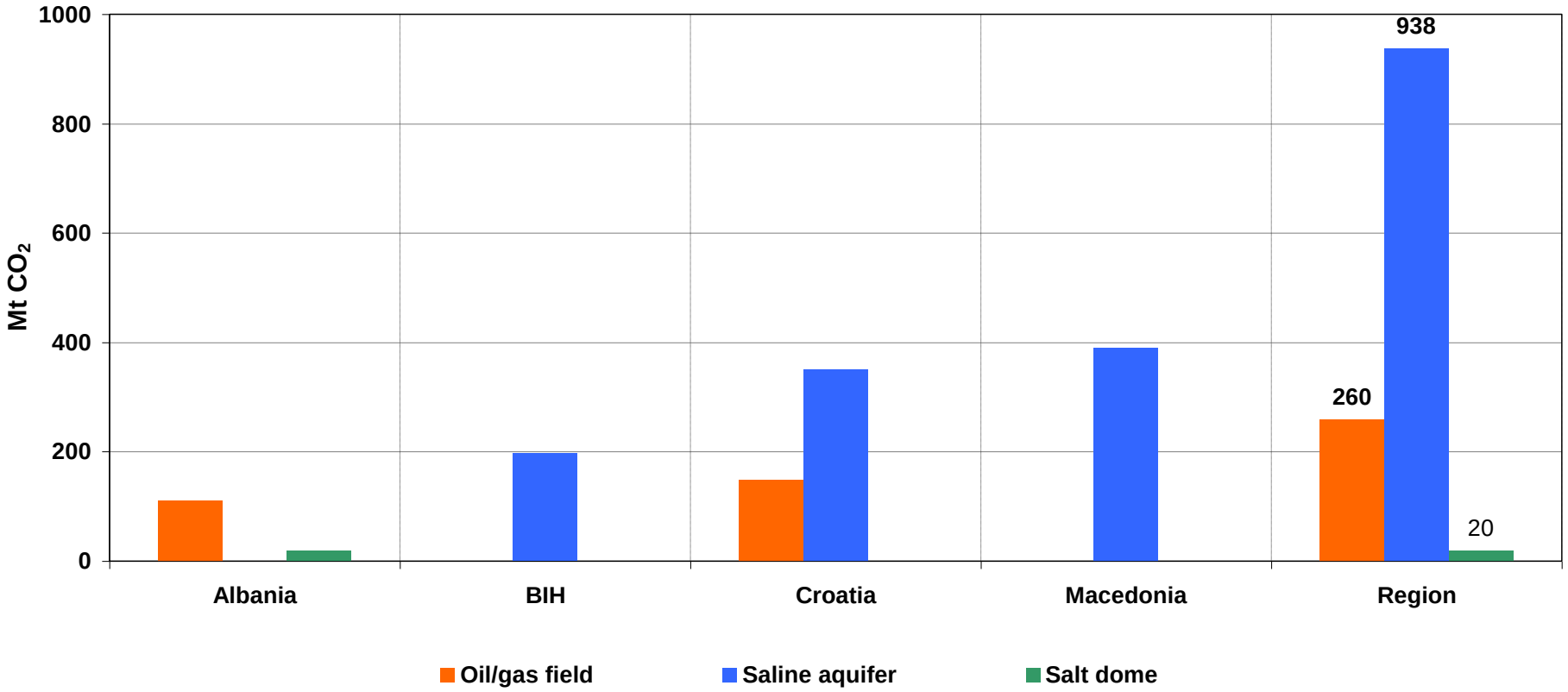
- Expansion of electricity generation
  - Local coal, large hydro, other RES, nuclear and natural gas
- GHG regulation becoming more and more visible in beyond 2020 era (CO_2 prices and limits)
- Identification of CO_2 sources and storages
- Linear optimisation of the regional/integrated electricity generation model

CO_2 Sources and Storages



Source: EU GeoCapacity

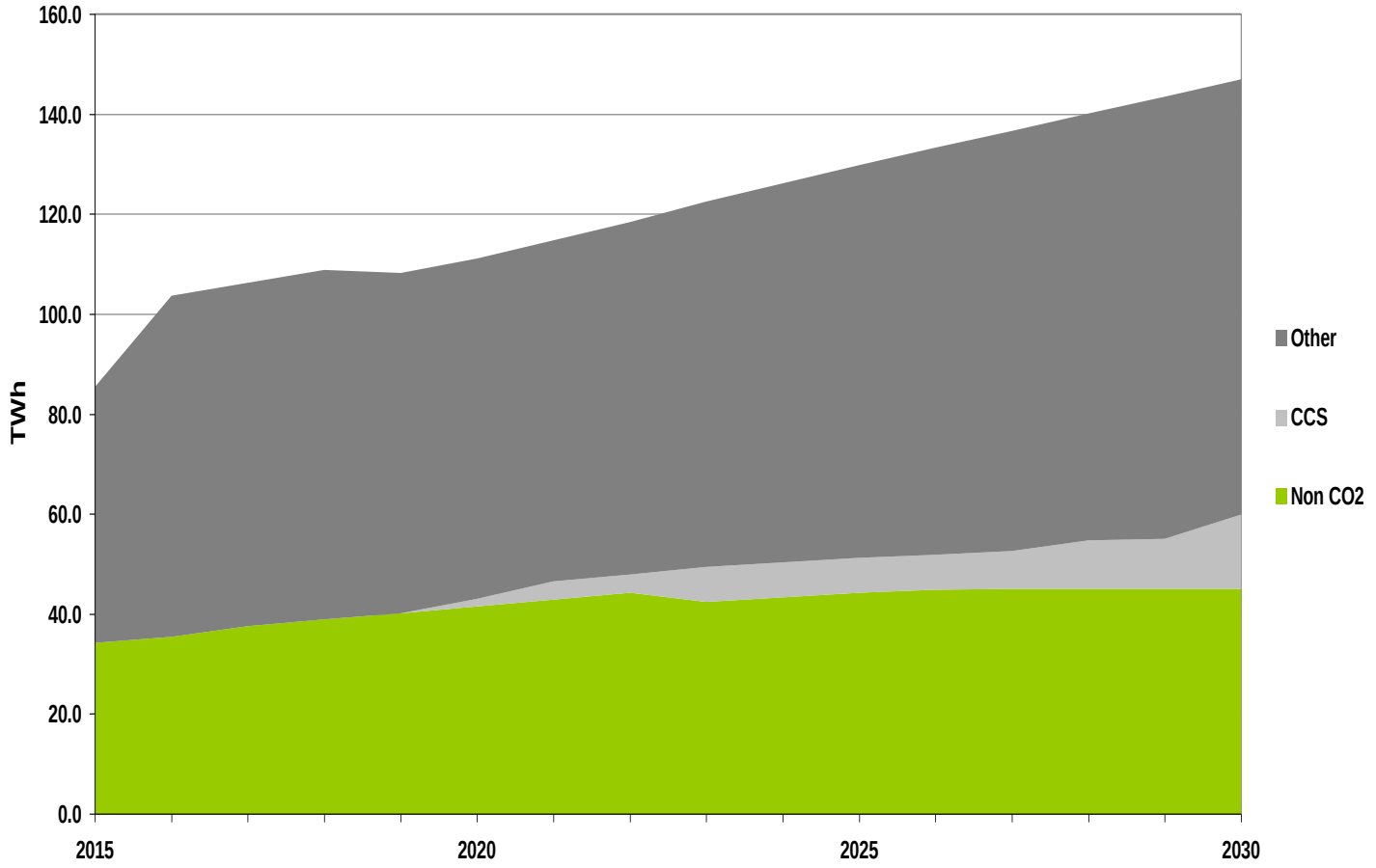
Viable CO_2 Storage Options in SEE



Source: EIHP

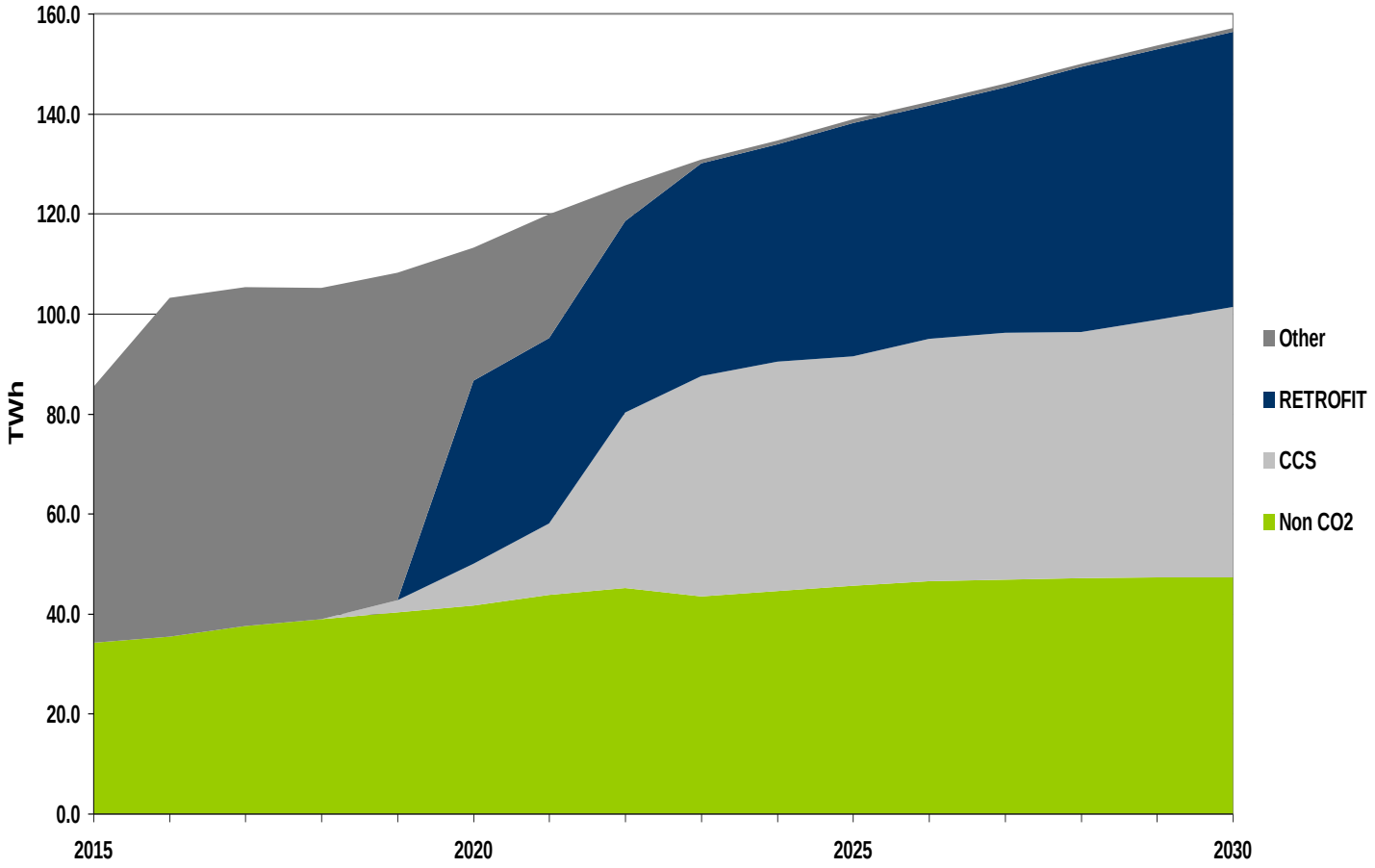
Share of CCS based generation in the CO2 Price scenario

50USD/ton CO_2 from 2020

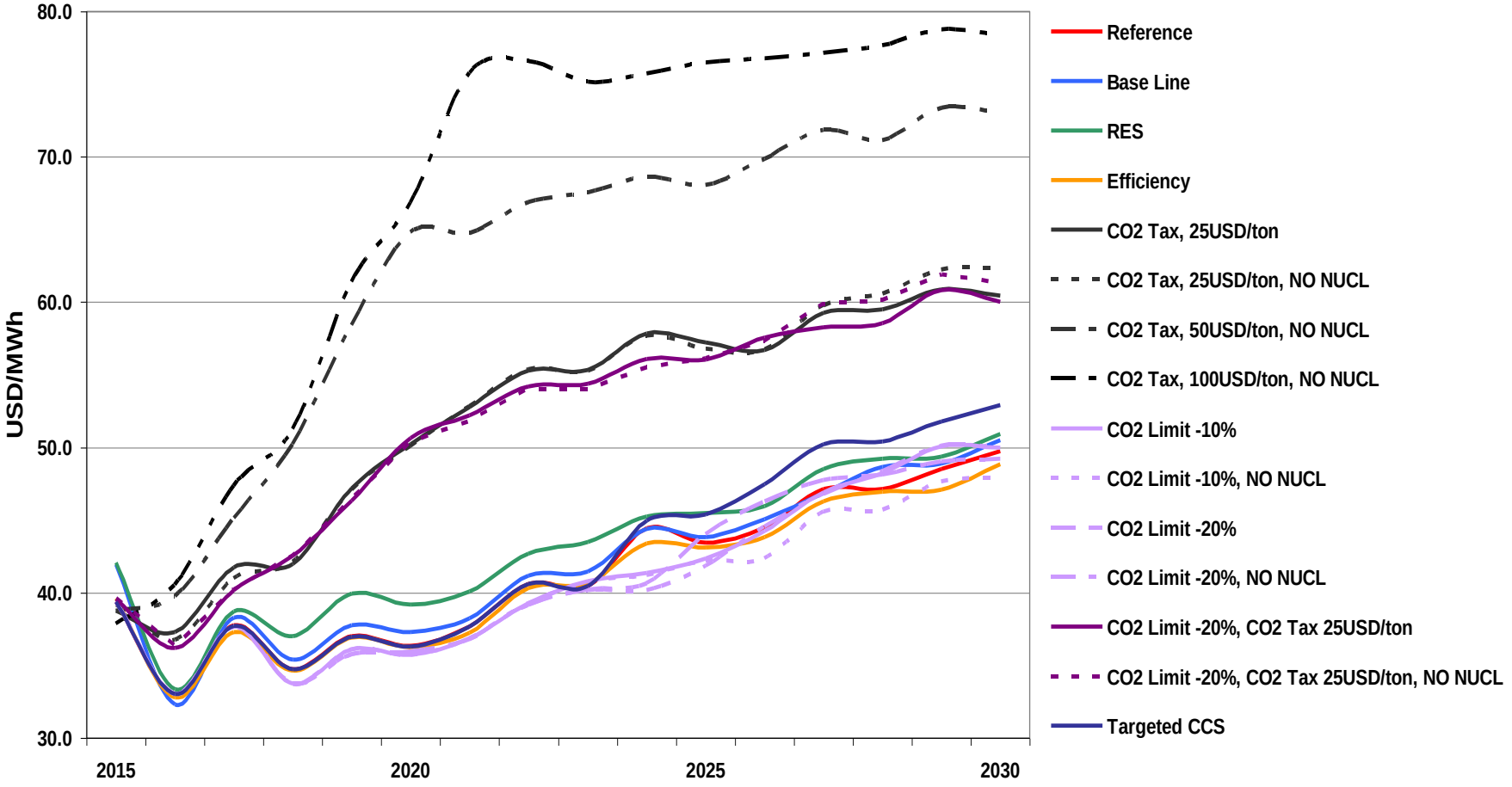


Share of CCS based generation in the CO2 Price scenario

100USD/ton CO_2 from 2025



Comparison of average generation costs across scenarios for Balkan region



Conclusions

- Viability of gas supply in SEE supported by the electricity generation development
- Natural gas as an interim option in electricity generation in 2030 horizon
  - Investment "friendly" option
    - Short lead times
    - Low environmental concerns
    - Low investment
  - Operational flexibility and high reliability
  - Diversification of generation portfolio
  - CO_2 Emission reduction

Conclusions cont.

- GHG regulation (CO_2 limits/prices)
  - Fierce competition at >50 USD/ton CO_2
  - Natural gas in electricity generation as intermediate solution and CCS ready projects
  - Average electricity generation costs almost doubled compared to the "free will" scenario
- Substantial potential in CCS activities
  - Opportunity for gas/oil companies in CCS business (exploration, drilling, transportation)
  - CCS ready plants
  - Beyond 2030 horizon
  - EOR-CCS projects competitive at current prices, but difficult realisation and limited opportunities in the region