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مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Impacts of grid integration on electricity production in the GCC

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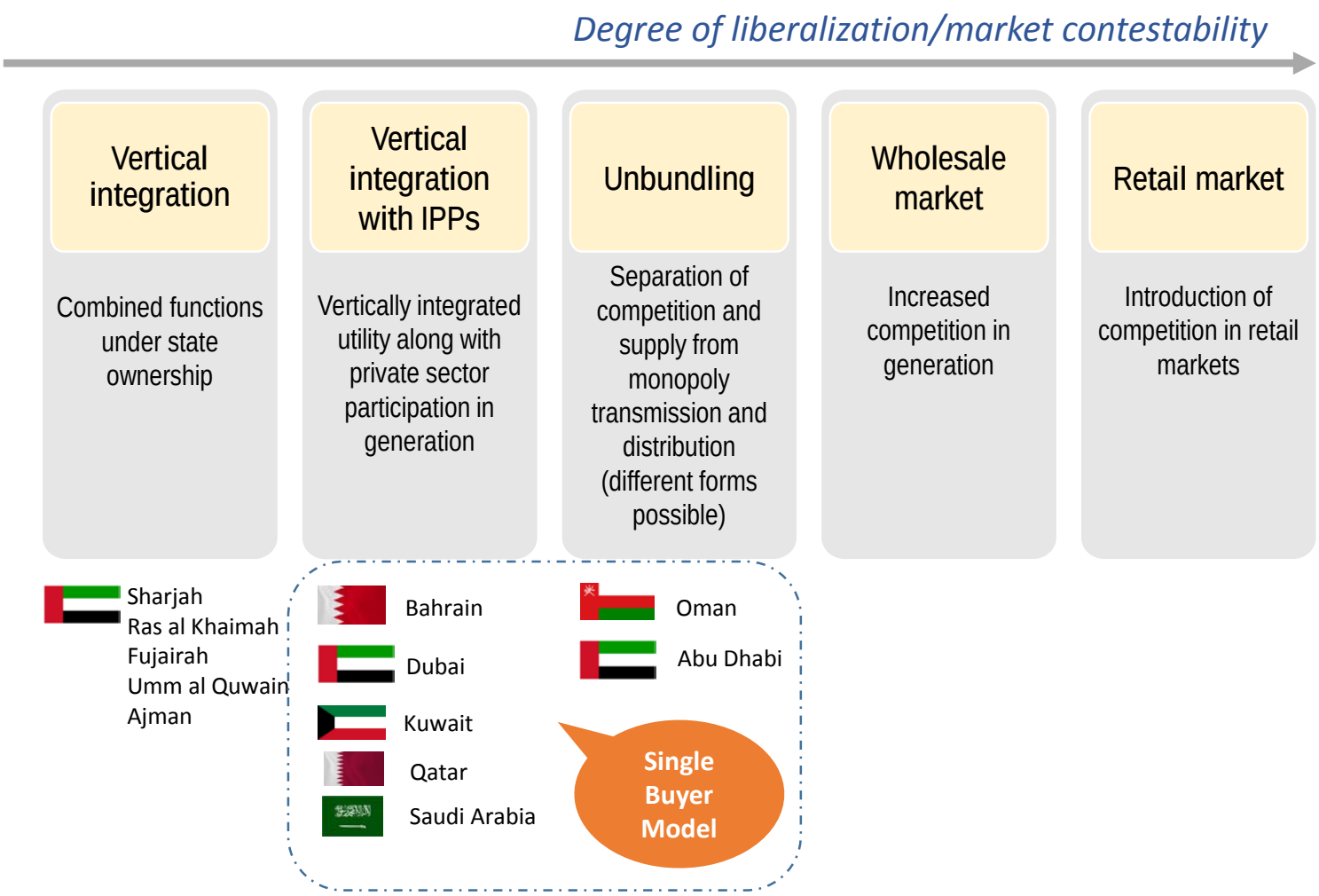
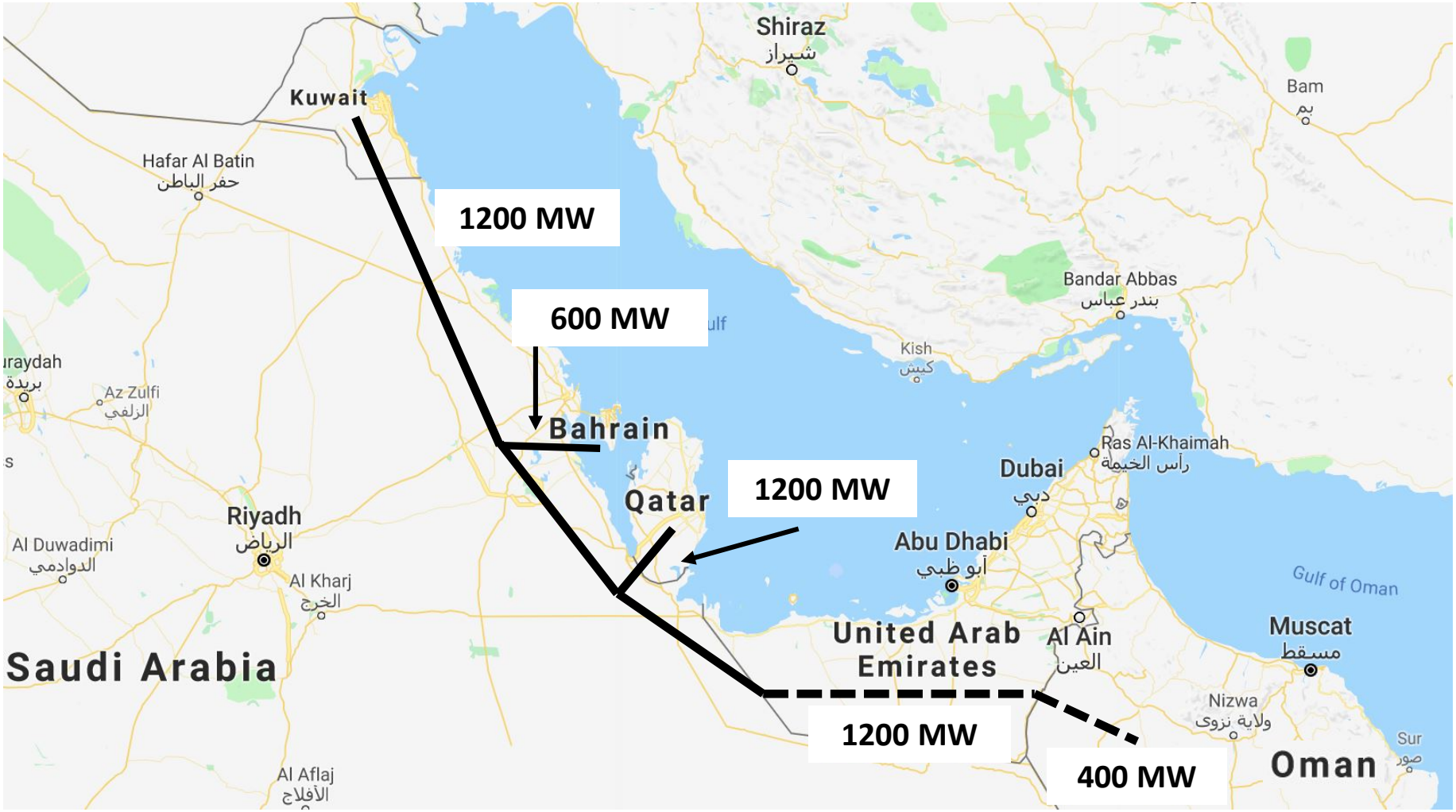
The GCC energy systems are in the early stages of liberalization



The GCC Interconnector is established but currently underutilized as a medium of exchange



Study: overview of GCC analysis

- The **objective** of this study is to explore the potential utilization of energy exchanges in the Gulf Cooperation Council (GCC) and quantify costs and benefits to member states.
- **Coordination** among member states could result in lower system costs through avoided capacity investment; reduced fuel consumption, and lower CO_2 emissions.
- The **GCC Interconnector** is modeled as the medium of exchange between the five countries (excluding Qatar).
- The **KAPSARC Energy Model (KEM)** is used for this analysis.
- Study available online at www.kapsarc.org

Electricity production and consumption are heavily subsidized through price controls

- Industrial fuels are subsidized at (e.g., Saudi Arabia as of Jan 2018):

Natural gas	$1.25/MMBtu
Crude oil	$6.35/bbl
Diesel	$14.00/bbl
Heavy fuel oil	$4.25/bbl

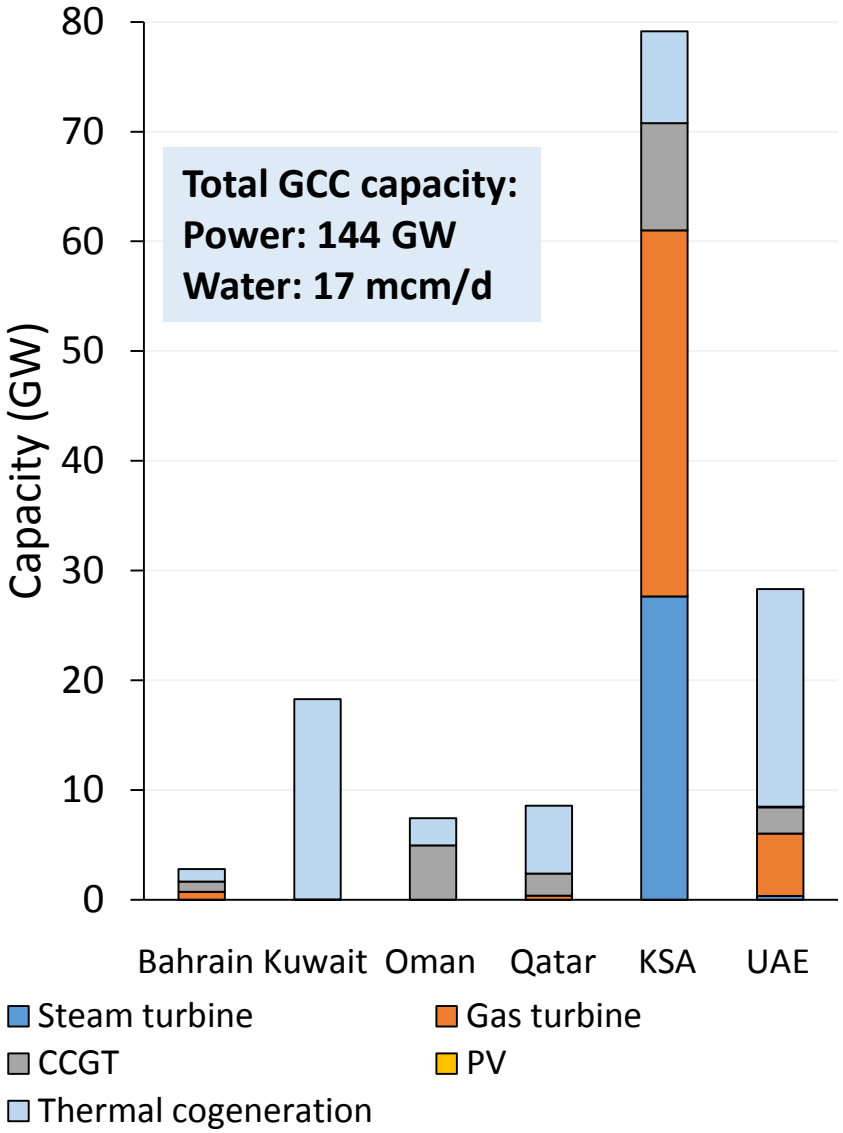
- Electricity demand increasing ~ 11% CAGR (1971-2013)
- Transitions are underway to restructure and decarbonize power production:
  - 200 GW of solar PV by 2030… (Saudi Arabia)
  - 5.6 GW of nuclear (U.A.E.), 3.3 GW (Saudi Arabia)
  - Liberalization and market creation…

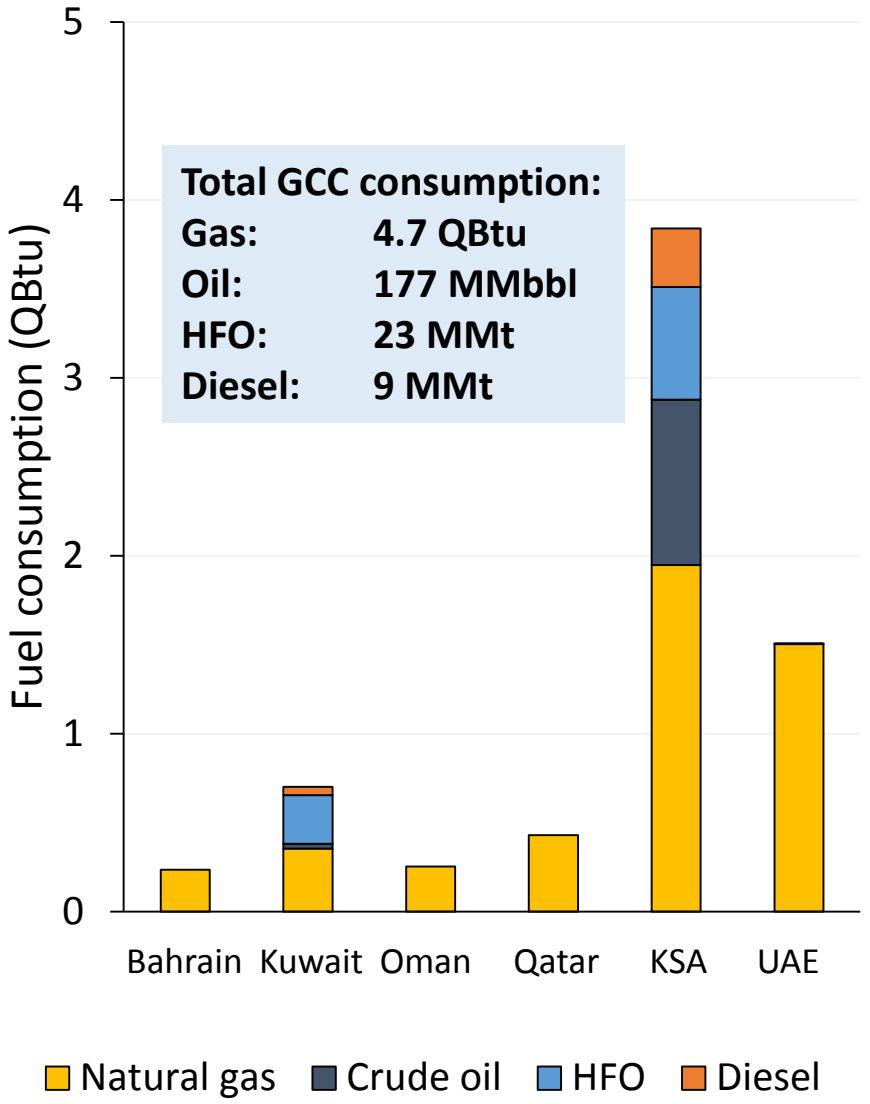
Scenarios

- **Reference** – replicate energy system of 2015 (fuel subsidies and no electricity exchange)
- **Subsidy exports** – keep fuel subsidies and allow electricity exchange
- **Exchange** – we couple subsidy removal with electricity exchange

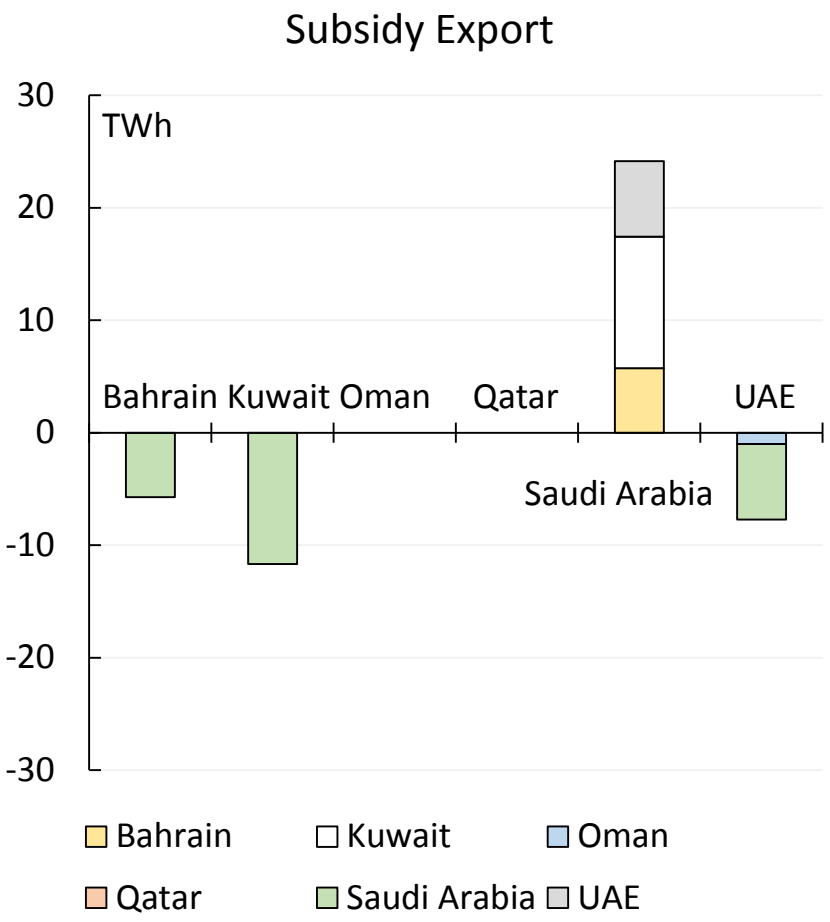
- All scenarios are a static analysis of 2015 using
  - reported electricity and water demand;
  - fuel production; and
  - fuel subsidies.

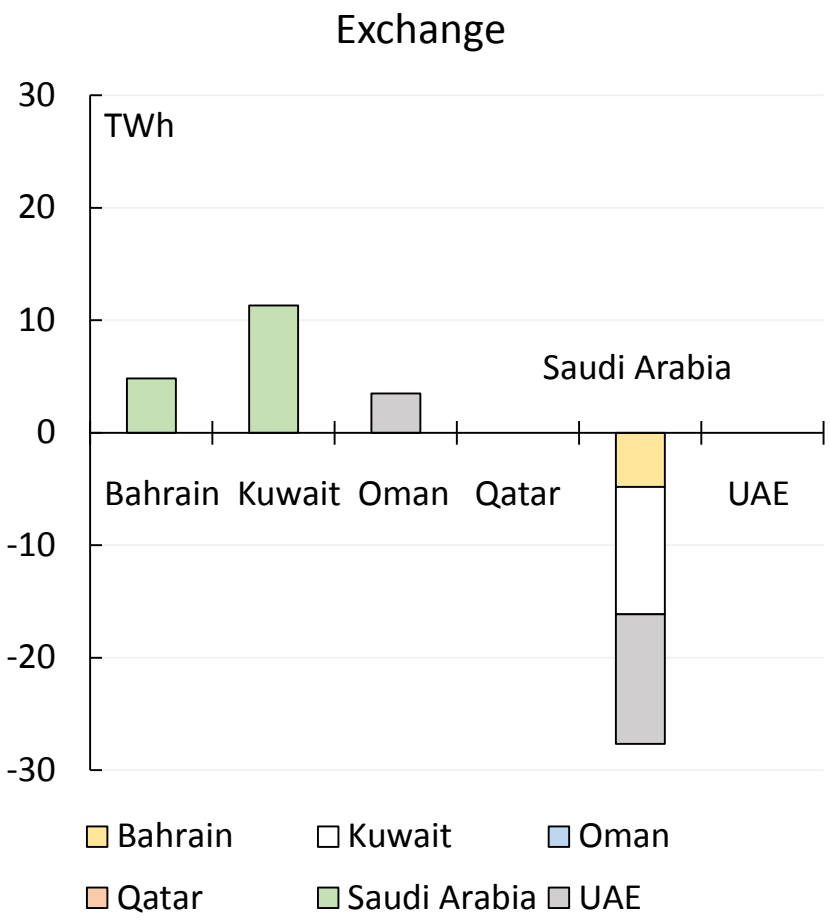
Presently, a substantial amount of power capacity co-produces water





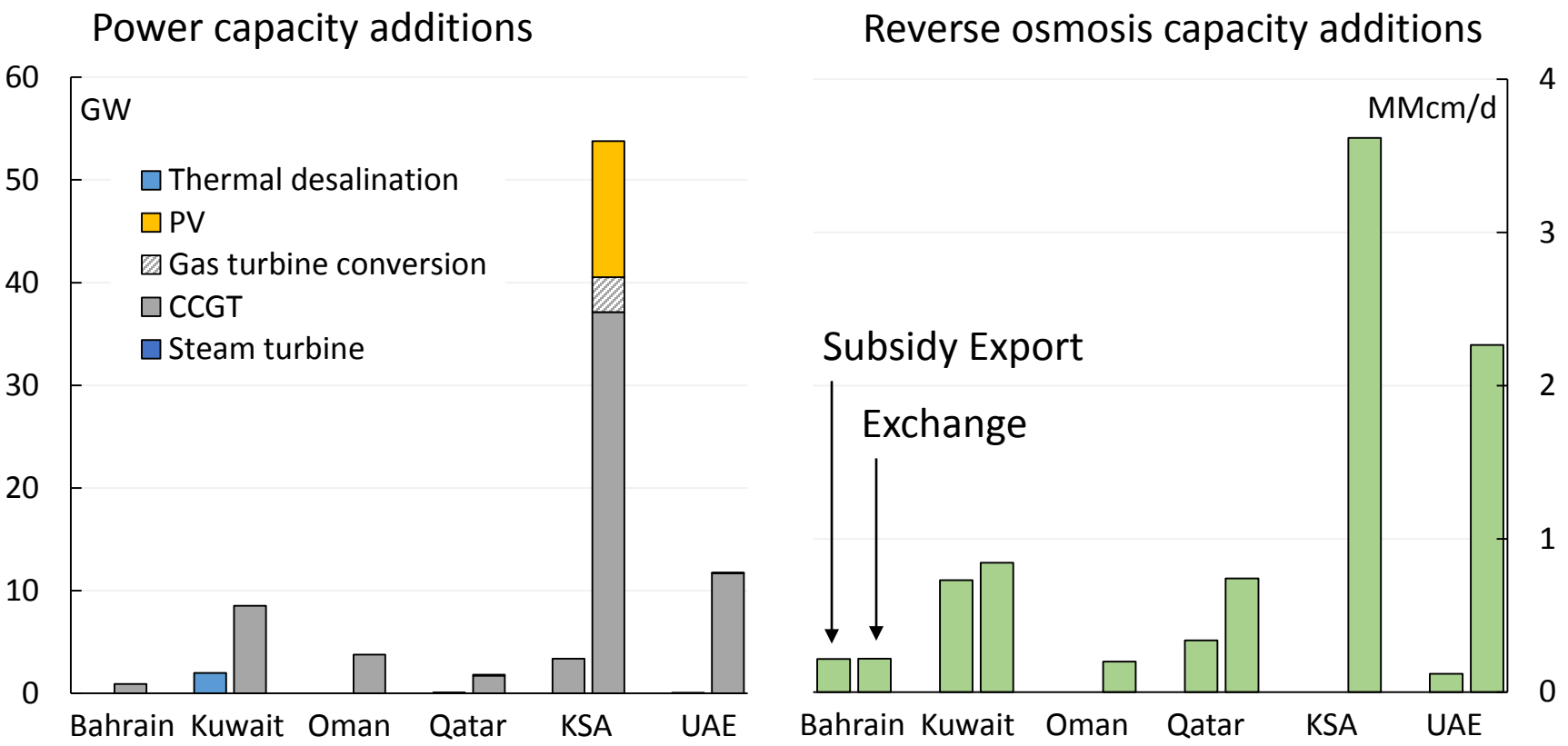
Relative cost of production affects flow of electricity





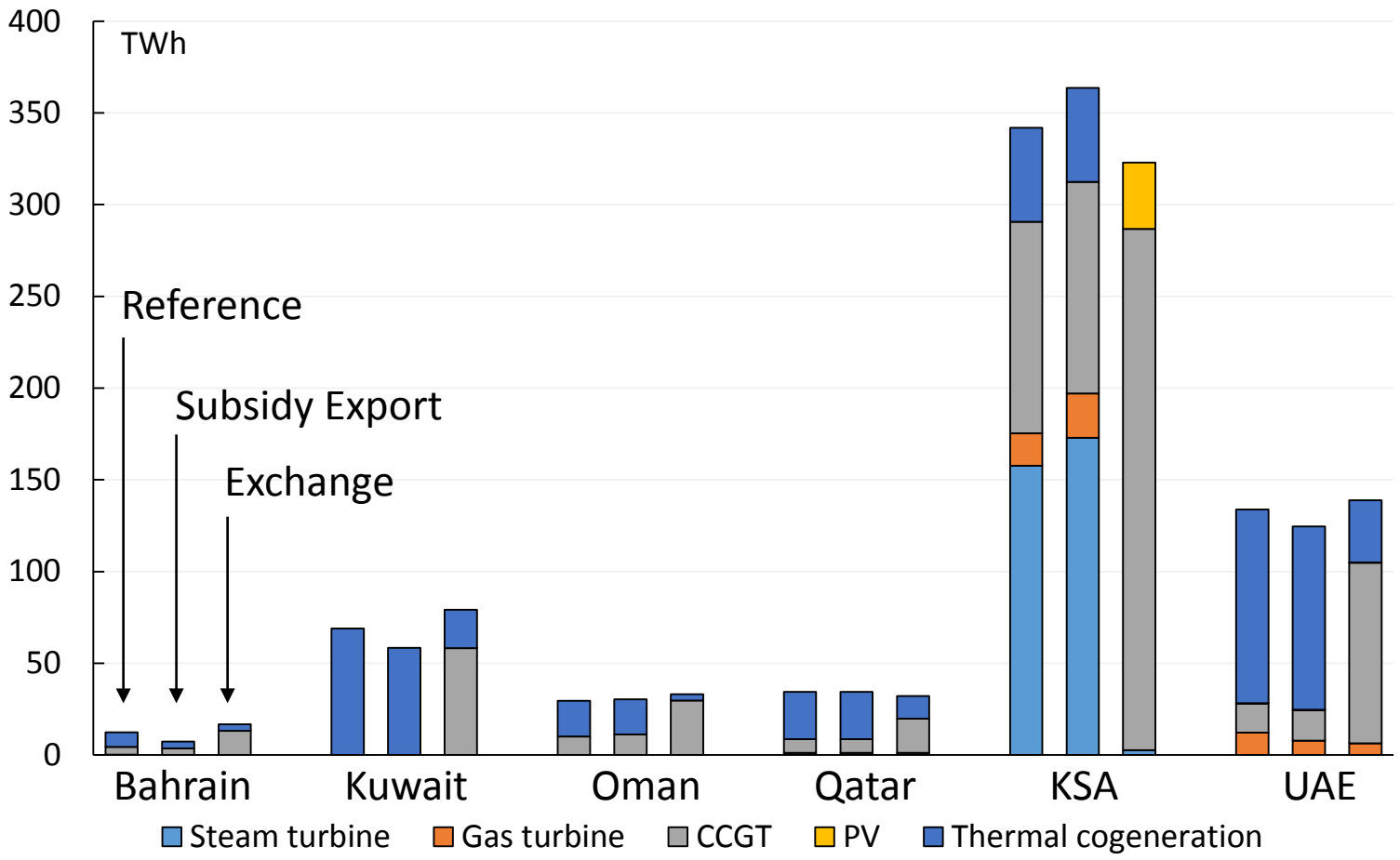
About 5% of electricity production would be exchanged.
Saudi Arabia would export $2.2 billion in 'subsidies' without reform.

Subsidy removal and exchange incentives investment in new capacity



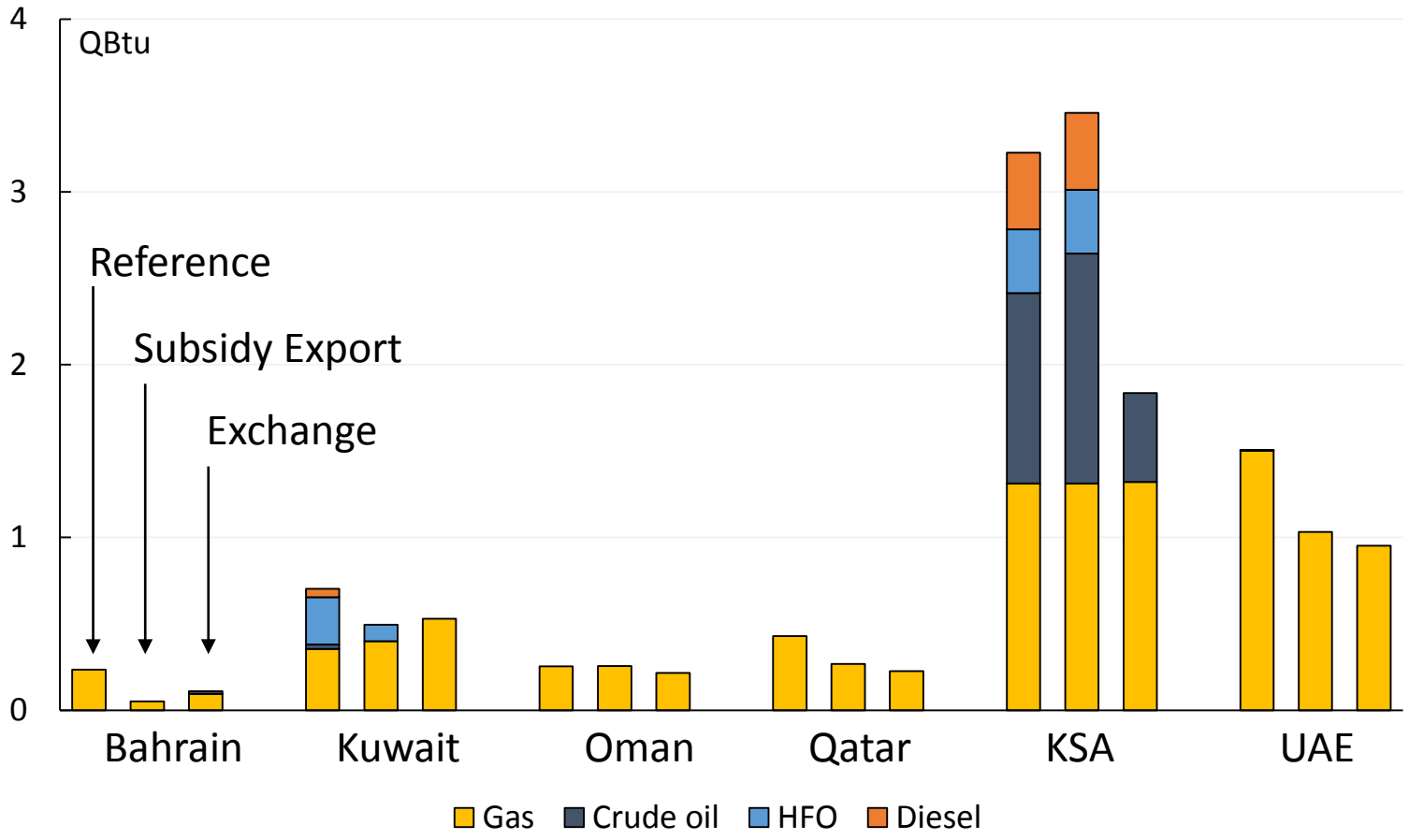
Utility scale PV and reverse osmosis water desalination become cost-effective

Desalination by reverse osmosis increases electricity demand



… but electricity production is more efficient and flexible because power and water production are decoupled

Exchange and investment in more efficient capacity lead to lower aggregate fuel consumption



However, Saudi Arabia increases fuel consumption when exporting subsidies

All countries must experience economic gain for exchange to be feasible

- Economic gain = export revenue - capital investments - O&M - fuel imports
- Relative to Reference:

	Subsidy export	Deregulated exchange
Bahrain	0.1	0.4
Kuwait	0.5	1.5
Oman	-0.1	1.3
Qatar	0.0	1.6
Saudi Arabia	-4.3	31.0
UAE	1.0	6.1
Total system	-2.8	42.0

Subsidy removal is a necessary prerequisite for equitable electricity exchange. Furthermore, subsidy removal delivers 98% of economic gain

All values: 2015 U.S. dollars

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Thank you

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