THE ENERGY TRANSFORMATION AND THE MIDDLE EAST

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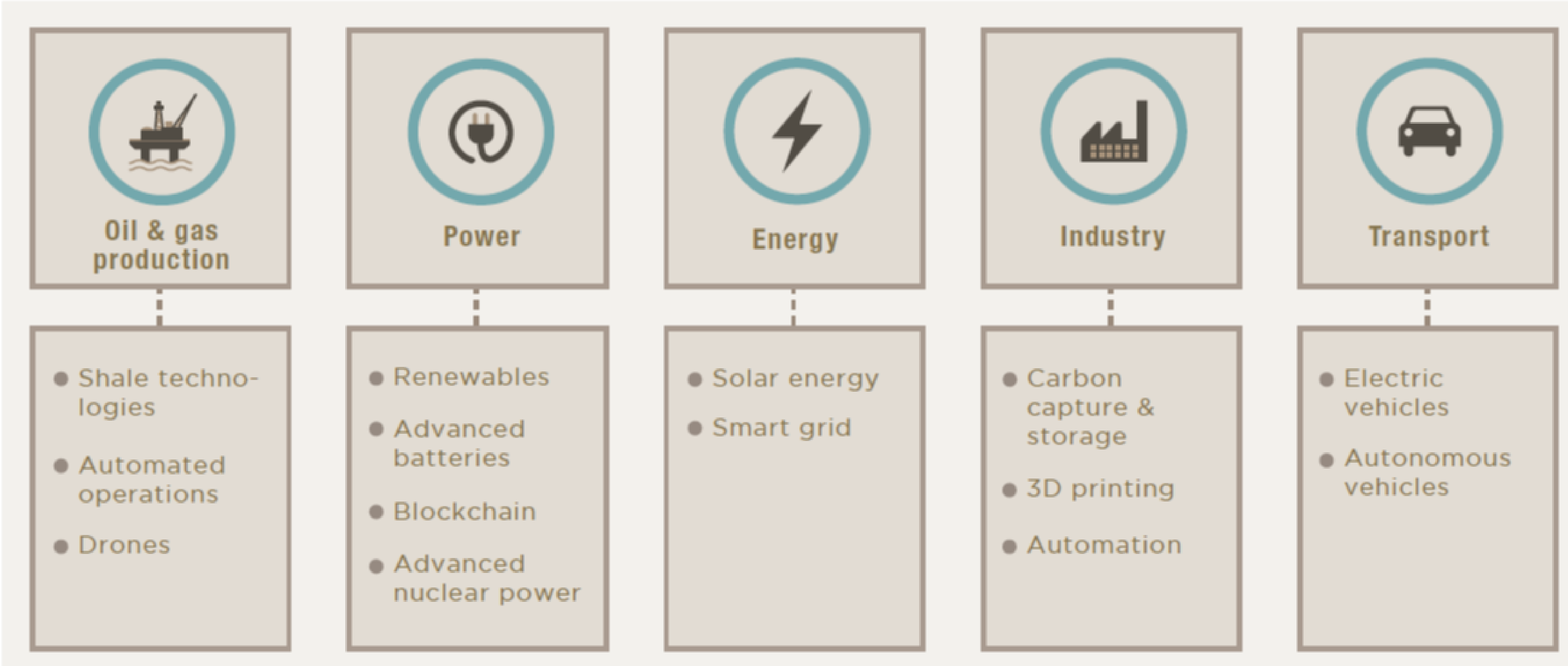
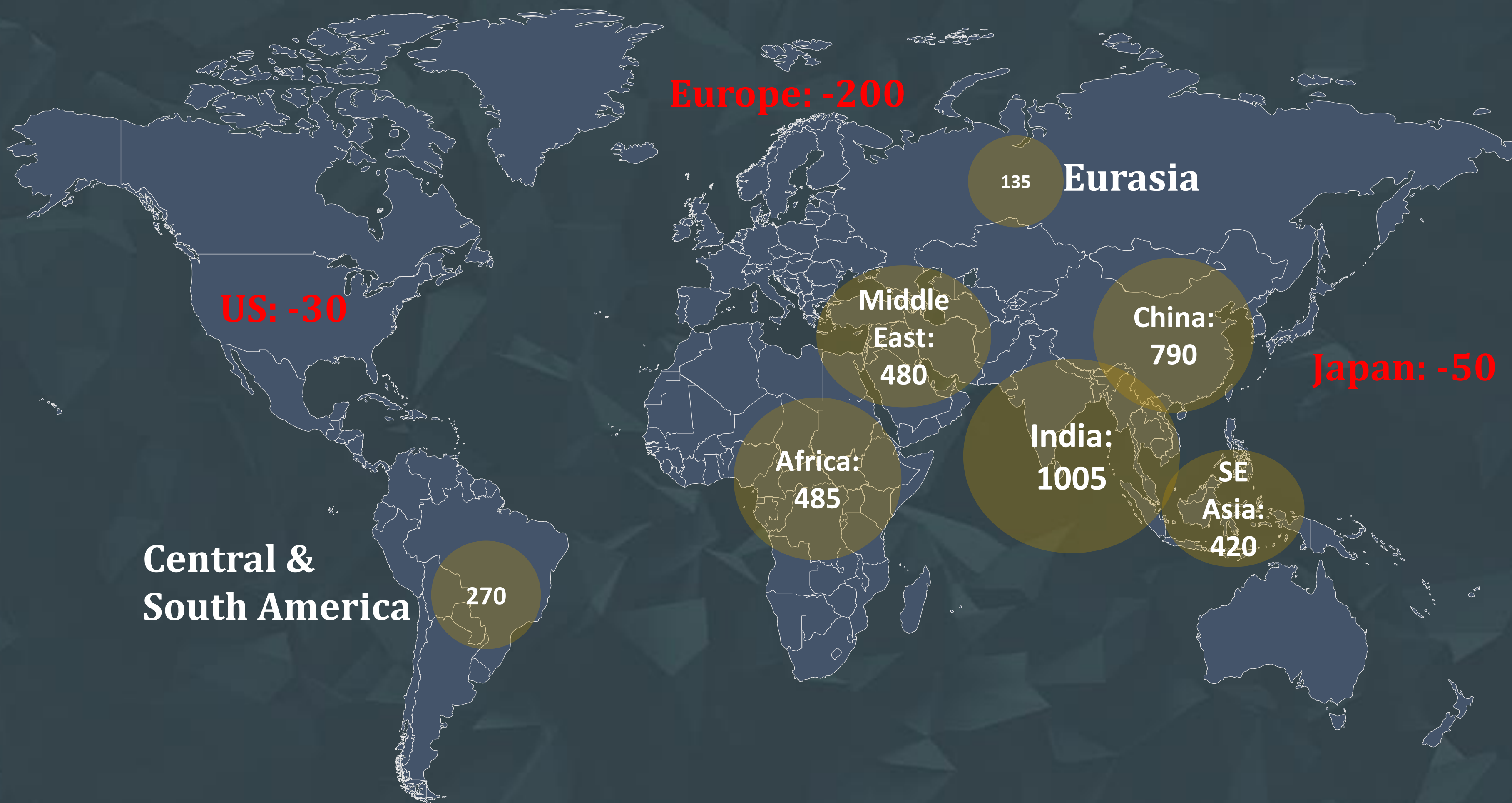
THE ENERGY TRANSFORMATION



WHAT IS CHANGING IN THE WORLD ENERGY LANDSCAPE?

- US shale: leading oil and gas producer & exporter
- Cleaner energy supplies → mainly China & Europe
- Green technology creates security; Gas is key
- Electrification
- Digitalisation

WHAT TO EXPECT? A CHANGE IN ENERGY DEMAND, 2016 – 2040 (MTOE)



- Global energy demand will rise up to 2040, but at a decreasing rate
- We will see a shift away from coal and oil and towards gas and renewables
- Major energy producers to watch for early warning signs of slowing demand by geography and sector to diversify economically and hedge

Source: IEA World Energy Outlook 2017; Qamar Energy

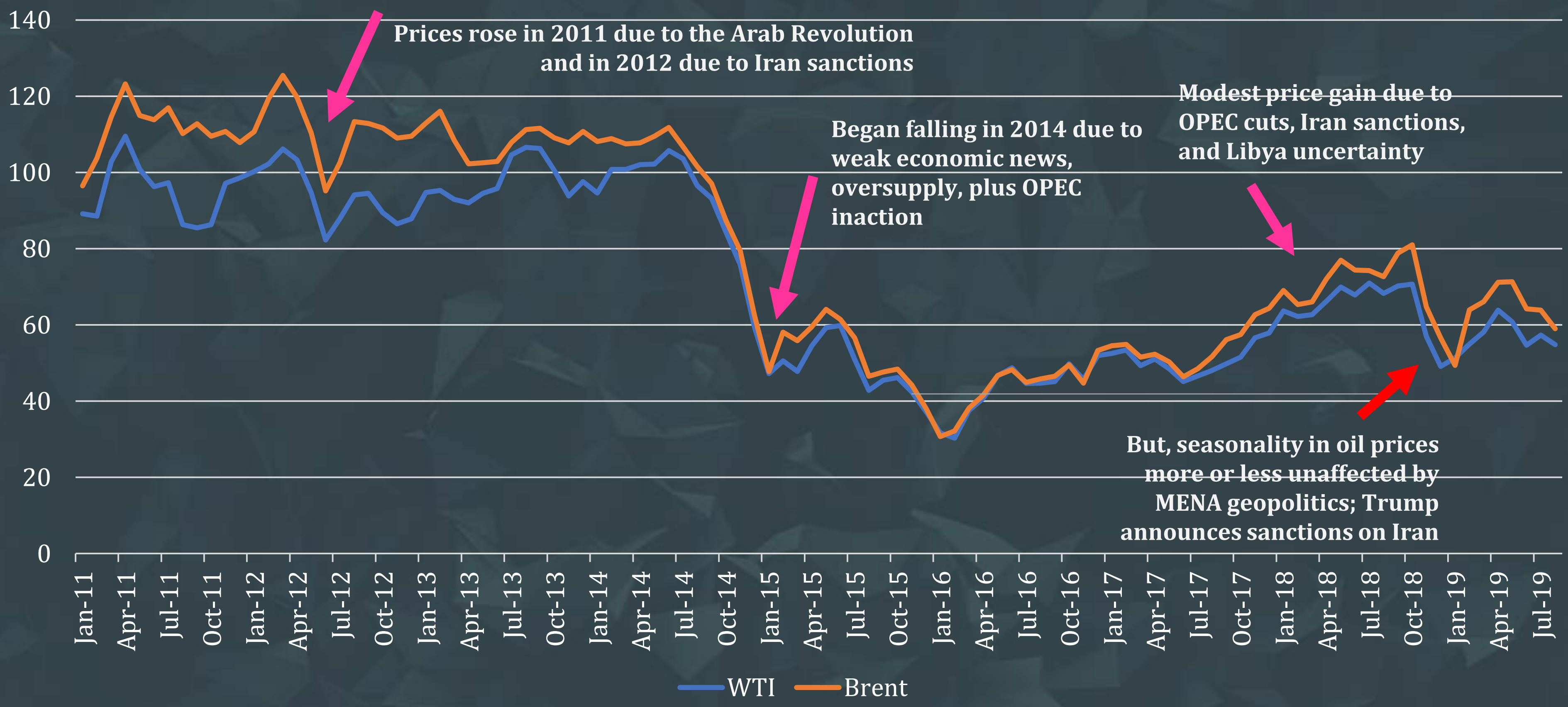
THE MIDDLE EAST TRANSITION

KEY THEMES

How is the Middle East going to adapt/cope to the changing world energy landscape?

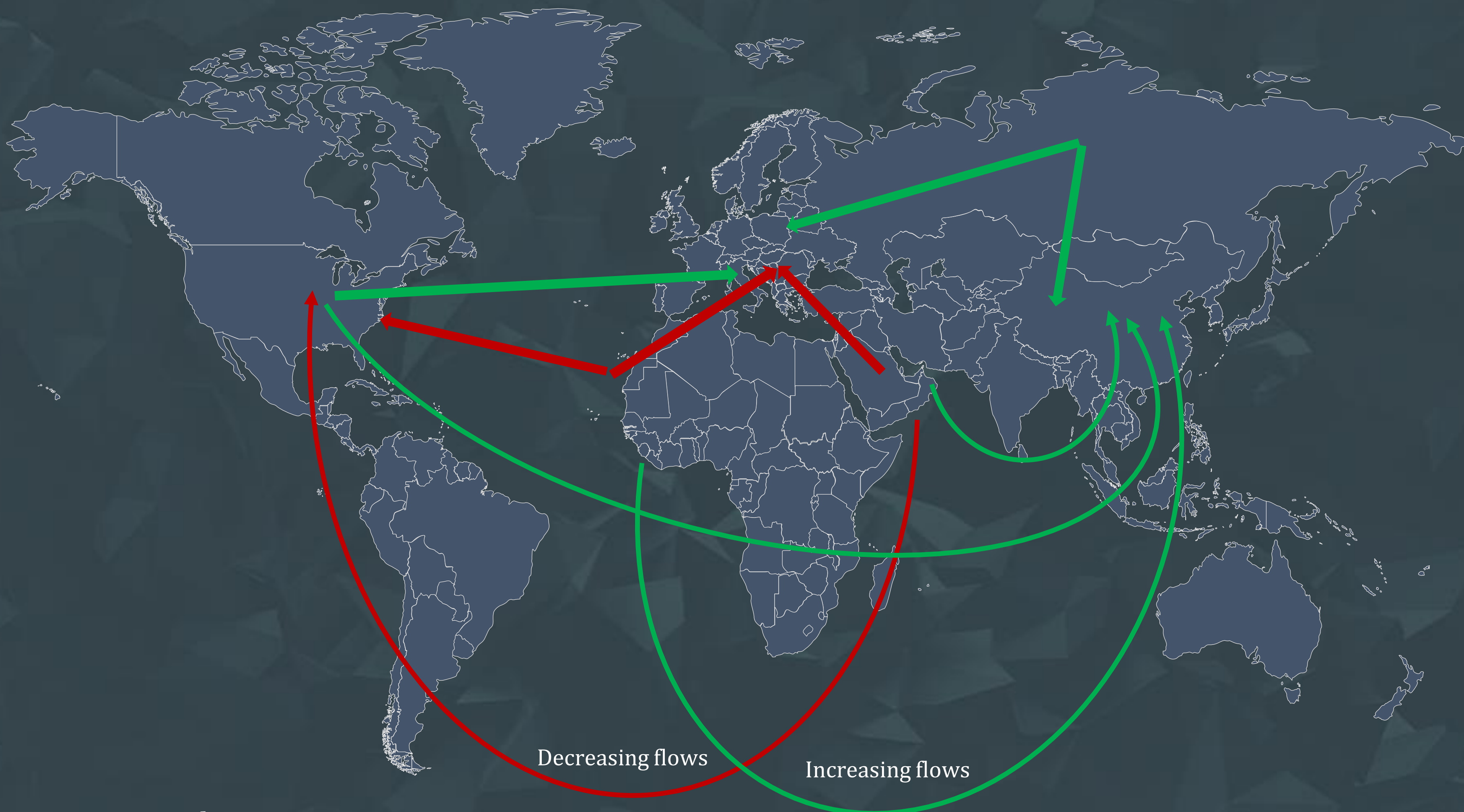
- Geopolitics
- Geography of oil production shifts
- Target oil markets shift
- A new age of gas
- Carbon capture?
- Nuclear power
- The rise of renewables, efficiency and subsidy reform

OIL PRICES NOW ONLY MARGINALLY AFFECTED BY GEOPOLITICS



- The recent attacks on Saudi's infrastructure: a prolonged outage of four weeks or more would see Brent crude trading close to $80/bbl
  - Oil price increases muted from expectation it will be short-lived
  - Concern about the global economy
- Now there are increased trade routes, increased supply outside OPEC, high inventory stocks & emergency stocks, & SPR releases

OIL SUPPLY GEOGRAPHY SHIFTING



- Demand centre remains Asia
- Non-OPEC oil geography has already shifted towards North America, and secondarily Russia
- OPEC oil geography is moving towards the members who combine reserves & investment: Saudi Arabia, Iraq, UAE and (politics permitting) Kuwait, Libya and Iran

Source: Qamar Energy

THREE VISIONS OF GAS

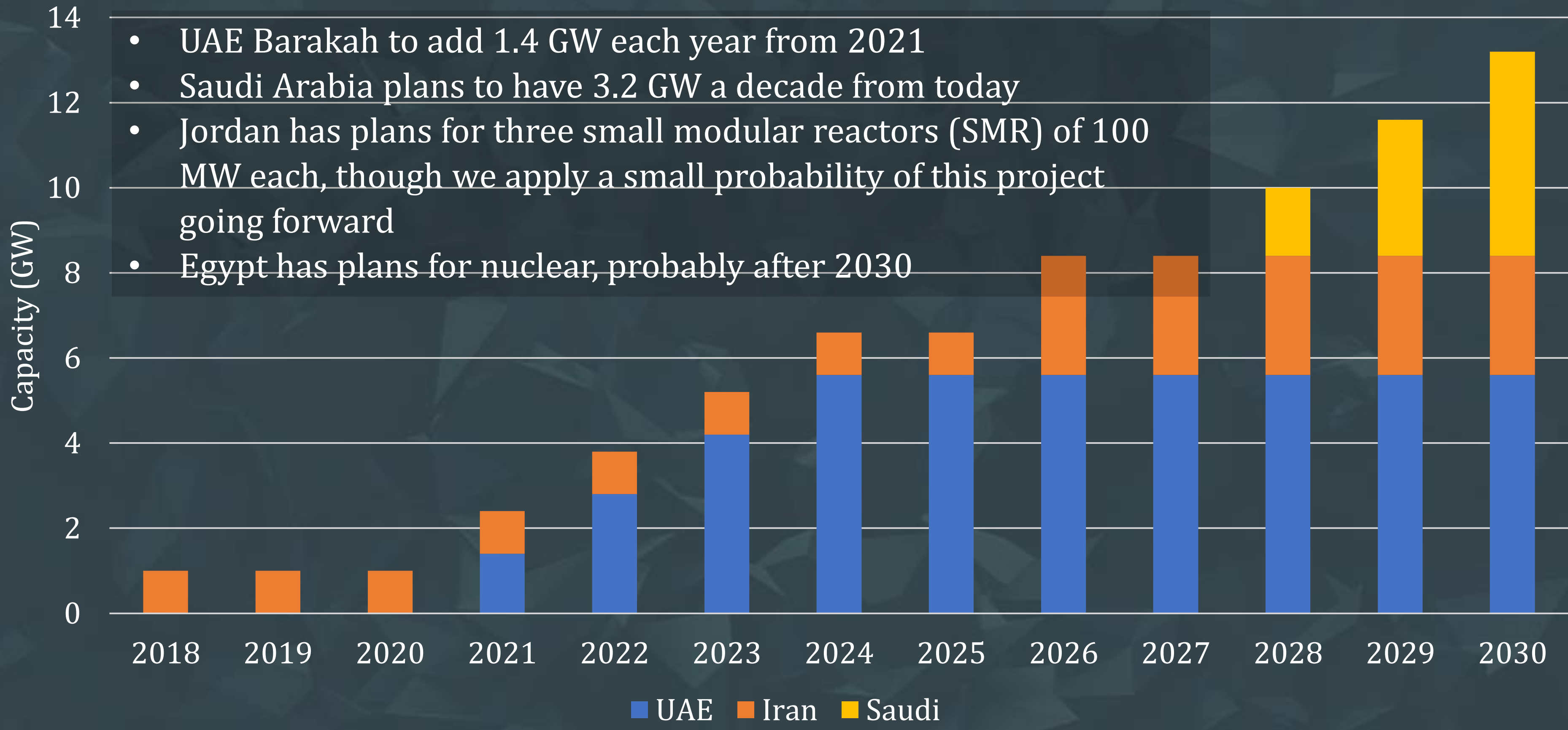
	VISION	DRIVERS
DEAD END 	• A renewable future	• Shift from coal direct to cost-competitive renewables • Strong climate action • High cost of LNG
BRIDGE FUEL 	• Gas to 2040 before renewables take over	• Flexible interim back-up to renewables • Need for gas in industry, transport • Failure of widespread gas CCS
DESTINATION FUEL 	• A large part of the energy mix indefinitely	• Success of gas CCS • Massive cheap unconventional resources • Difficulty in balancing renewable-only grids

Source: Qamar Energy

CARBON CAPTURE UTILISATION & STORAGE (CCUS)

Good for Middle East	Bad for Middle East
Creates 'carbon space' for oil and gas exports	Supports continuing coal use
Potential for Enhanced Oil Recovery (EOR) to improve recovery of the oil from the well	Potential for EOR outside Middle East
Can displace gas used for reinjection into wells	Can make high-carbon unconventional oil more acceptable (oil sands, coal-to-liquids)
Important to reduce carbon footprint of gas-to-liquids plants	Reduces 'carbon leakage' effect *(when companies move their production abroad to countries with less strict climate policies)*
Reduces future CO_2 mitigation costs	

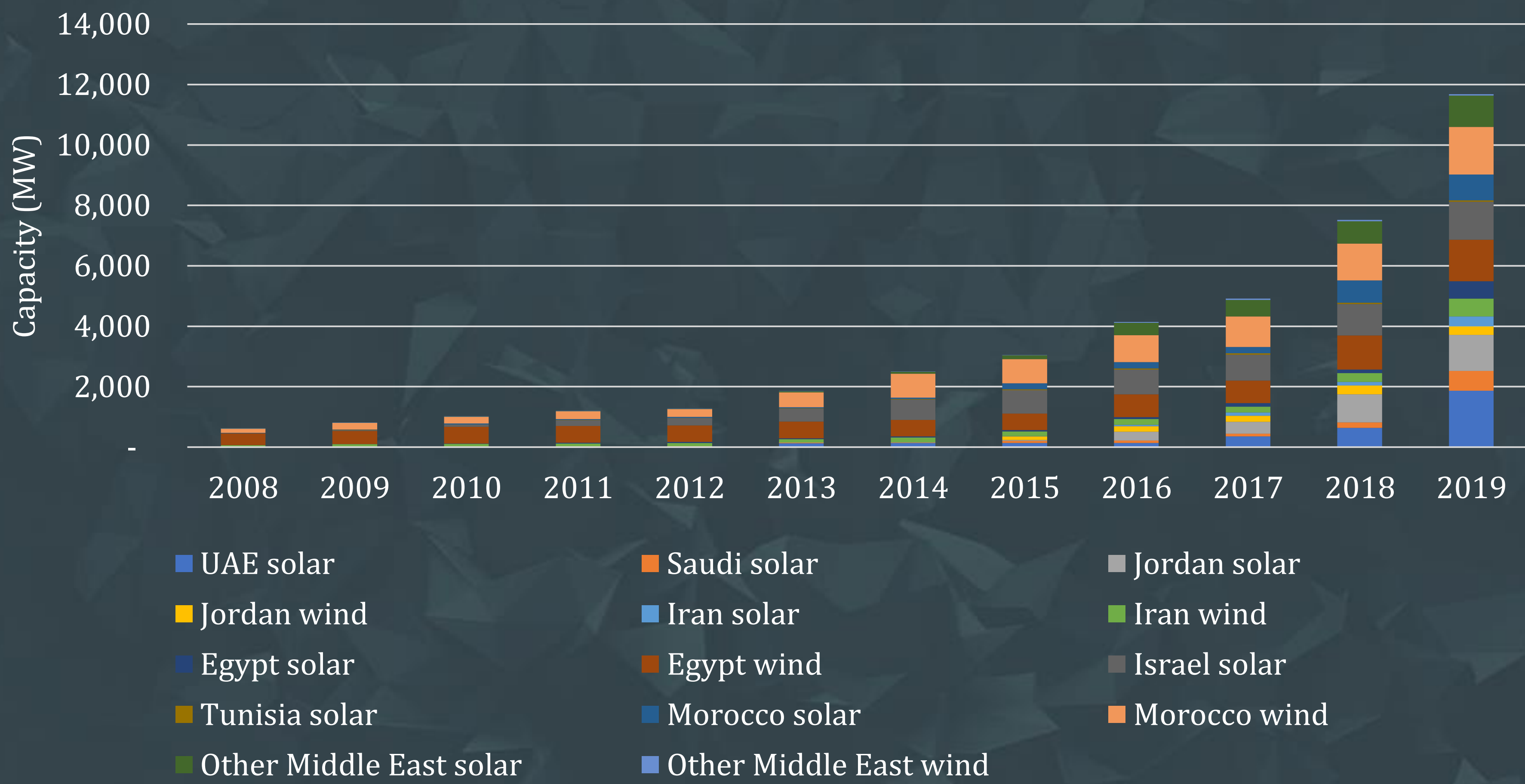
NUCLEAR POWER HAS MADE SIGNIFICANT BUT HALTING PROGRESS IN THE REGION



- Remains an expensive generation option
- Has strong geopolitical overtones
- However, will continue to attract attention because of its advantages
- SMRs & SMART reactors (System-integrated Modular Advanced Reactor) offer better economics
- 4th generation nuclear reactors - significant advances in sustainability, safety, economics

Source: Qamar Energy Research; News Sources; EIA

RENEWABLE ENERGY IN MENA IS REACHING THE STAGE OF TAKE-OFF



- New countries are joining the early leaders
- Installed MENA capacity had its largest increment in 2018, adding more than 1.5 GW
- Increased energy, lower solar PV prices, efficiency targets, subsidy reform has paved the way for higher RE integration

Source: Qamar Energy Research; IRENA

KEY CONCLUSIONS

- The “energy transition” is not just about renewables or carbon
- Visions of future energy are subject to change!
- Focus on gas, the cleaner fuel
- Middle East countries are adapting at varying paces and ways to future lower oil demand and prices
- Future outlook for Middle East oil & gas exporters remains positive, but with shifting markets and new competitors

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