



SAUDI ARABIA: ENERGY LANDSCAPE

Generation capacity

- Saudi Electricity Company (SEC) 60 GW today → 90 GW by 2020
- Other generators ~10 GW currently (mostly desalination, Aramco & industry self-generation)
- Total national capacity → 120 GW by 2032
- Implied annual growth rate 3.2%
- Subsidy reform in December 2015 but fuel, power, water prices remain well below international levels
- Privatisation of SEC planned

Gas supply

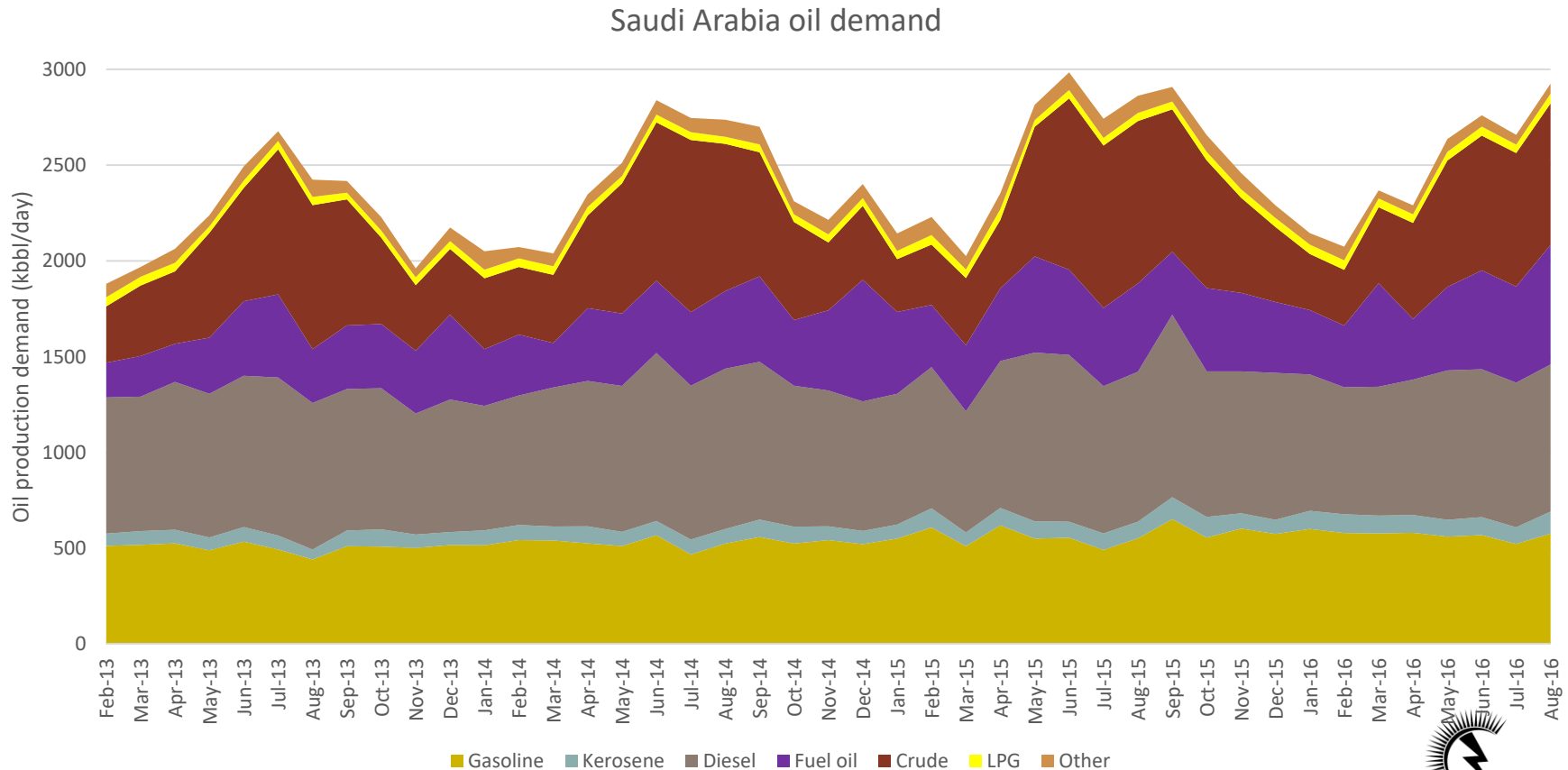
- Planned to grow from 12 Bcfd currently to 17.8 Bcfd by 2020
- Much gas needed for industry
- If all devoted to power, would fuel ~26 GW → share of gas would rise substantial but absolute oil use would still rise
- Gas imports politically difficult

Other power generation

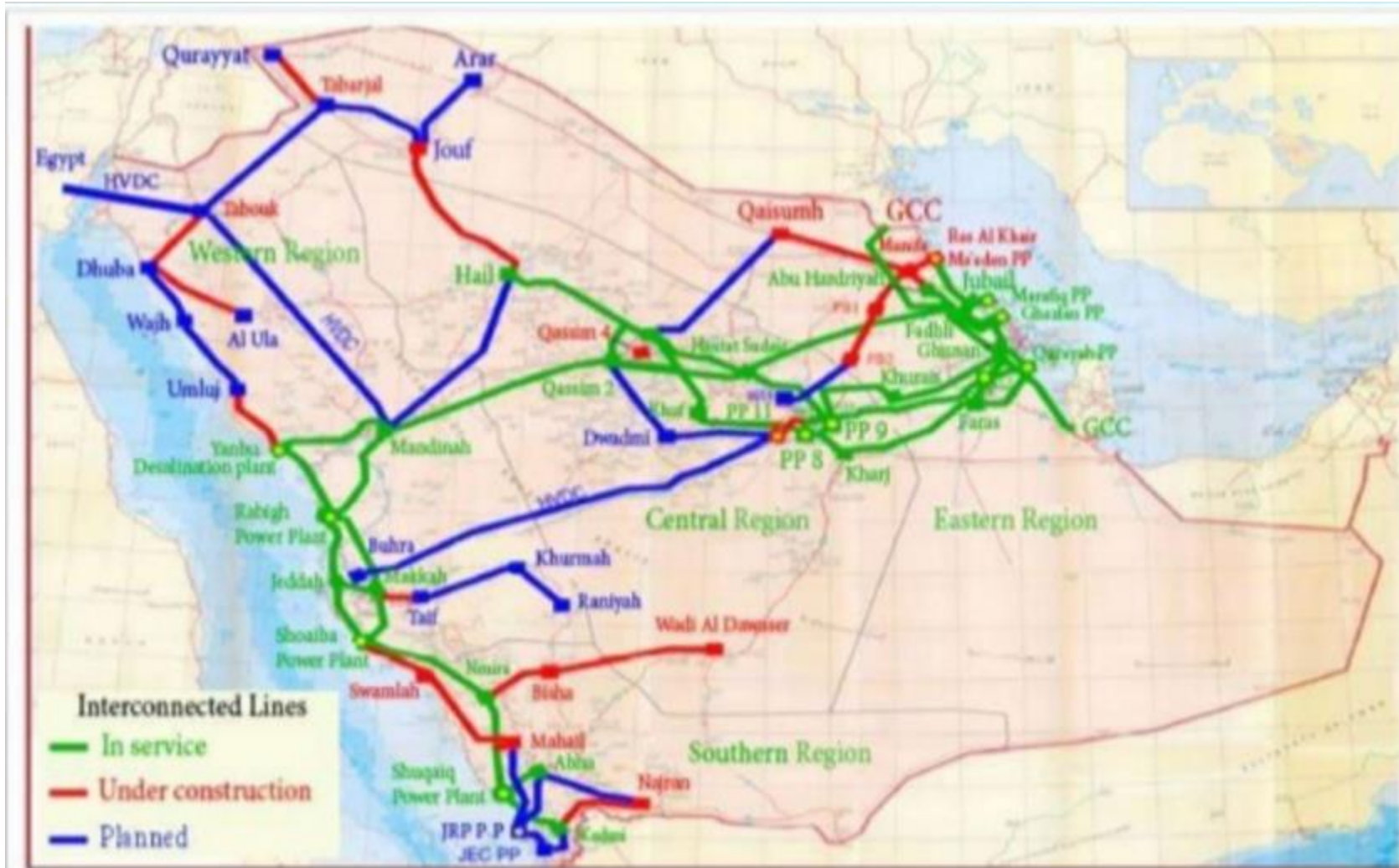
- Some studies to use coal; no firm plans
- Minimal use of renewables today, but 400 MW wind & 300 MW solar to be awarded by September 2017
 - Target 3450 MW by 2020 and 9500 MW by 2023
- Initial goal of 2800 MW nuclear, said to be in design phase
- 2 x 1000 MW pumped hydro storage facilities in design on Red Sea coast

SAUDI POWER GENERATION REMAINS HIGHLY DEPENDENT ON OIL

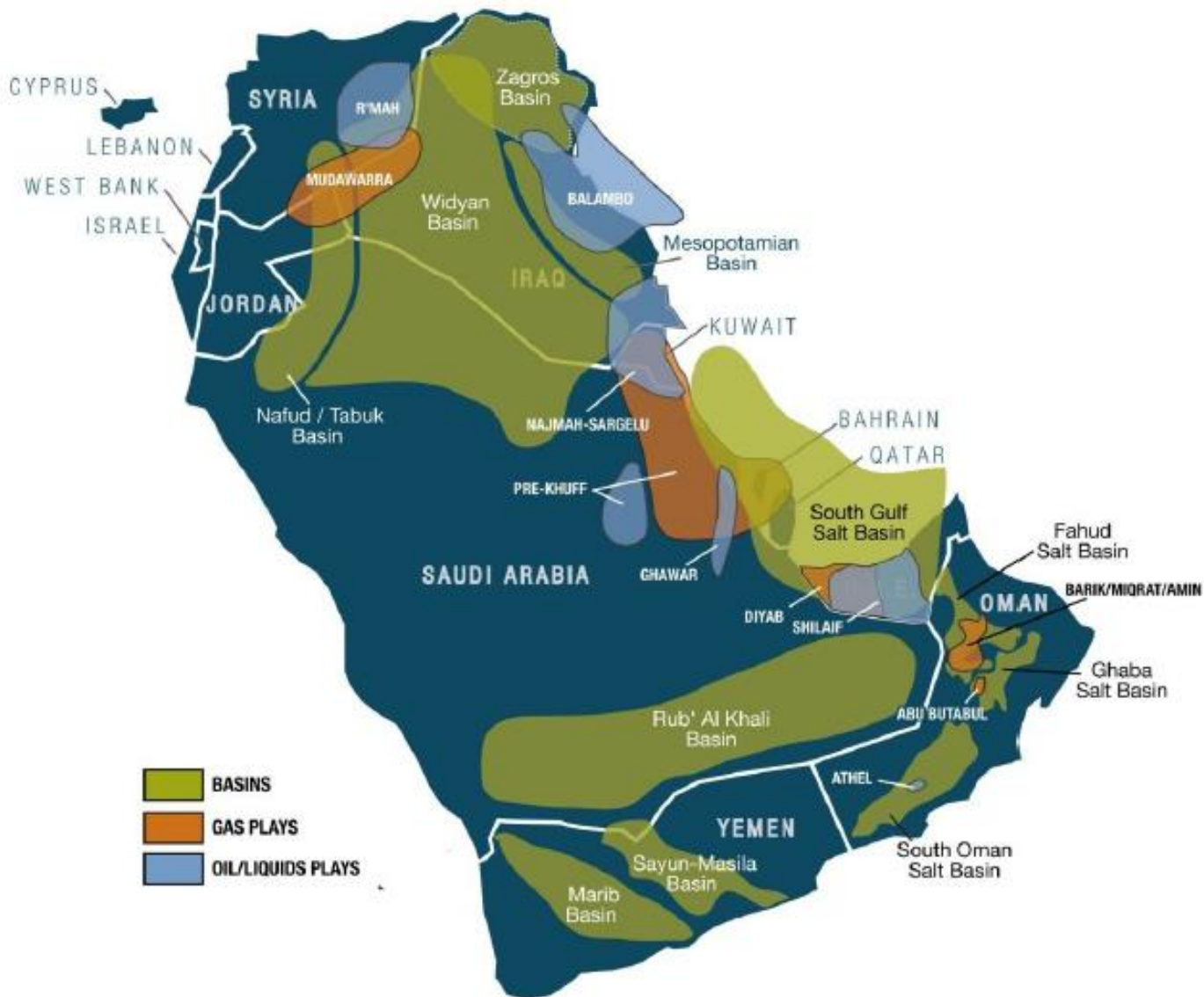
- 50% of more of total power demand met by oil (fuel oil, diesel, crude)
- Nearly all the remainder from natural gas
- Peak summer demand (air-conditioning) 60%+ above winter demand
- Situation improved slightly in 2016 with start-up of new gas fields



SAUDI GRID INTERCONNECTION STILL UNDERWAY

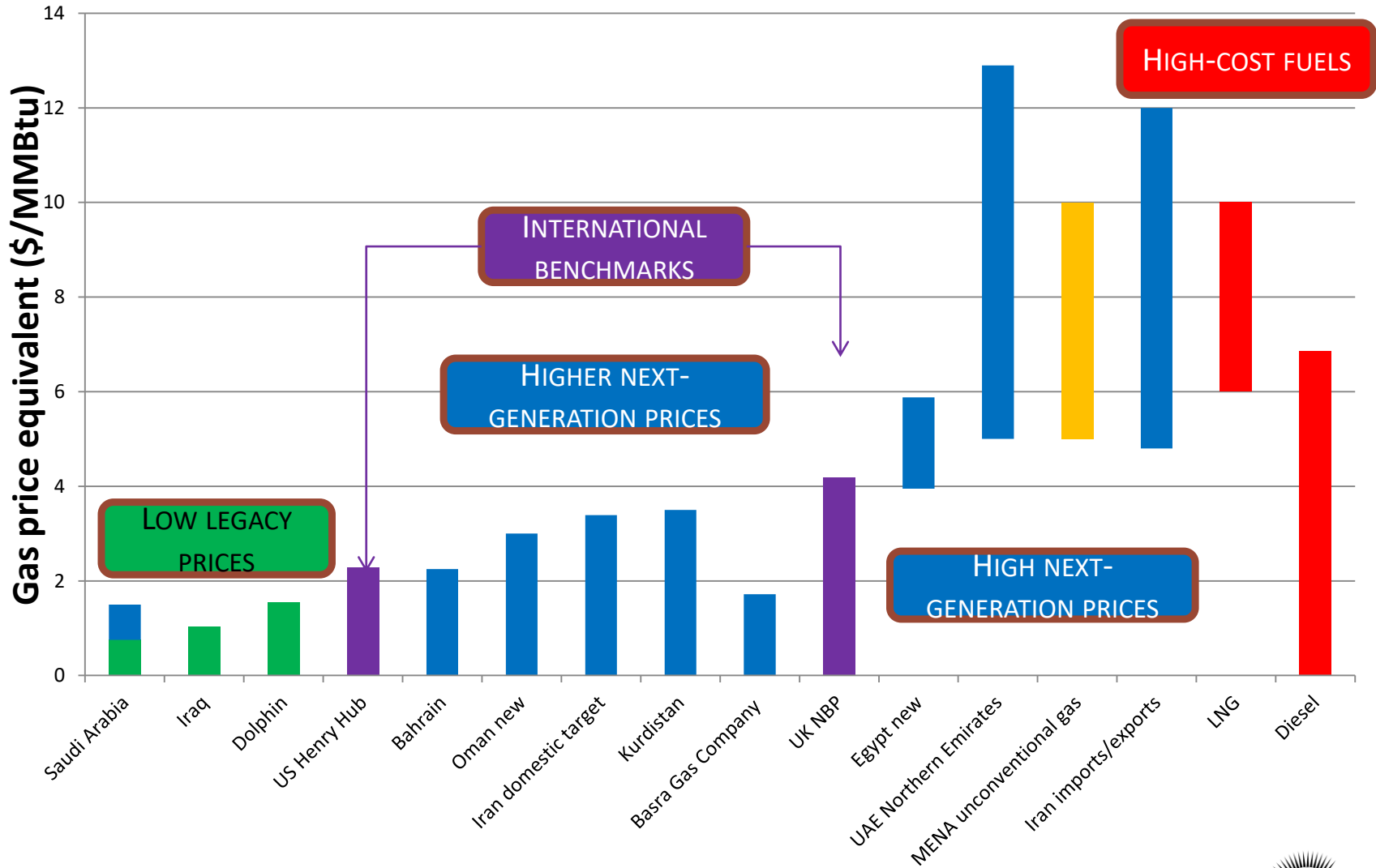


SAUDI ARABIA HAS NEW GAS OPTIONS – CONVENTIONAL AND UNCONVENTIONAL

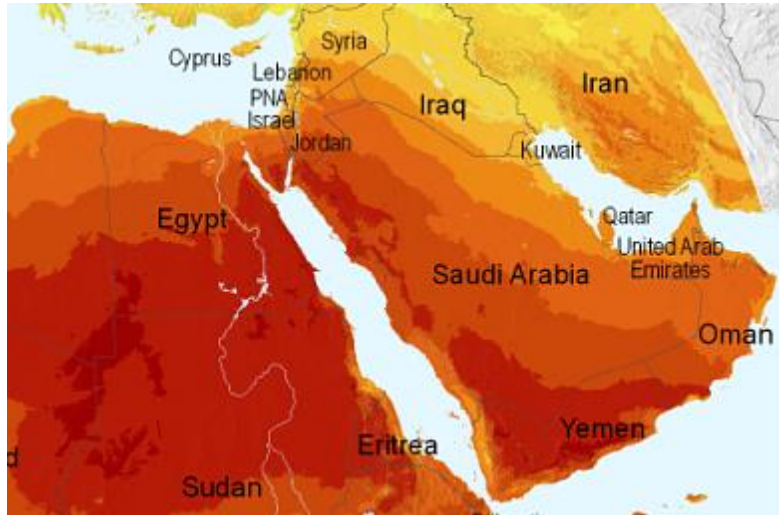


Source: PacWest; Qamar research

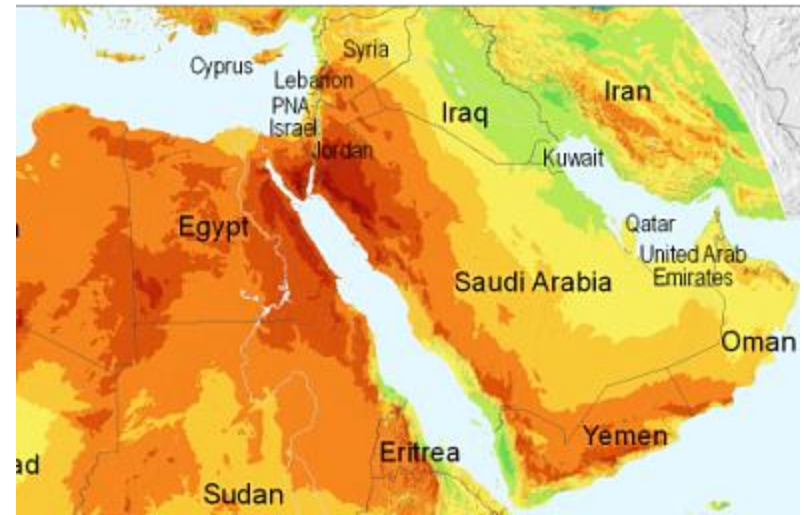
SAUDI AND REGIONAL NATURAL GAS PRICES GRADUALLY RISING



SAUDI ARABIA IS RICH IN RENEWABLE POTENTIAL (MOSTLY SOLAR)

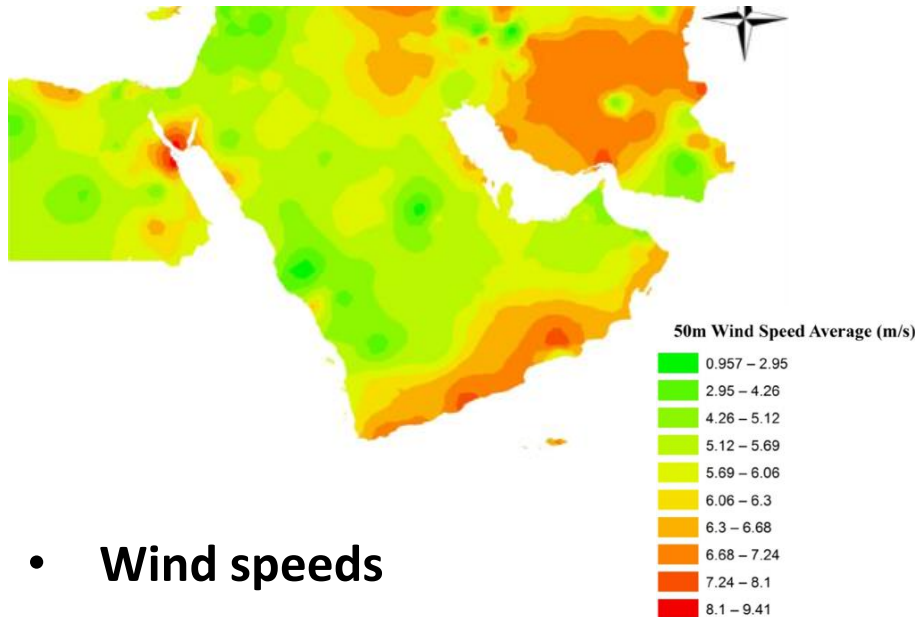


- **Total solar radiation (PV)**



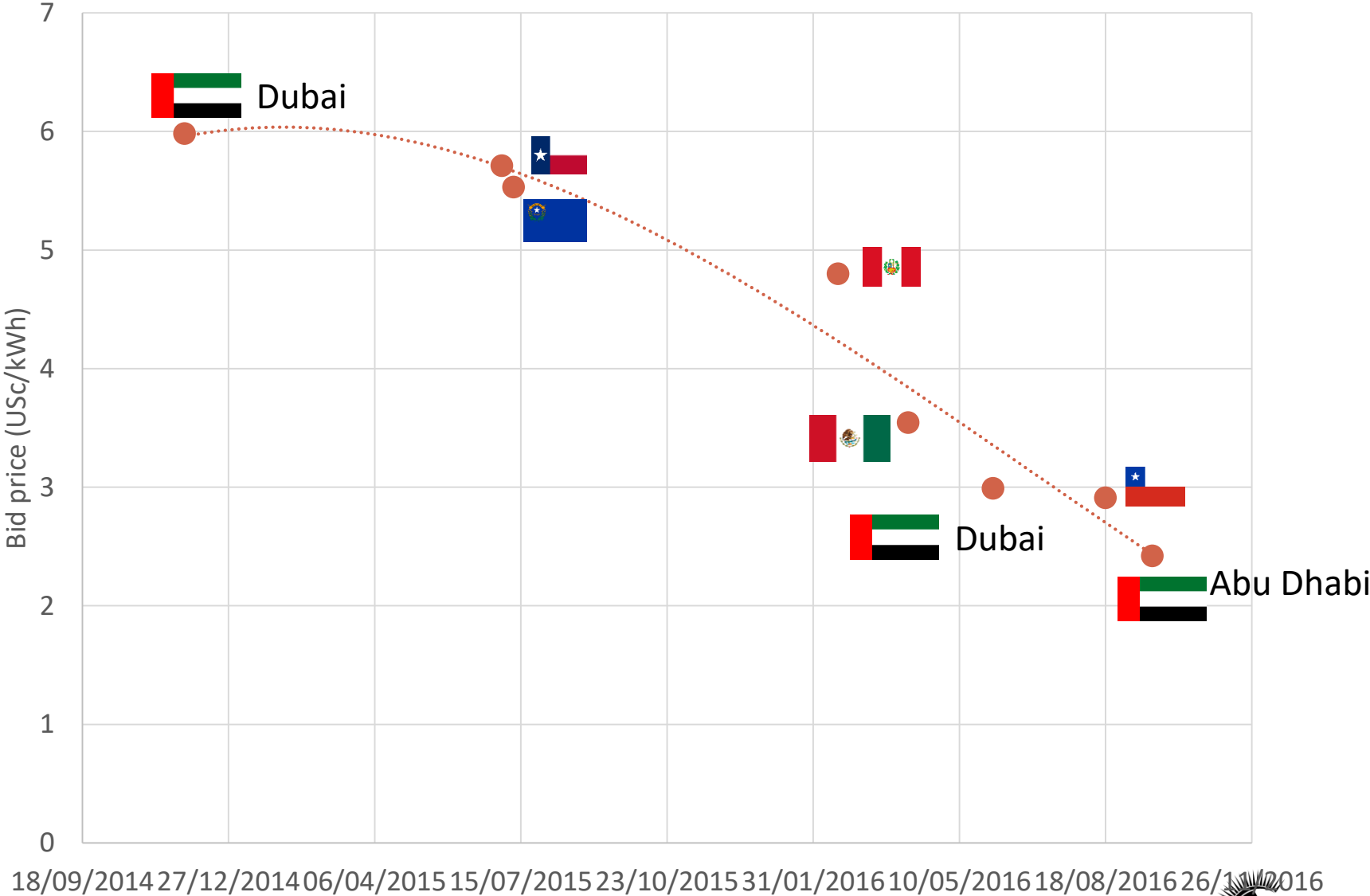
- **Direct solar radiation (CSP)**

- GCC focuses on Solar PV because it is cheaper
- Advantage of CSP is its thermal storage
- Possibility of PV power with storage



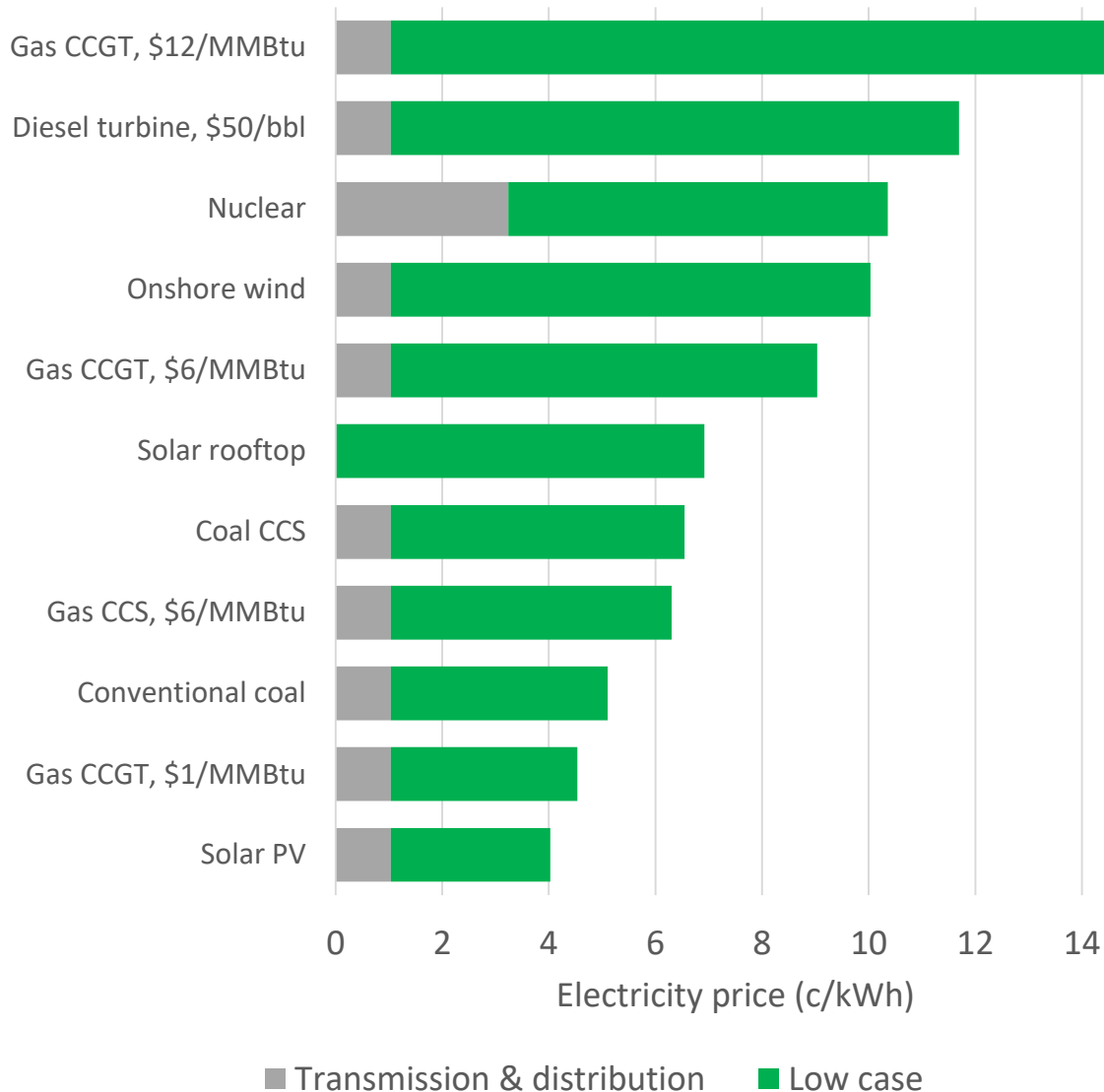
- **Wind speeds**

DRAMATIC FALLS IN SOLAR PV POWER BIDS



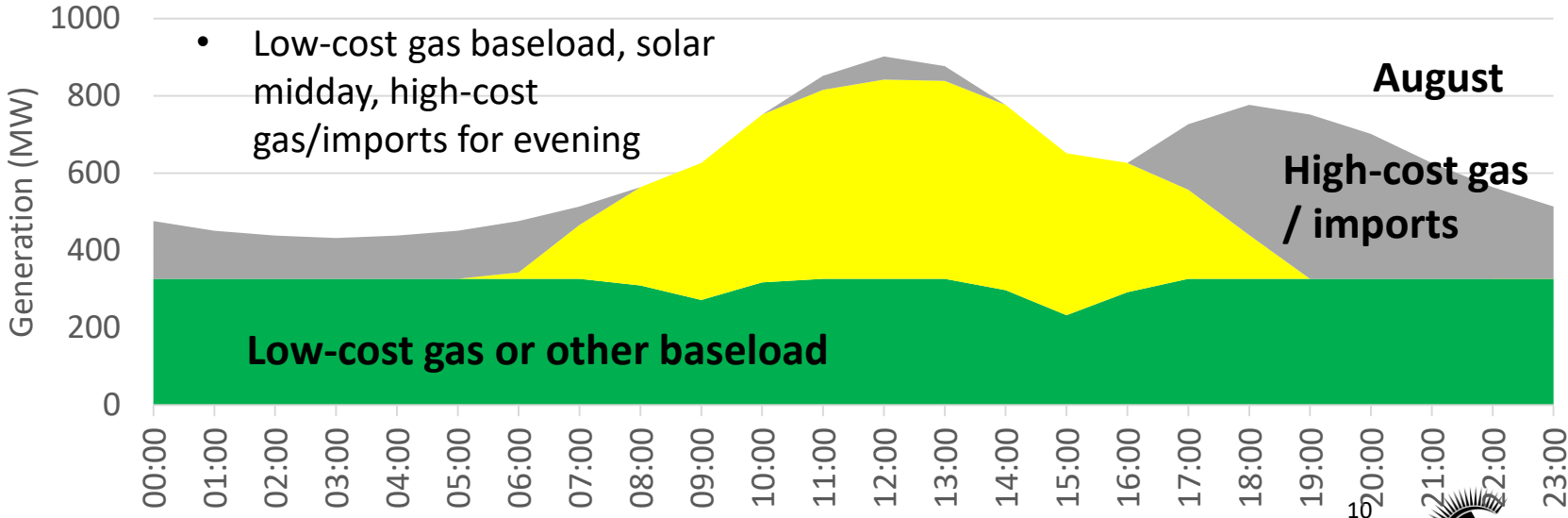
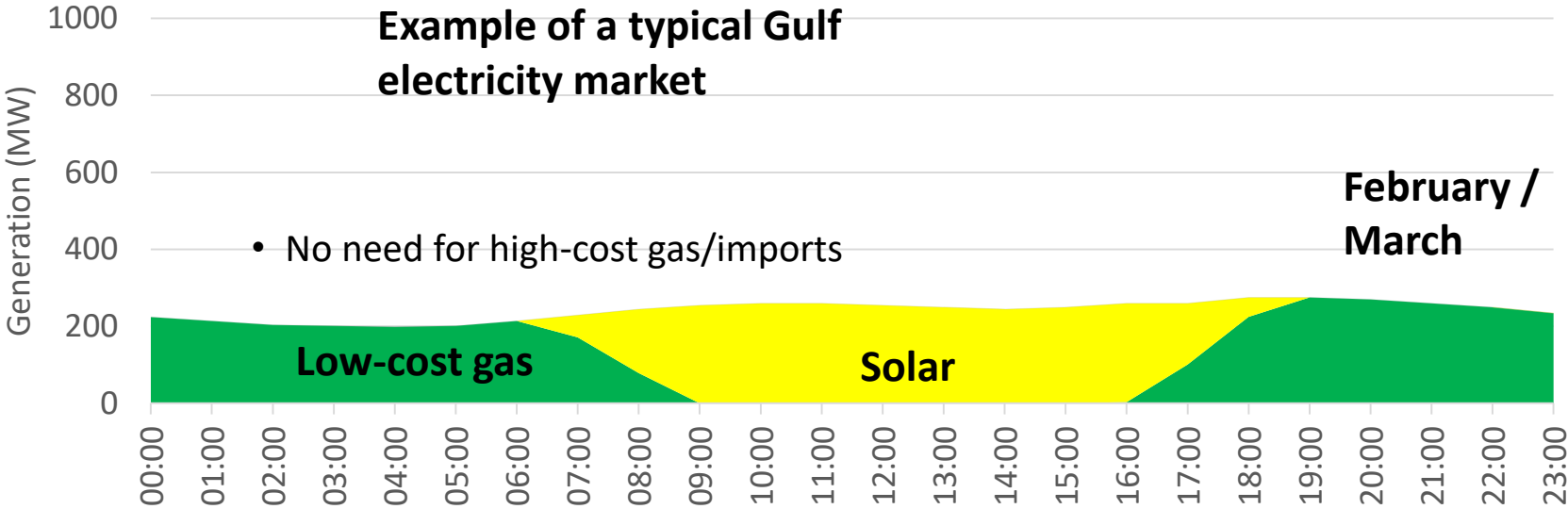
Source: Qamar research

SOLAR PV ATTRACTIVE VS TRADITIONAL GENERATION



- Solar and wind now competitive against gas, and particularly against oil
- Alternative energy sources – solar, nuclear and coal (without CCS) – are being pursued actively by several Gulf countries

LCOE NOT ENOUGH – NEED TO EVALUATE SOLAR AS ONE COMPONENT OF SUPPLY



- Even with subsidy reform & efficiency initiatives, reducing demand growth and replacing oil in power remains a major challenge
- Domestic gas production will contribute but unlikely to be sufficient
- Large-scale gas imports technically possible but politically & commercially challenging
- Solar & wind are commercially & technically viable components of future generation mix
- Challenges
 - Scale & speed
 - Technological capability and organisation
 - Grid extension/reinforcement
 - Demand patterns/storage
 - CSP, batteries, pumped hydro, others?

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