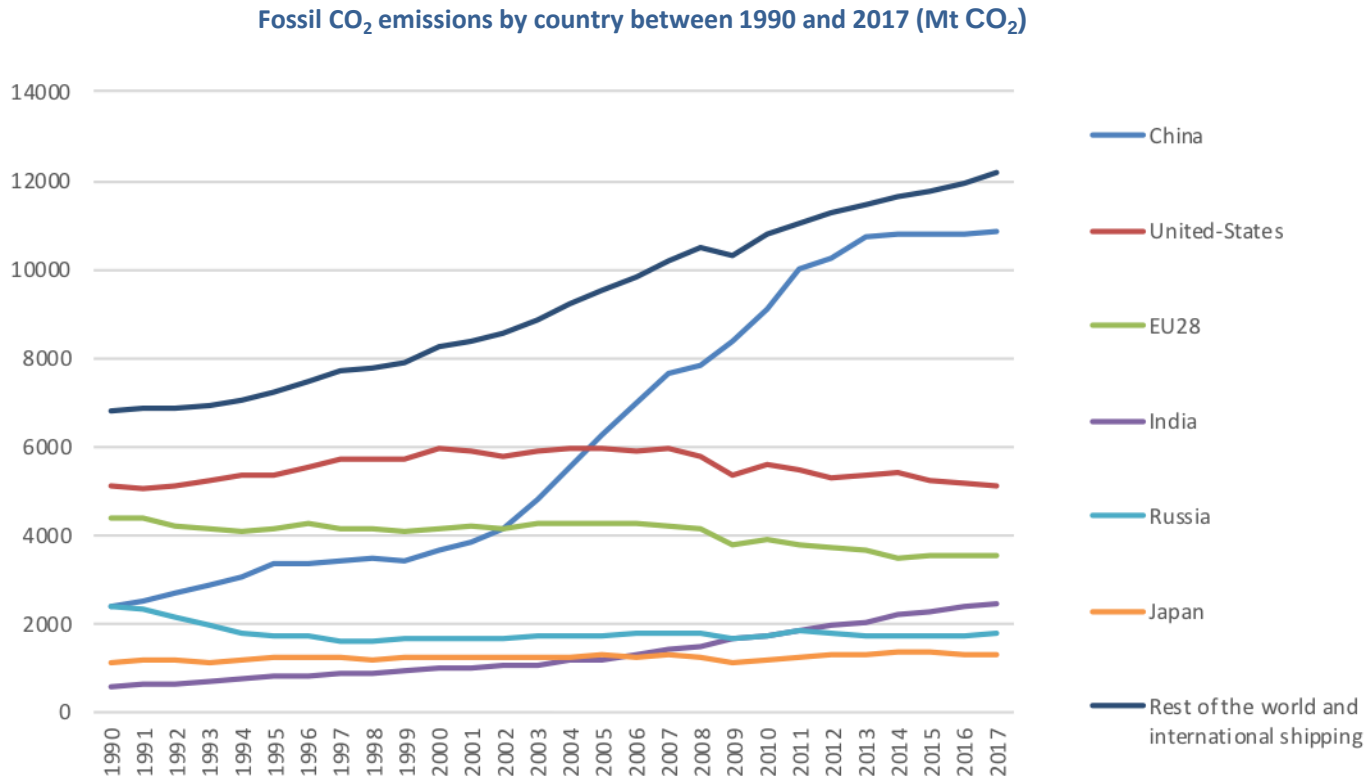
Centre Energie - Centre for Energy

Global and regional energy security revisited: old trends, new paradigms

Marc-Antoine Eyl-Mazzega, Director

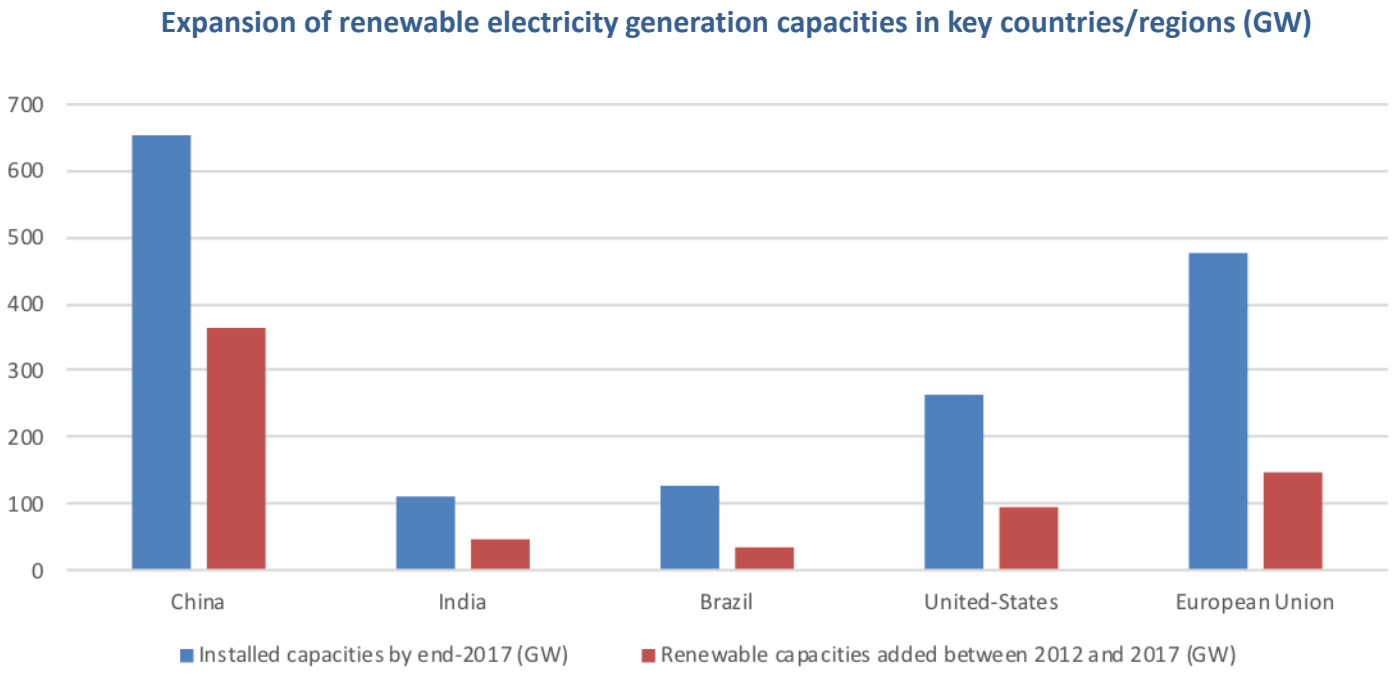
Trilateral Forum, Council of Europe, 25/03/2019

World on a > 3°C track, CO2 emissions keep rising, mounting pressure for a 2050 strategy with a deep decarbonization



Challenges for the global and European energy transitions

Renewables expanding almost everywhere

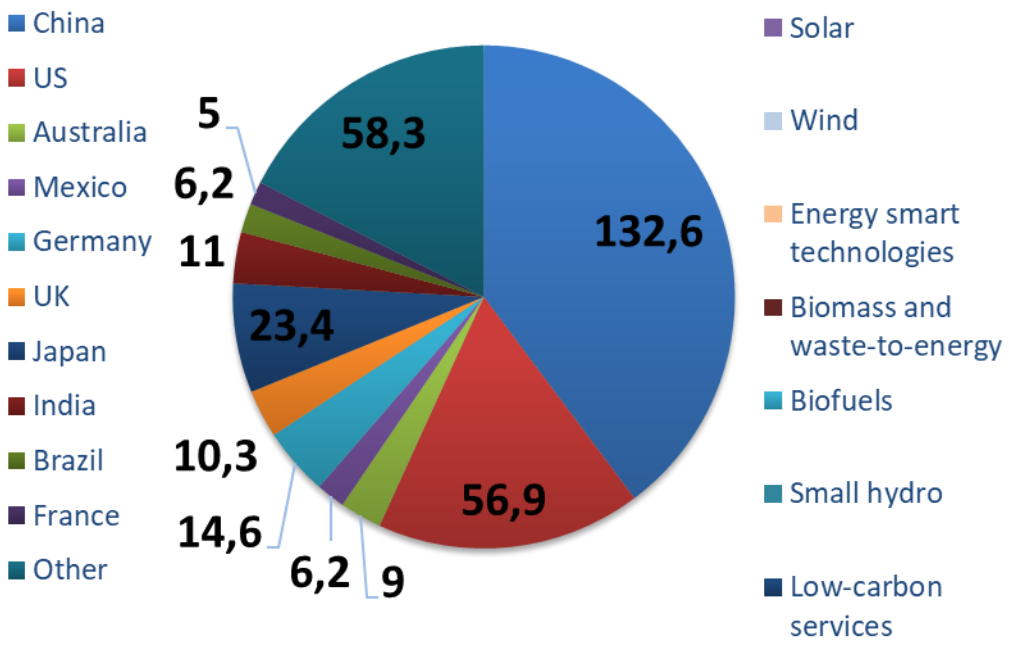


Source: IEA Renewables 2018, Market Report Series

EU aims at reaching a share of 32% of renewable energy sources in final energy consumption by 2030

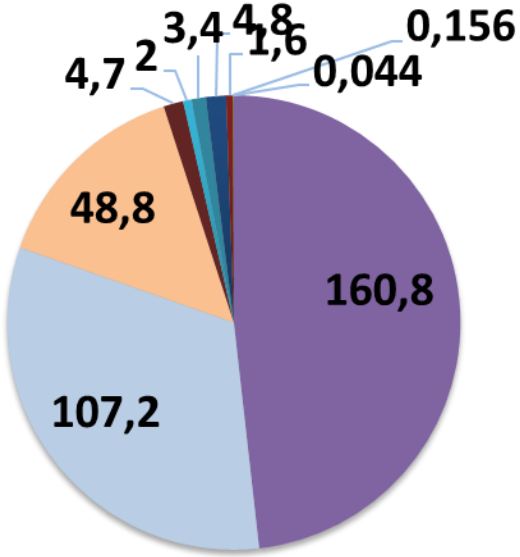
2017 renewable investment high but too little in Africa, especially solar PV where the potential is strongest

Global RES investments in 2017 in key countries ($ billion)



Source: Bloomberg New Energy Finance

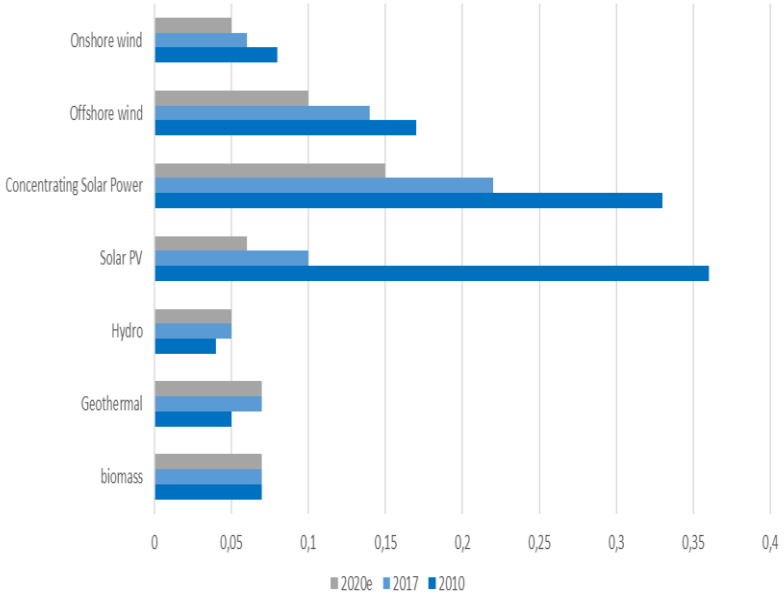
Global RES investments in 2017 by technologies ($ billion)



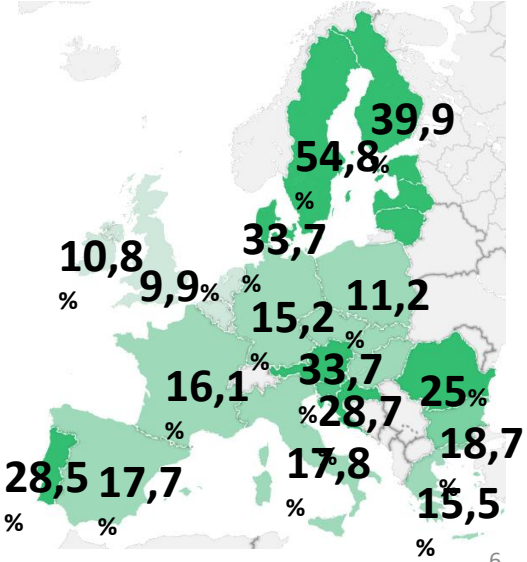
Source: Bloomberg New Energy Finance

Falling deployment costs but higer connection costs, integration challenges and resistances

Global levelised costs of electricty from utility-scale renewable power generation technologies, 2010-2020e ($/kWh)



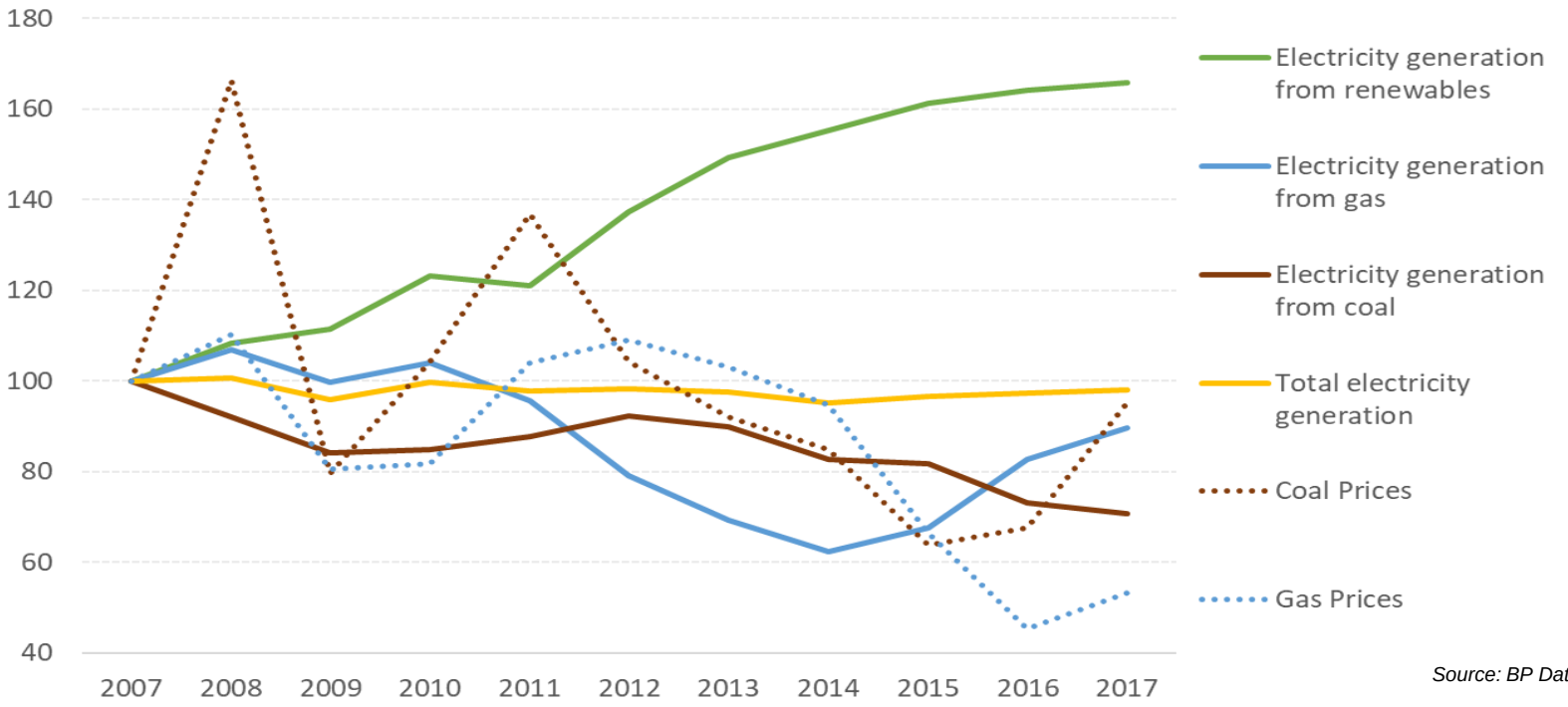
Share of renewables in final energy consumption in 2017



Source: European Environmental Agency

+ 230 GW renewables have not pushed gas fired power generation in the EU

Evolution of selected power generation indicators in the EU, Base 100, Reference year 2007

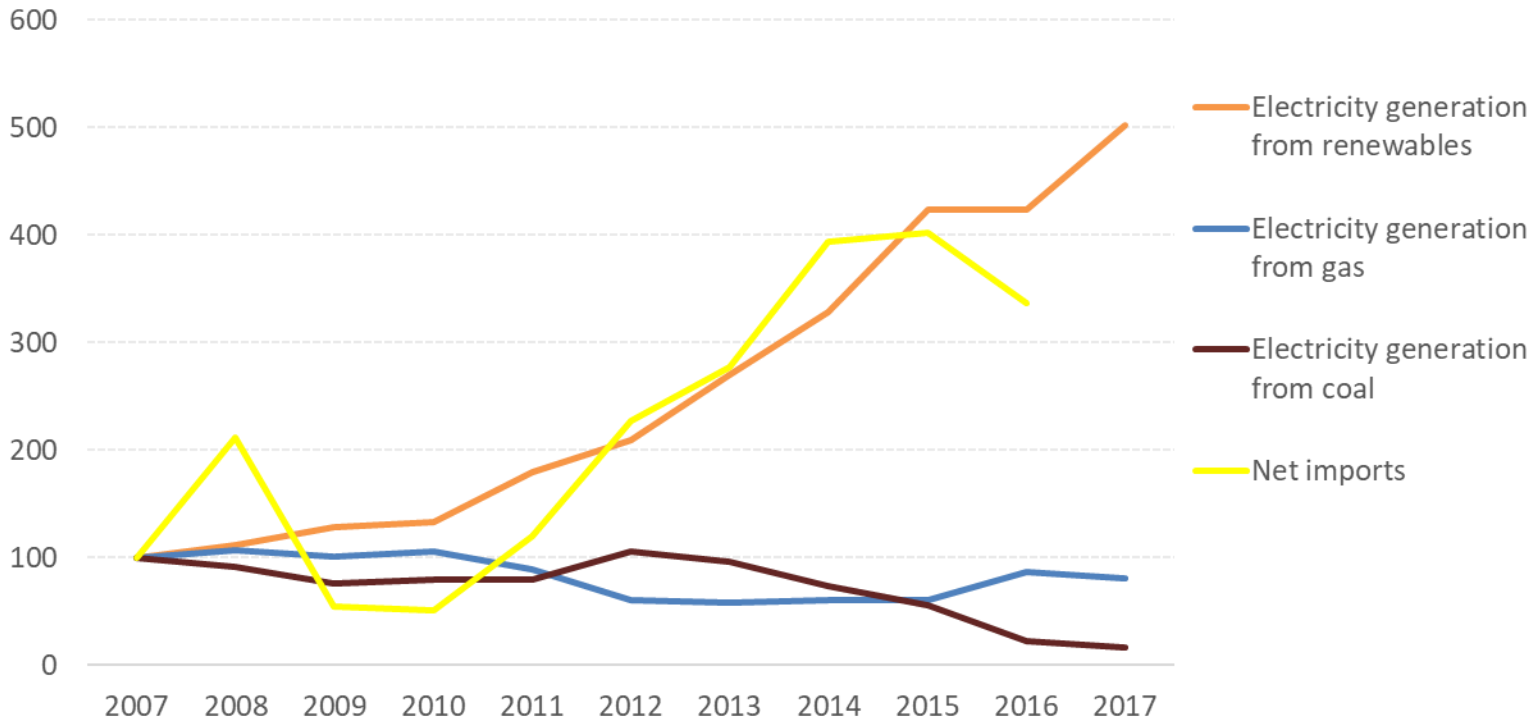


Source: BP Databank

Following cold weather, low hydro, problems with nuclear and UK coal phase out, and stronger GDP growth, gas fired power generation has nonetheless bounced back since 2015

UK coal phase out: 80% coal generation decrease only leads to 30% gas generation increase as renewables pick up

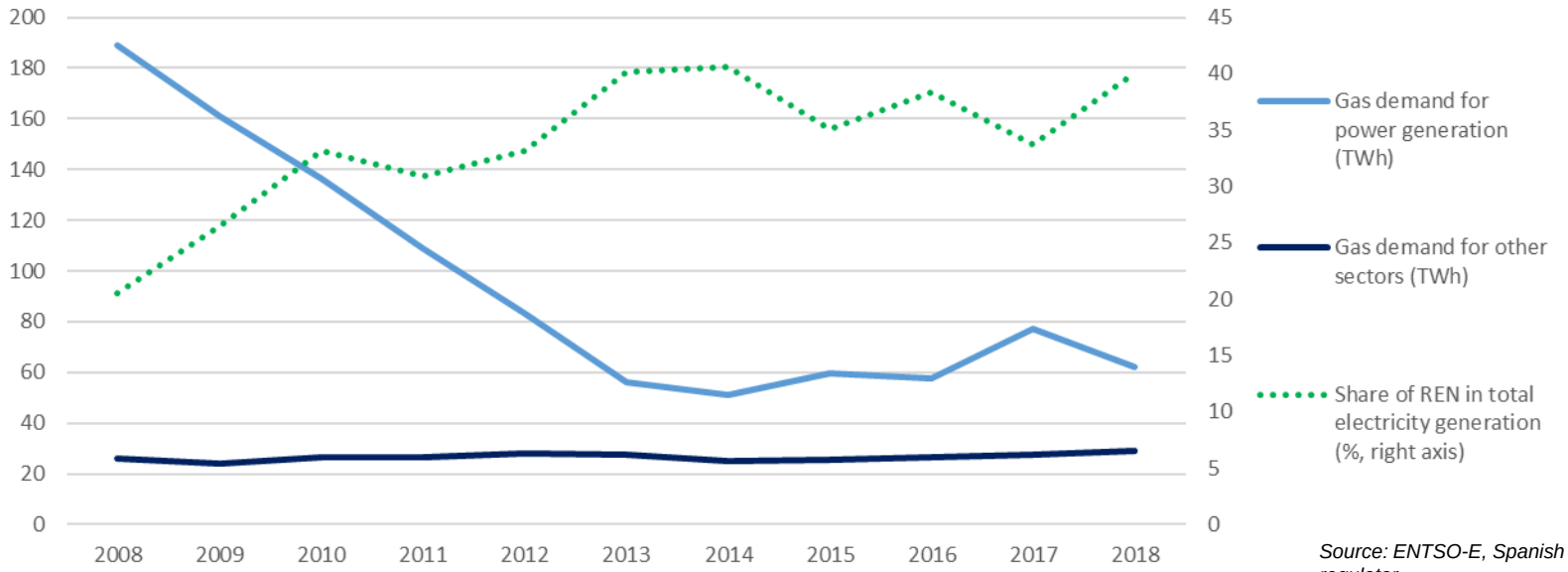
Evolution of electricity generation in the UK by type of fuel, base 100 Reference year 2007



Source: BP Databank

Spain: large renewables deployment pressures gas, yet demand varies depending on wind & hydro availability + GDP

Evolution of Spanish gas demand and share of renewables in total power generation (2008-2018)

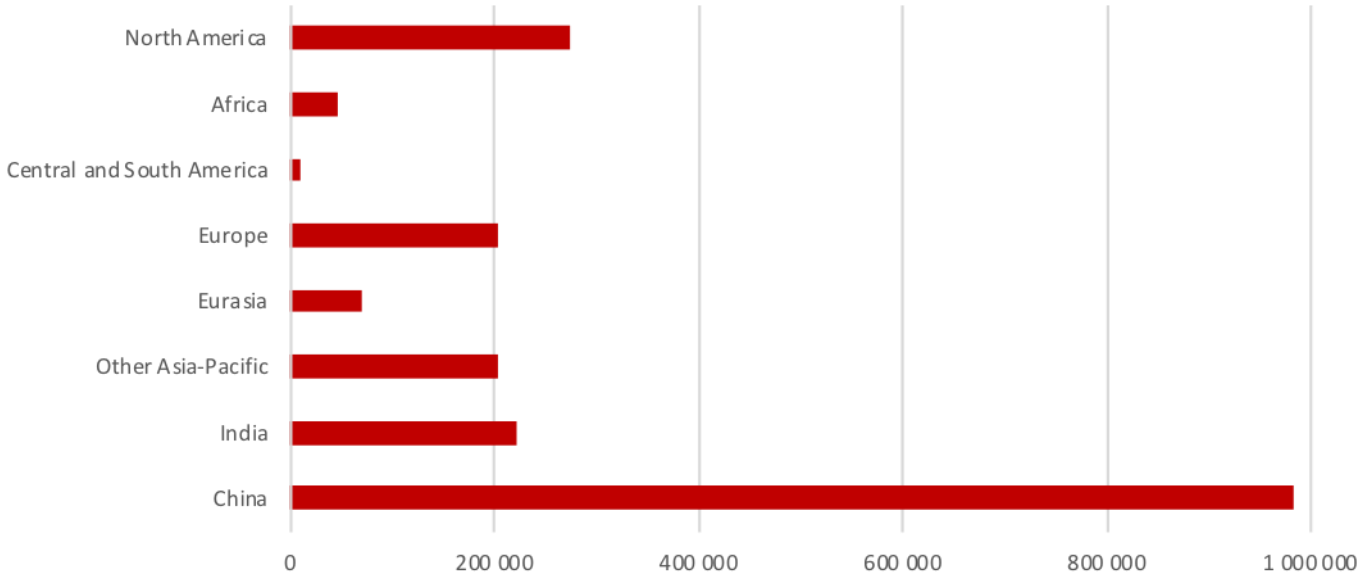


Source: ENTSO-E, Spanish regulator

The key challenge for energy systems in transition is flexibility. Intermittent renewables and variable hydro require much more flexible gas demand patterns… and are harder to predict.

EU's coal fired power generation matters but is little compared to Asia

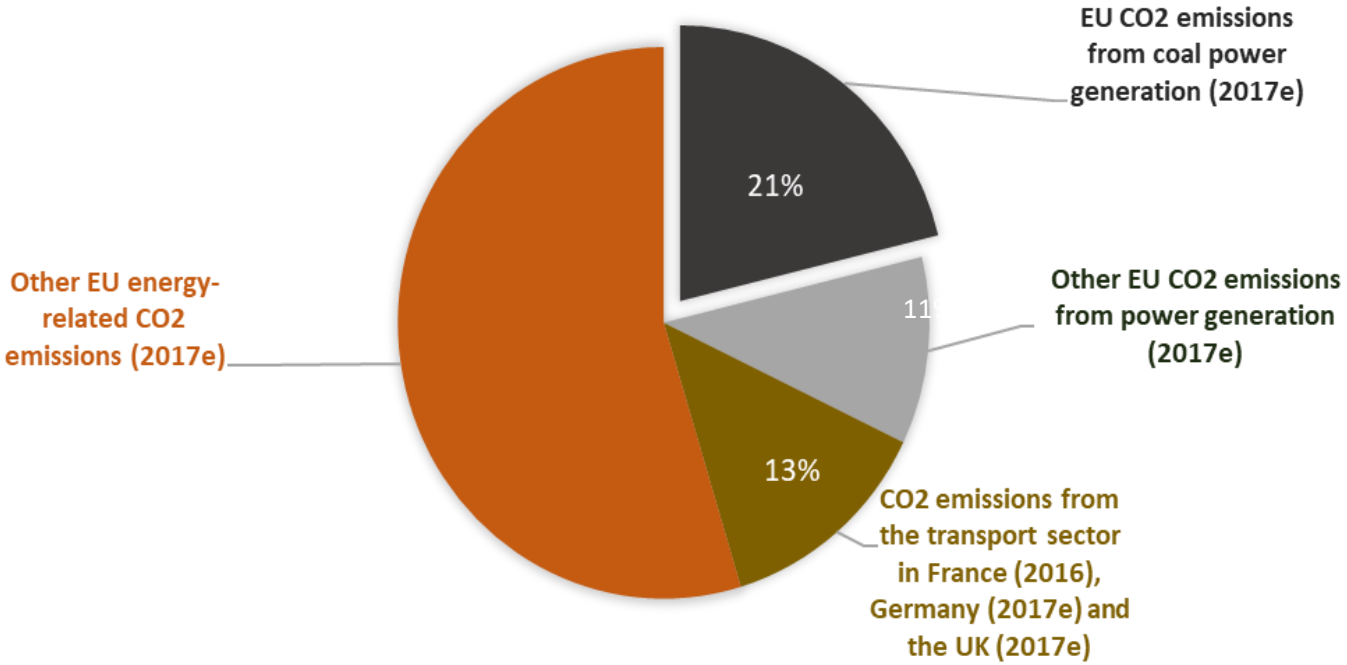
Split of installed coal power capacity in the world, January 2019 (MW)



Source: Global Coal Plant Tracker

Coal-fired power generation is a key source of EU emissions

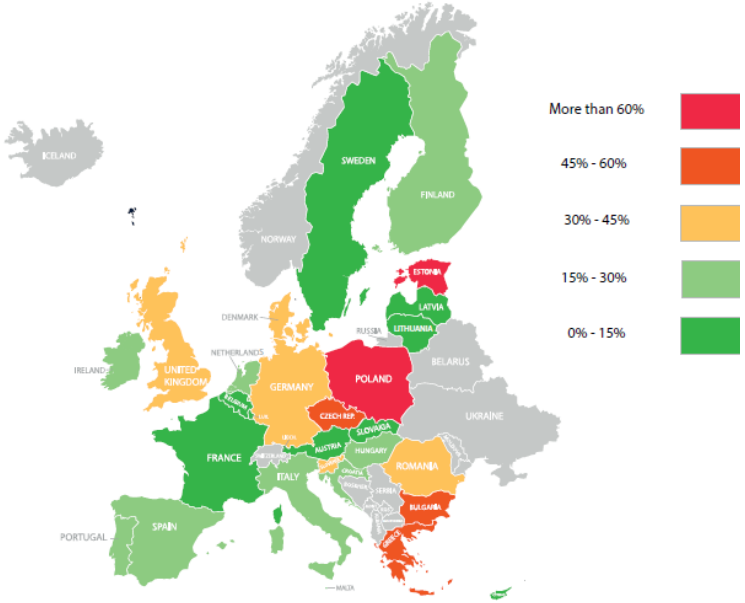
Energy-related CO2 emissions in the EU in 2017(e)



Source: Ifri based on IEA WEO2017 and Global Energy & CO2 Report 2018, Sandbag 2018, National statistics databases from France, Germany and the UK

Progress in reducing coal-fired power generation, yet coal well entrenched notably in Germany

Electricity generation from coal sources (% of total) in 2011



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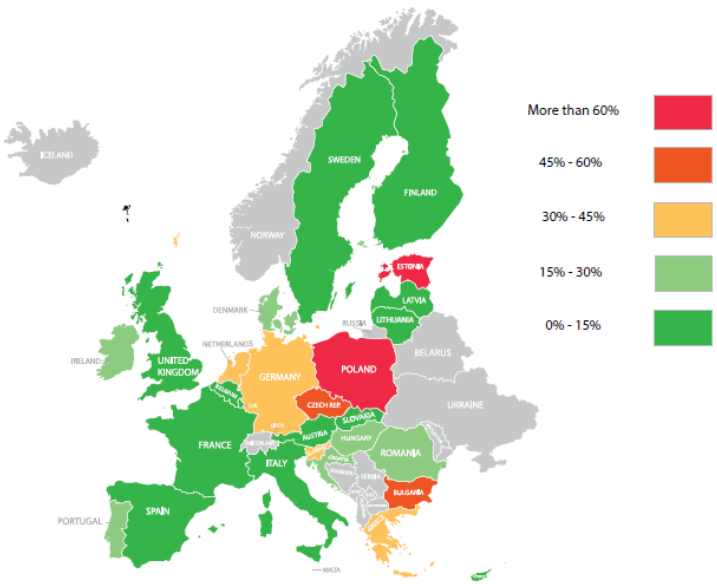
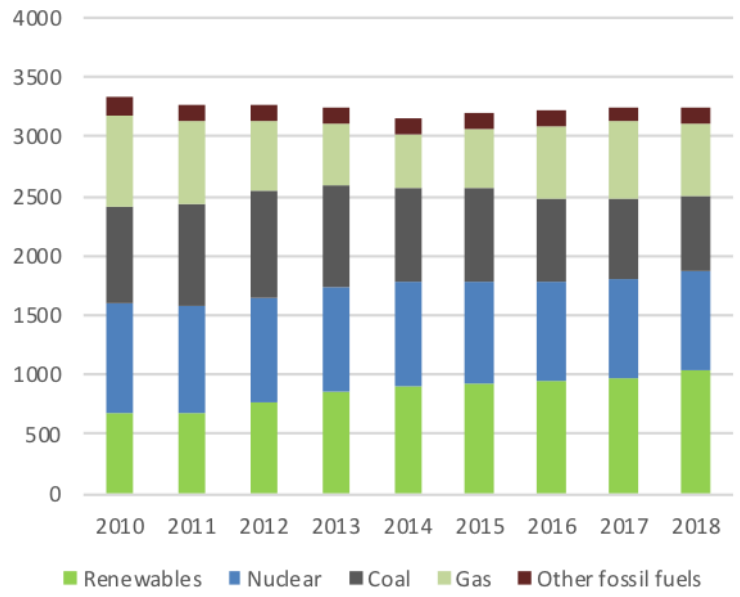


Source: Ifri based on IEA Electricity Information 2017, Romanian Energy Regulatory Authority, based on 2015 data for Croatia and Bulgaria.

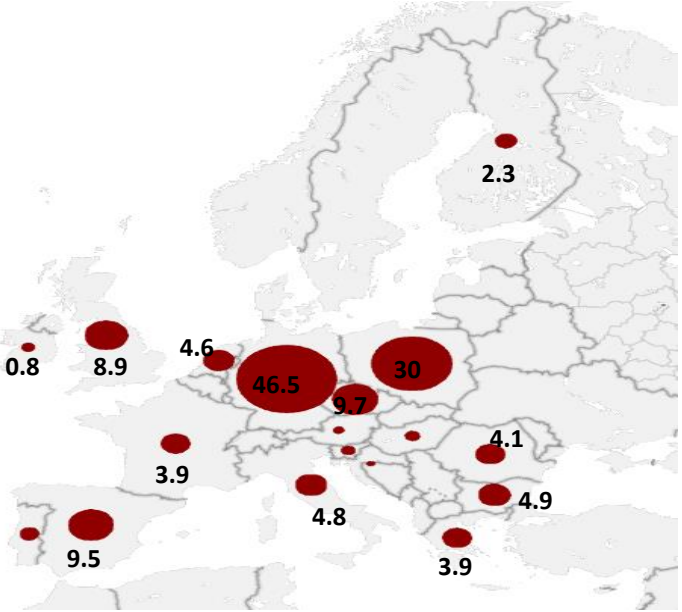
EU expected to phase out 65% of coal fired power generation by 2030, raising gas demand by about 20 bcm/y

EU power generation mix in TWh (2010-2017)



Source: Eurostat, Agora Energiewende & Sandbag

Installed coal power generation capacities in 2019 (GW)



Source: ENTSO-E Transparency Platform

Yet the call for CCGTs can also be offset by larger hydro availability, very productive renewables with large wind and solar generation, as well as demand side management measures

EU emission allowance prices rise, no good news for gas unless it is more competitive than coal

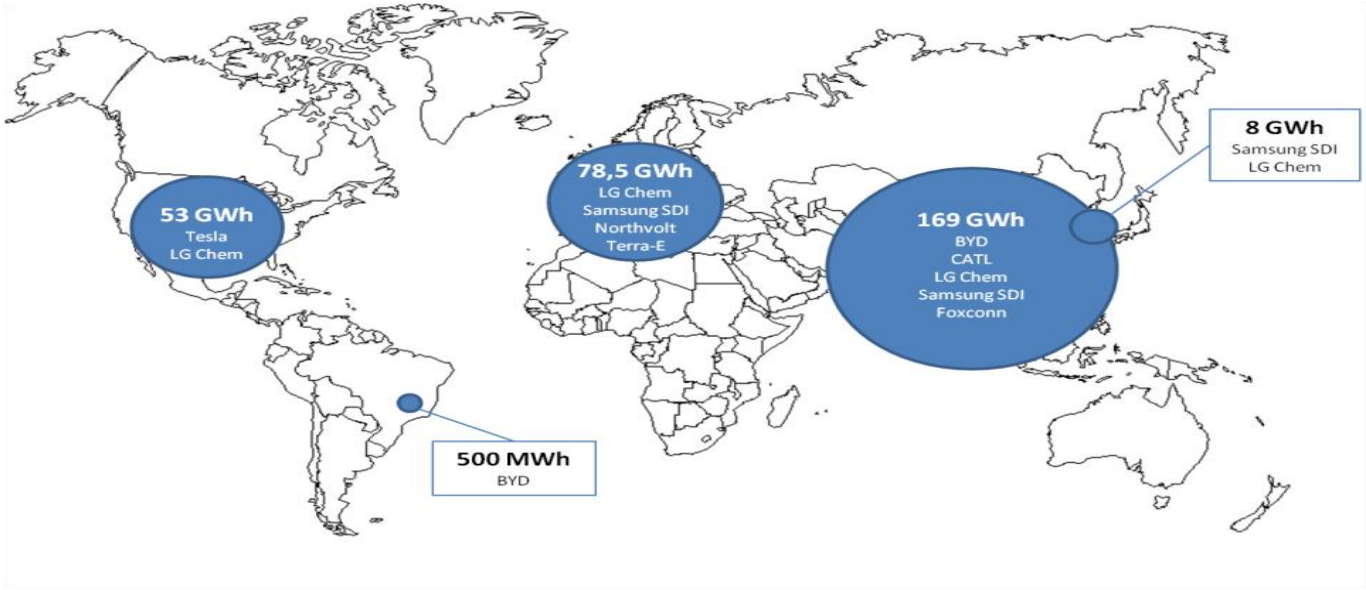
EU ETS settlement prices, March-2018 to February-2019 (€/tCO_2)

Source: Market Business Insider, European Energy Exchange, Market Data, 13.03.19

- EUA prices at 7 years high
- Around 20€/ton since mid-August 2018
- The best-performing « commodity » in 2018

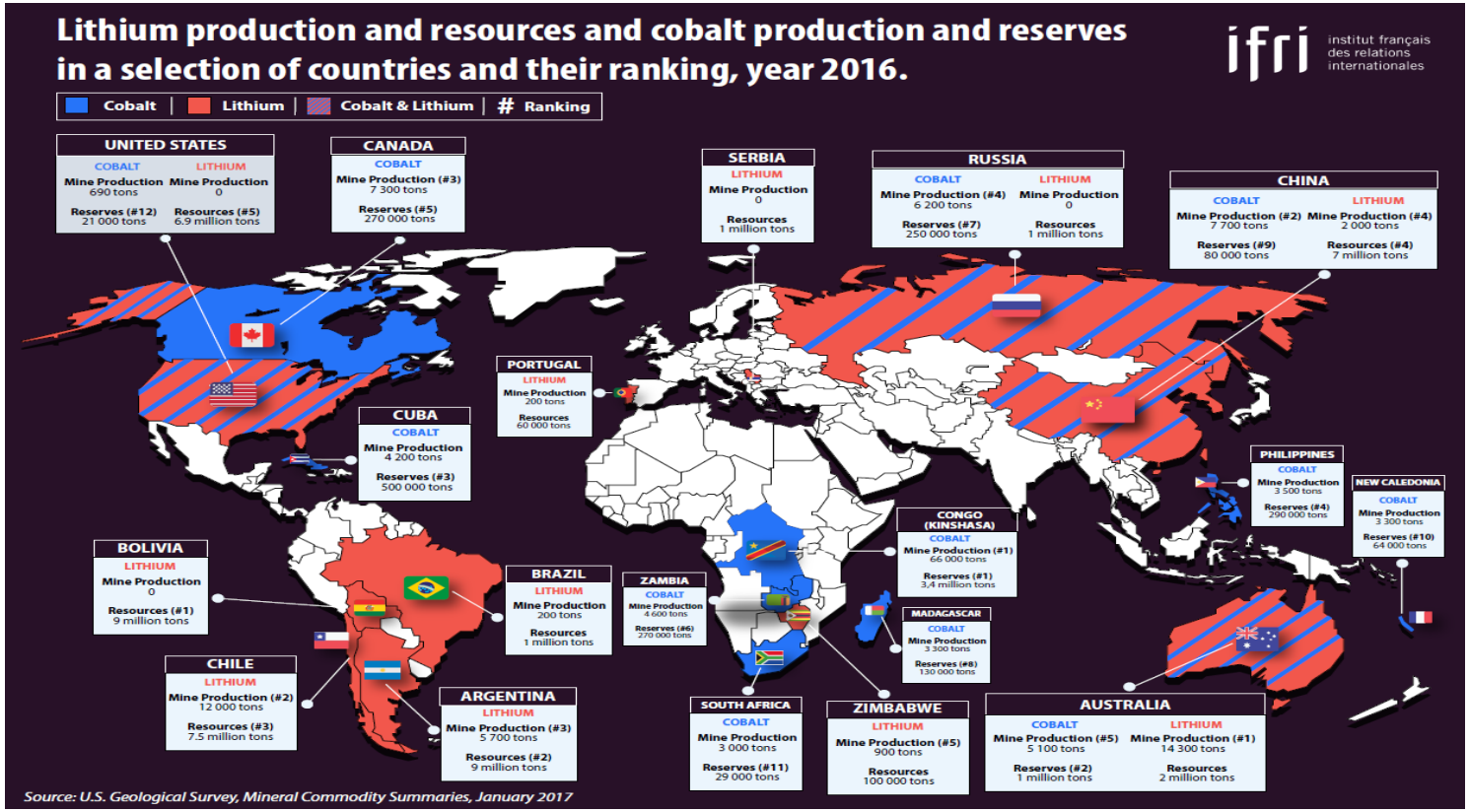
The global battle for batteries: is the EU loser?

Annual lithium-ion battery cell production capacities by 2021



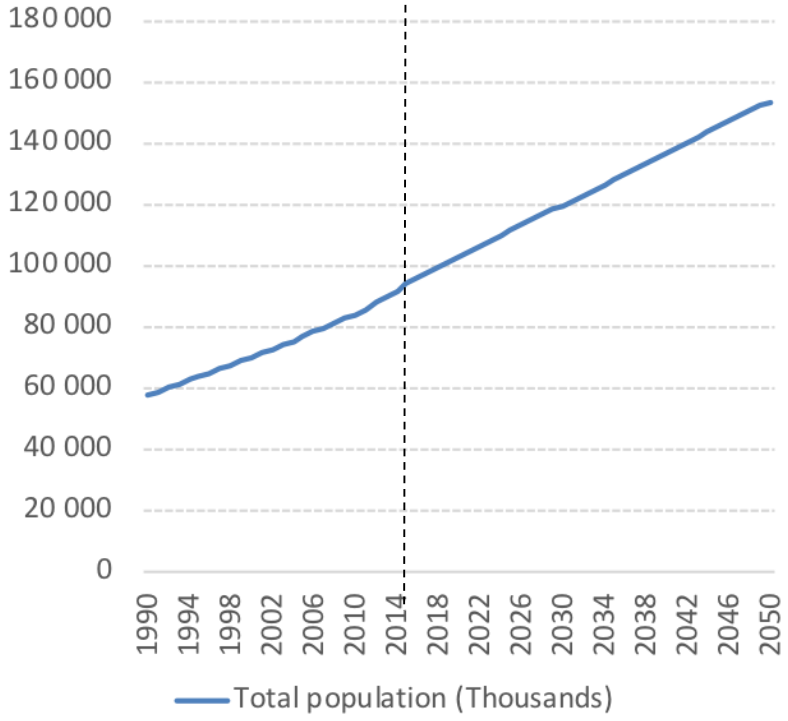
Sources: Ifri, Benchmark Mineral Intelligence, Ministère de l'Economie, de l'Industrie et du Numérique, Commission européenne

The strategic role of critical metals: vulnerabilities must drive recycling&substitution policies



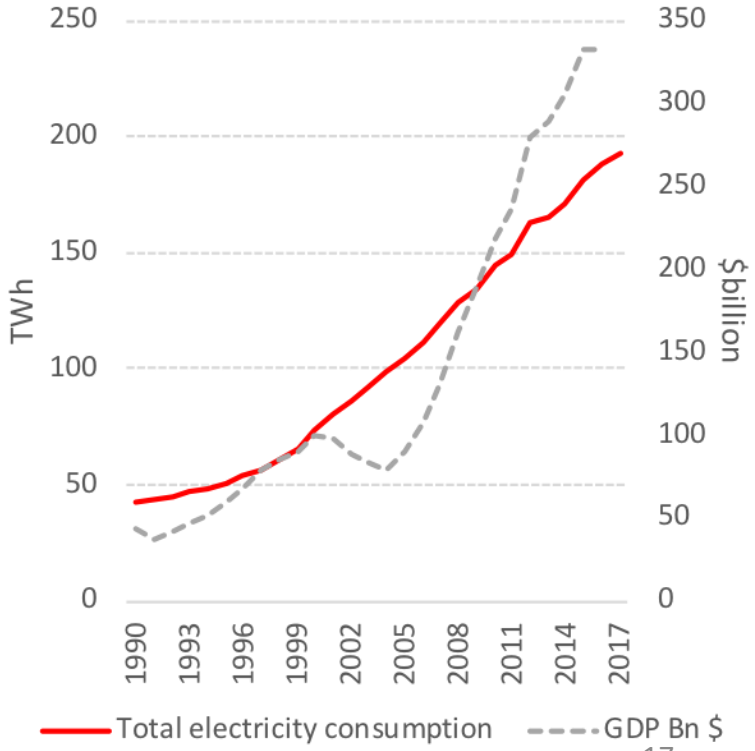
Egypt's population is booming, so is electricity demand, fueling energy insecurity in past years

Evolution of Egypt's population, 1990-2050e



Source: UN. World Population Prospects 2017

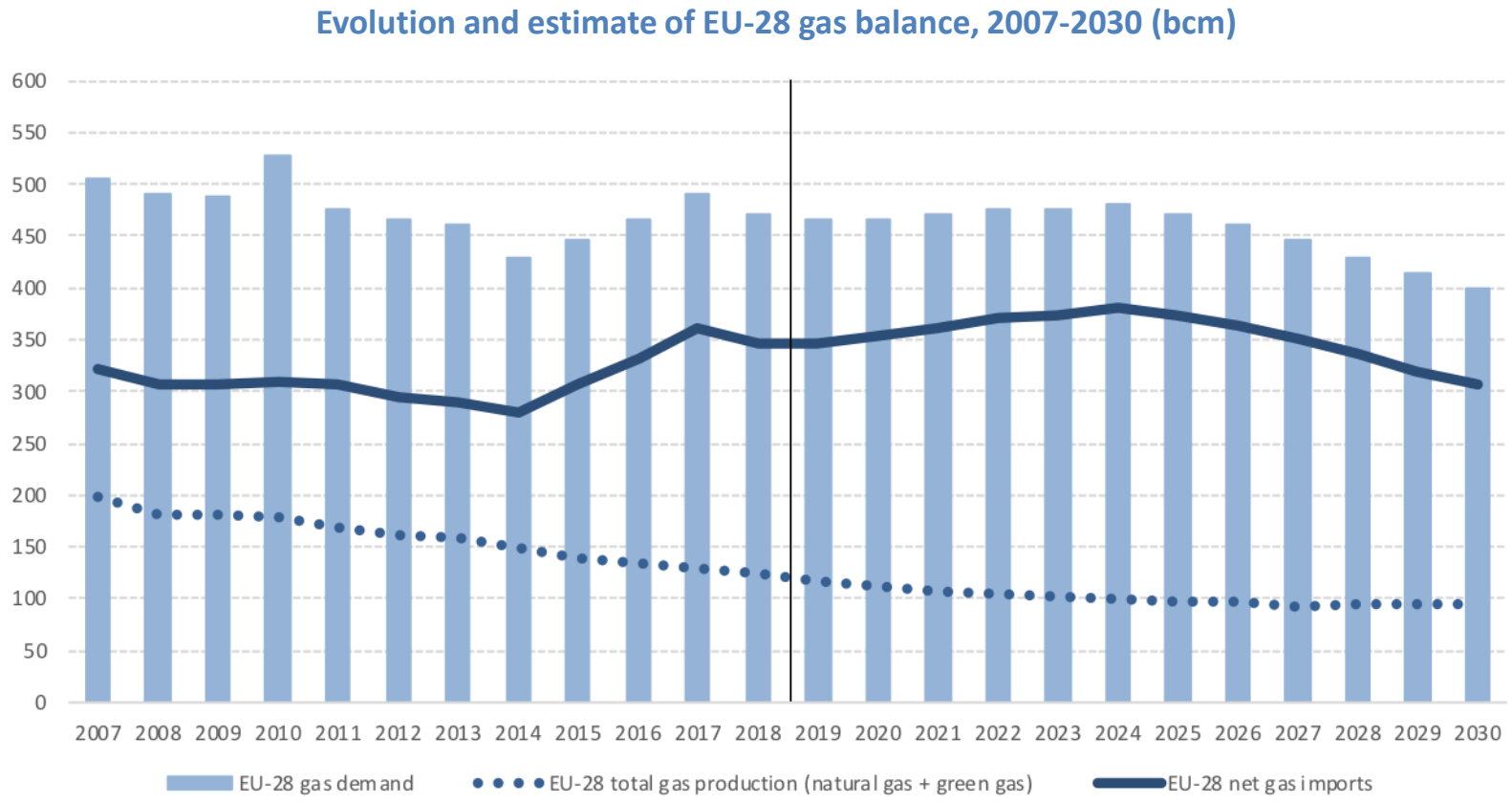
Total Electricity Consumption (TWh) & GDP ($Bn)



Source: IEA, World Bank

The future of gas in Europe and gas supply security

Outlook to 2030: demand overall flat until 2025, before progressively & slowly declining

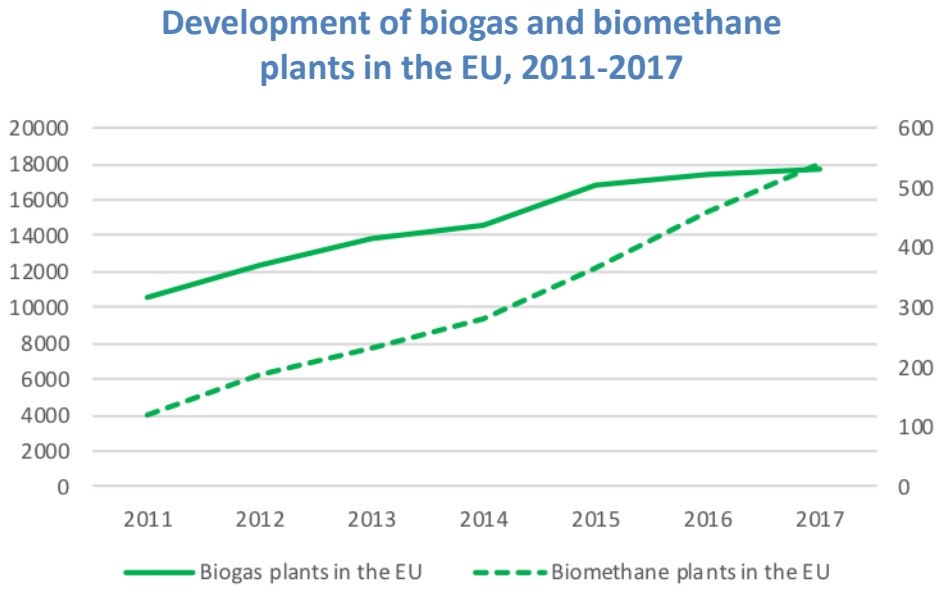


Source: Ifri

Future of natural gas in Europe

- EU gas demand will overall remain steady until 2030
- Natural gas can further expand in power generation and develop in the transport sector
- Gas demand will decline in the residential sector, most probably also in the industrial sector
- There is a likely growing volatility/seasonality in gas demand which requires flexibility
- It is likely that the deep decarbonization will face serious challenges and delays so that gas can help fill the gaps
- Competitive gas prices is key for securing demand
- The role of natural gas will have to sharply decrease towards 2050 in a near net zero emissions trajectory
- Producers need to use the next ten years to prepare for the decarbonization of gas:
    - Reducing carbon footprint in modernizing infrastructure
    - Biomethan and hydrogen injection
    - CCUS

Greening the gas: biomethane + H2O soften the fall in natural gas production and help support demand



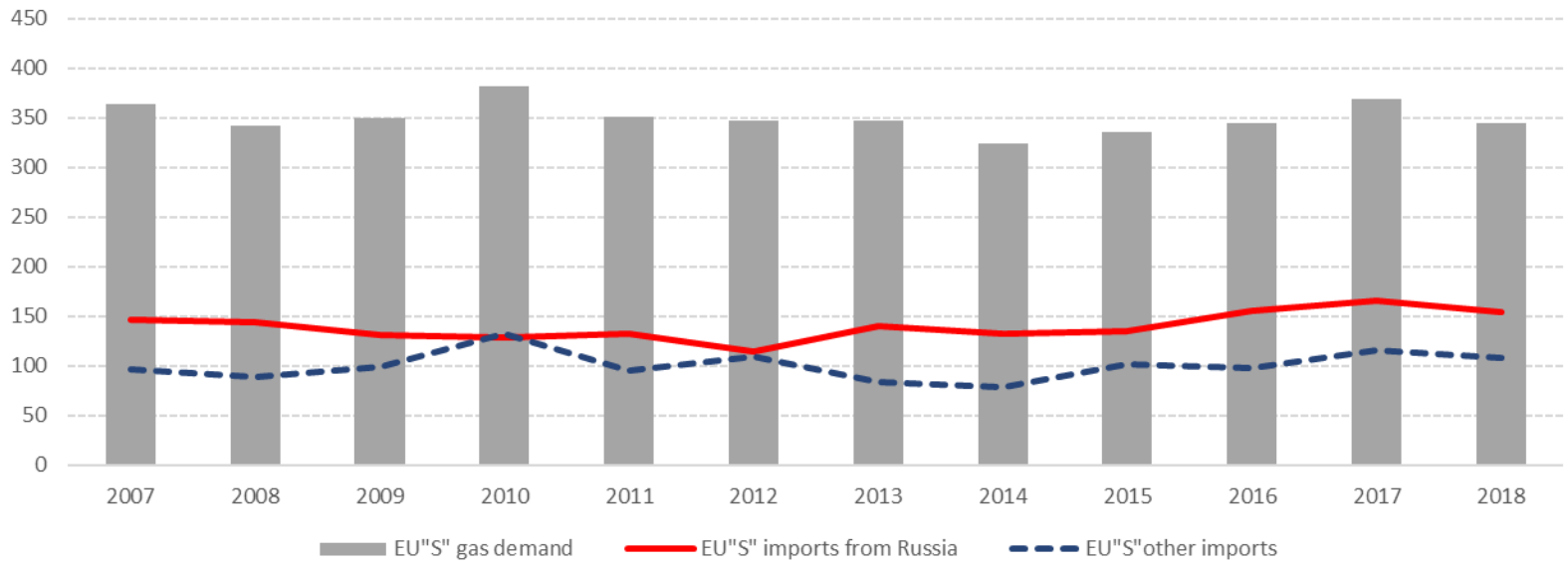
Source: European Biogas Association

- 2 bcm/y production in 2018
- 65 GWh electricity production
- New push in Italy, France, Denmark, UK…
- Costs in France must fall to reach 22 TWh by 2028

EU green gas production reaches 23 bcm in 2030 and helps to push gas use in the transport sector (CNG and LNG) will increase from 2 bcm currently to 20 bcm/y by 2030, including 10 bcm of LNG, driven by heavy duty transport.

Gazprom's push for volumes has benefitted itself, Naftogaz with robust transit volumes and EU industry buyers

Gazprom's exports to EU -S - zone* and comparison with other import sources, 2007-2018 (bcm)



Source: Ifri, Gazprom, Platts

Russian gas can remain strong and grow further in the EU S zone if Gazprom so wants and can. Yamal LNG will add Russian gas volumes to European markets

Egypt turns into gas hub, Noor & Calypso discoveries can unlock Leviathan phase 2 + Aphrodite + Exxon's Glaucus-1

East Mediterranean gas infrastructure and projects

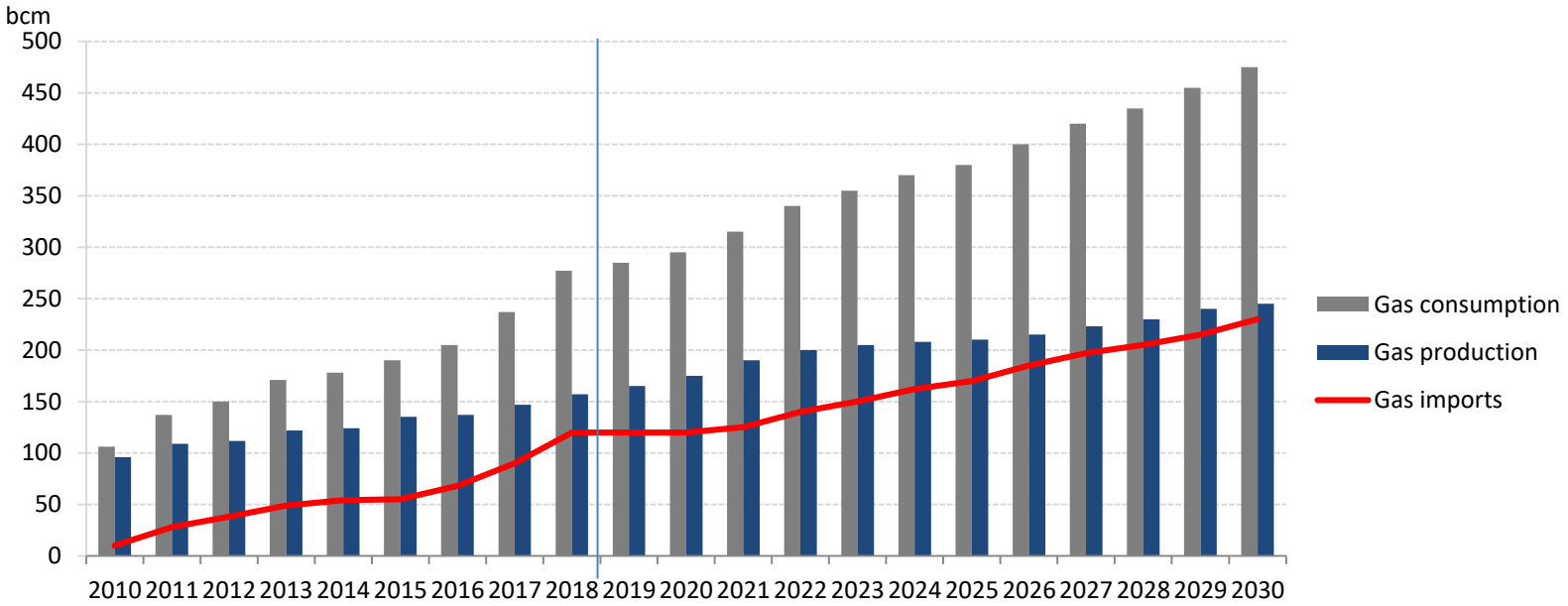
Source: Ifri

Can Russian gas exports be diminished by competition from other suppliers in the period 2020-2030?

- **Norway**: NO (resources)
- **Algeria**: NO (resources)
- **Libya**: NO
- **Iran/Turkmenistan** by pipeline: NO (sanctions, resources, costs)
- **Azerbaijan**: max + 10 bcm/y from Shah Deniz 2 (politics and resources)
- **East Med**: 20 bcm/y > 2025
- **LNG increasingly coming to the EU as Asian prices down:**
  - HH prices remain in the 2,5-3$/Mbtu range
  - EU spot prices recover beyond 5$/Mbtu
  - Summer and winter are mild in Asia
  - Demand from emerging economies does not surge
  - No geopolitical disruption in the Middle East
  - China's import growth slows, and if Russian pipe exports grow
  - Japan restarts nuclear, reduces its LNG imports
  - Another LNG export wave comes from the US (but trade war has negative implications) + Russia (Arctic 2, Sakhalin-2) or pipeline (Altaï)+ East Africa + Canada for China
  - If Germany builds LNG import terminals

Russia and China, as well as Russia and Saudi Arabia, increasingly influencing global oil and gas prices

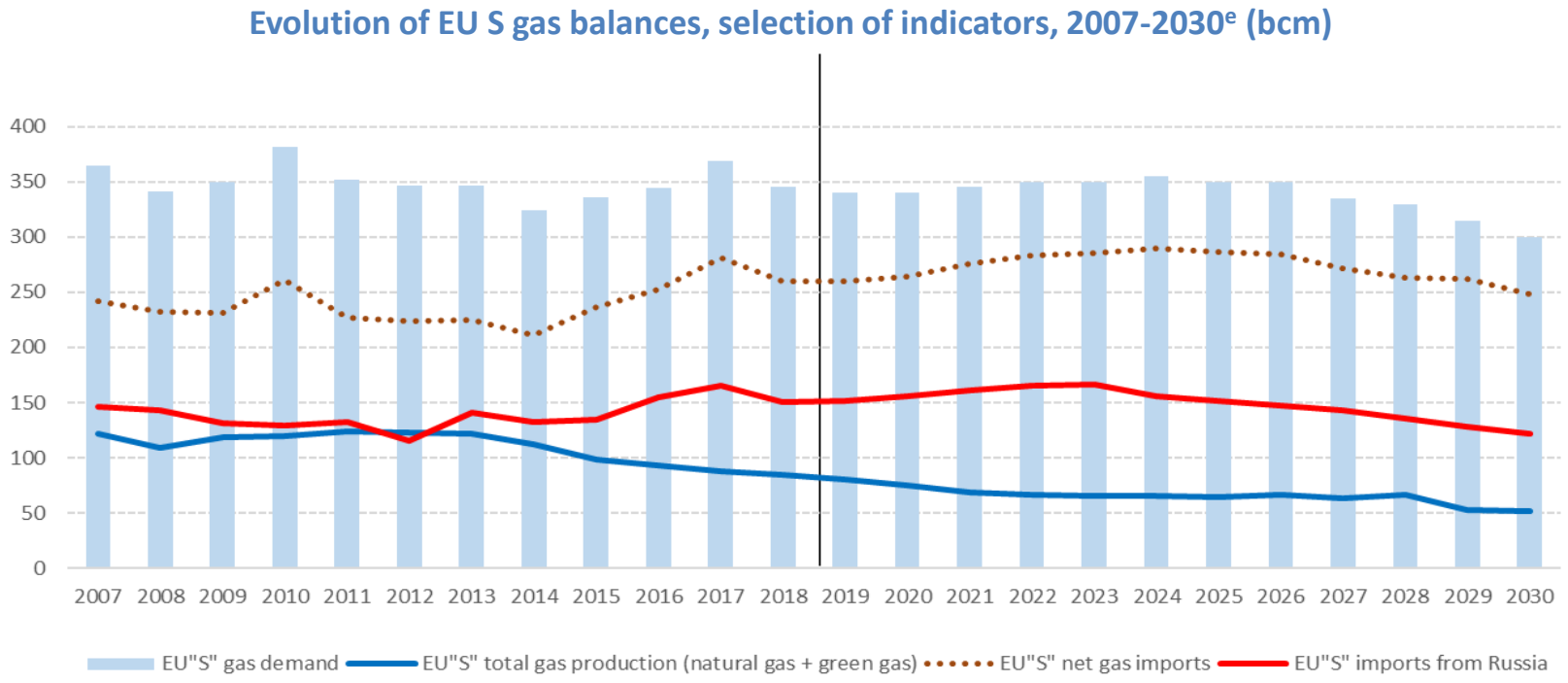
Evolution of China's gas balance, 2010-2030



China's gas market will become as large as the EU gas market by 2030, yet trade tensions and economic hurdles could revigorate coal to gas and coal to liquids projects

Source: Ifri, IHS CERA, IEA

Demand and import outlook to 2030: Russian pipeline exports robust until 2023, then declining to 2015 level

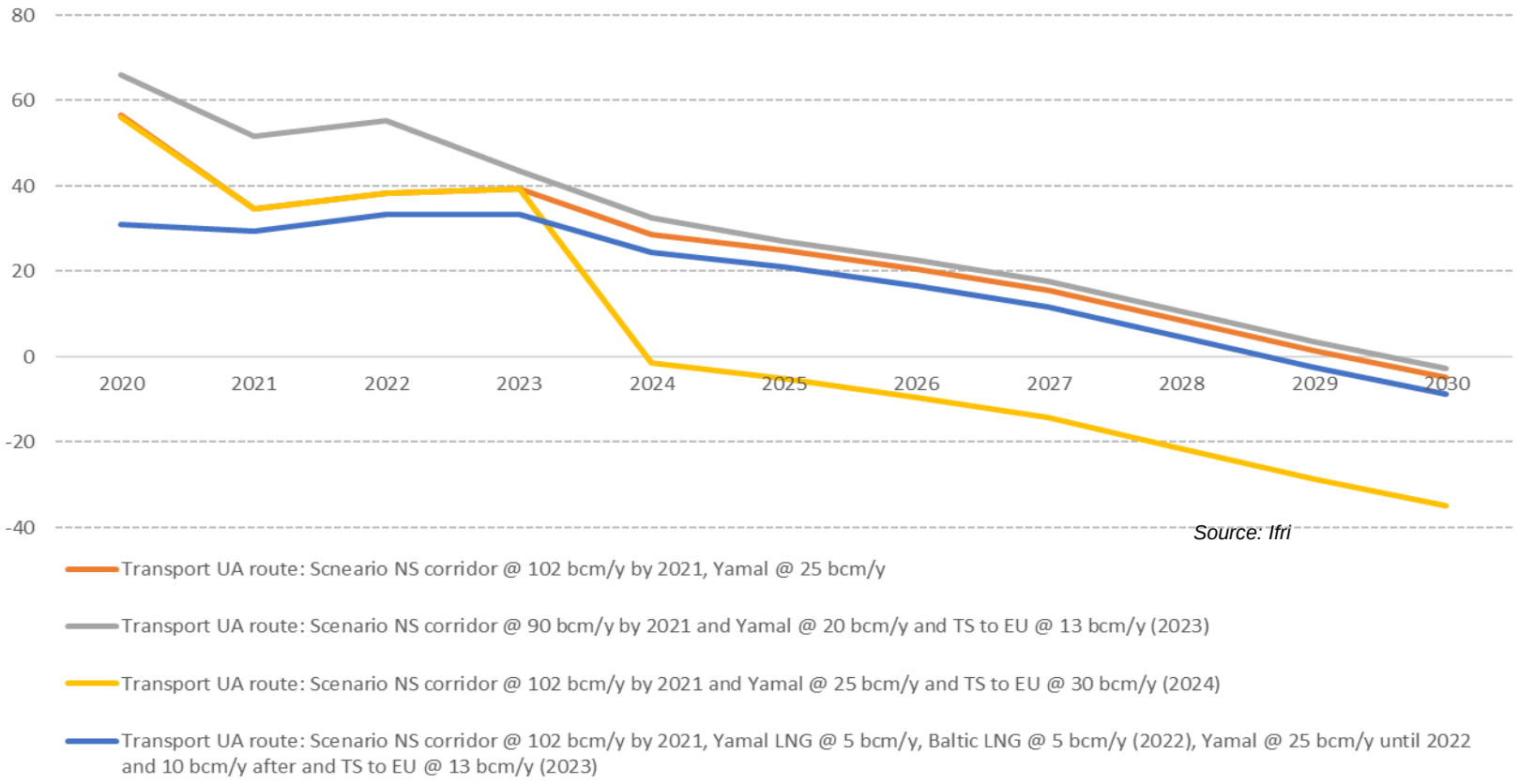


Source: Ifri

EU S gas demand seen steady until 2026 around 2016 levels following the partial coal/nuclear exits in DE, before declining progressively as the transition deepens. Gas import levels increase yet at moderate pace.

Ukraine transit: fall to 0 in all scenarios, but with variations, especially if Nord Stream 2 is not fully loaded

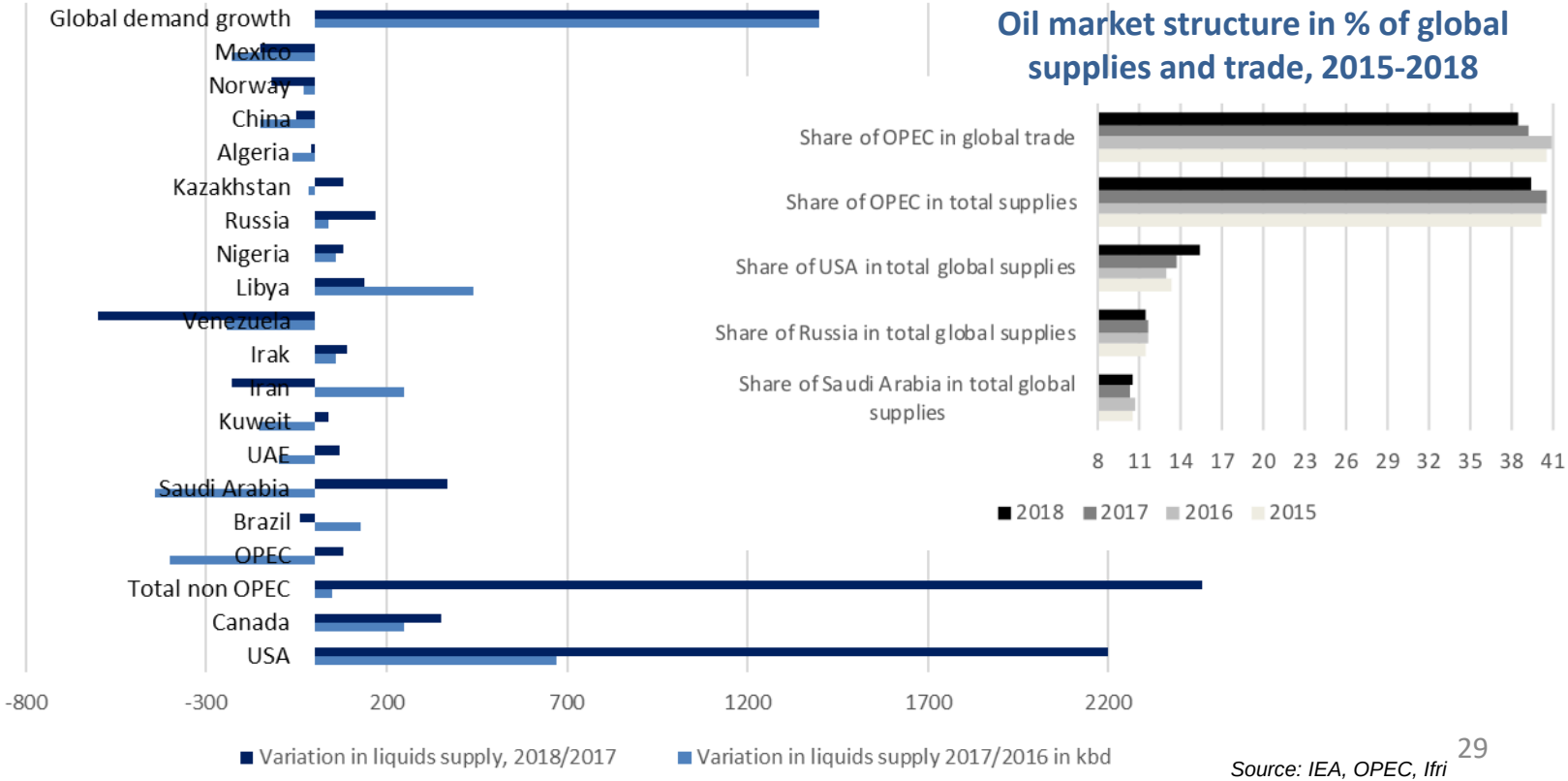
Evolution of gas transit via Ukraine in different scenarios, 2020-2030 (bcm)



Oil supply security issues

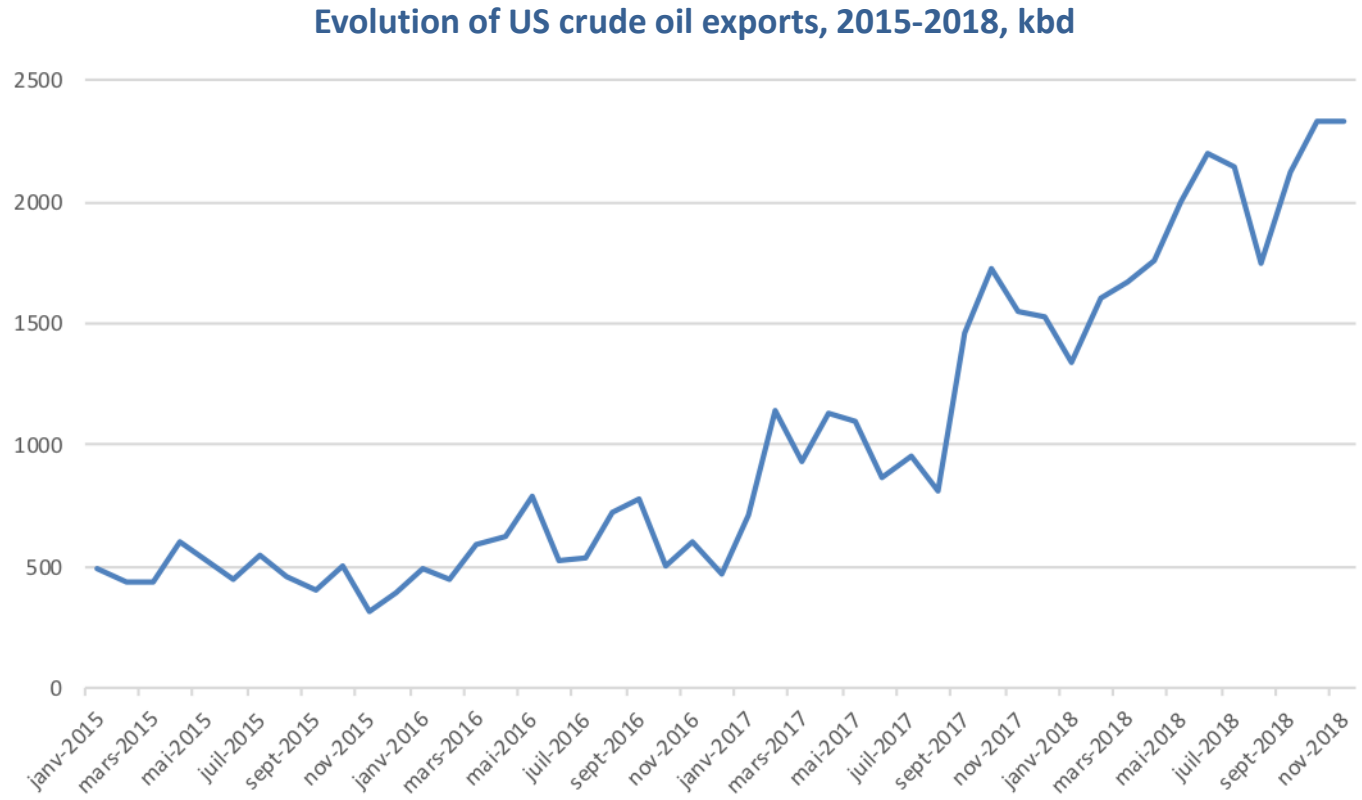
OPEC+: Saudi Arabia is the swing supplier, growth in non-OPEC supply meets 4/5 of incremental global demand

Evolution of liquids production by leading global suppliers, 2016-2018 (in kbd)



Source: IEA, OPEC, Ifri

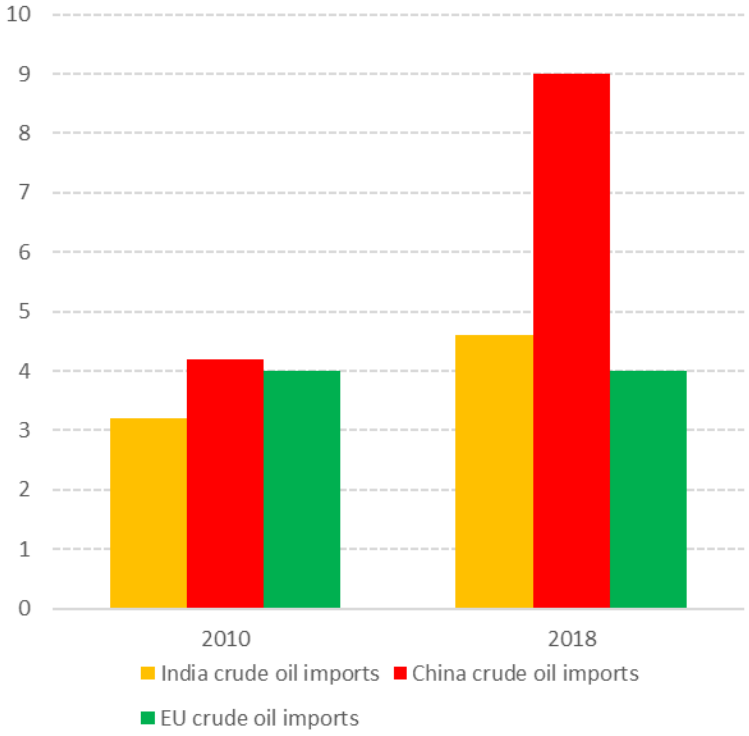
Boom in North American exports can compensate for sharp drop of Iranian exports by May, supply squeeze could backlash



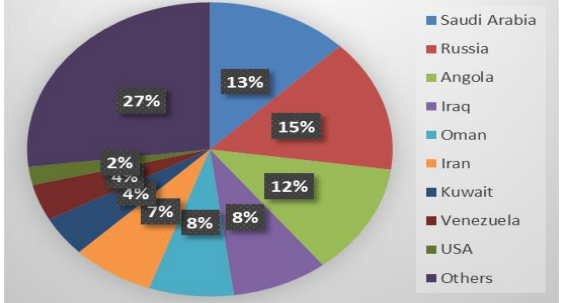
Source: EIA

Shifting geopolitics of global petroleum trade: China and India face new vulnerabilities in the Middle East

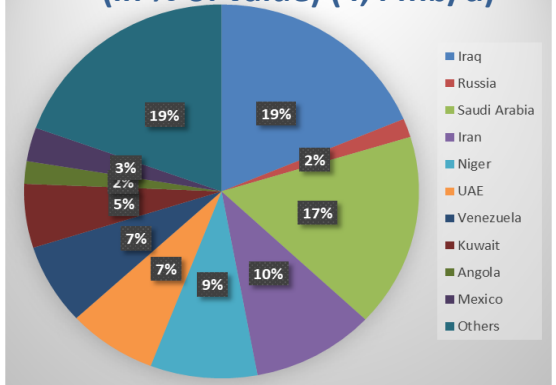
Change in crude imports of India, China and EU, 2010 and 2018 (mb/d)



China's 2017 oil imports by country (in % of value) (8,4 mb/d)



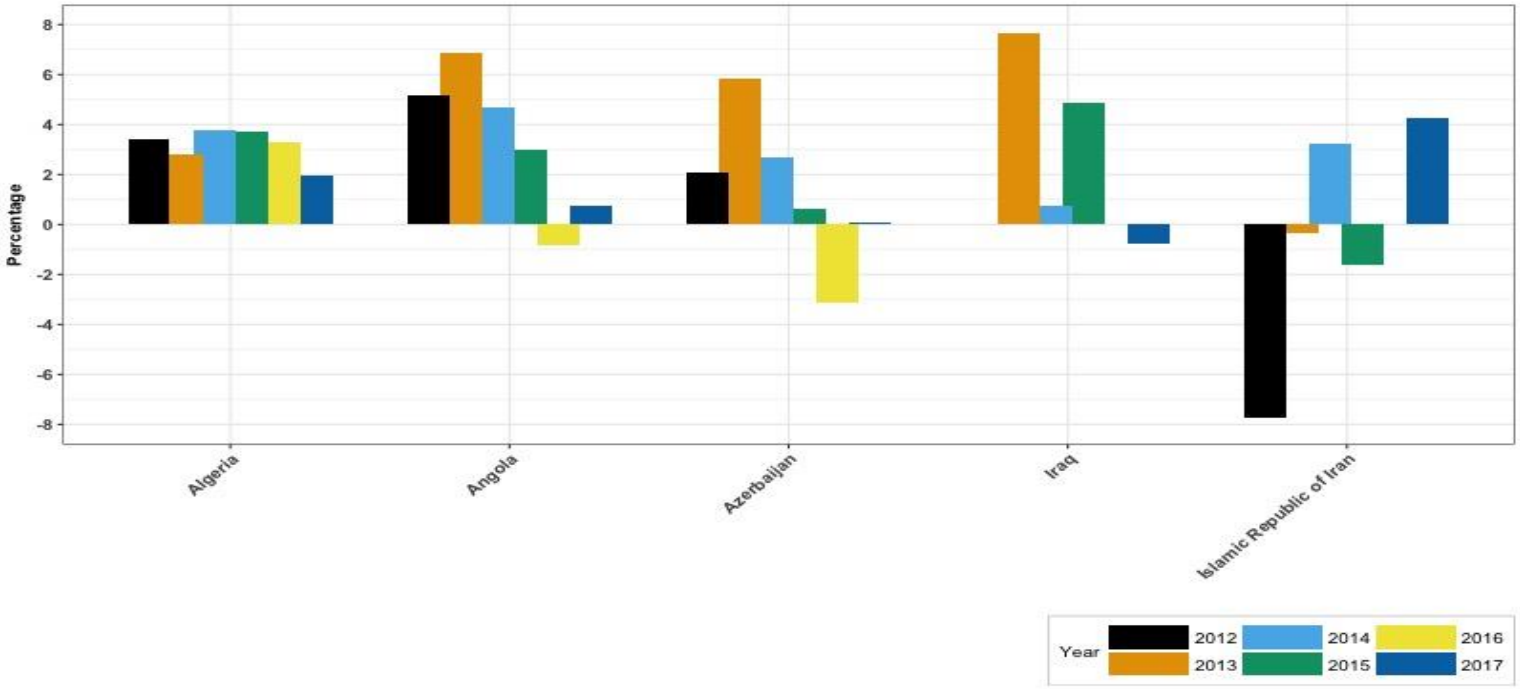
India's 2017 oil imports by country (in % of value) (4,4 mb/d)



Source: EIA, statistical data from countries' customs

OPEC+ producers' economies hit by the fall of oil prices in 2015 and saved by its rebound in 2017

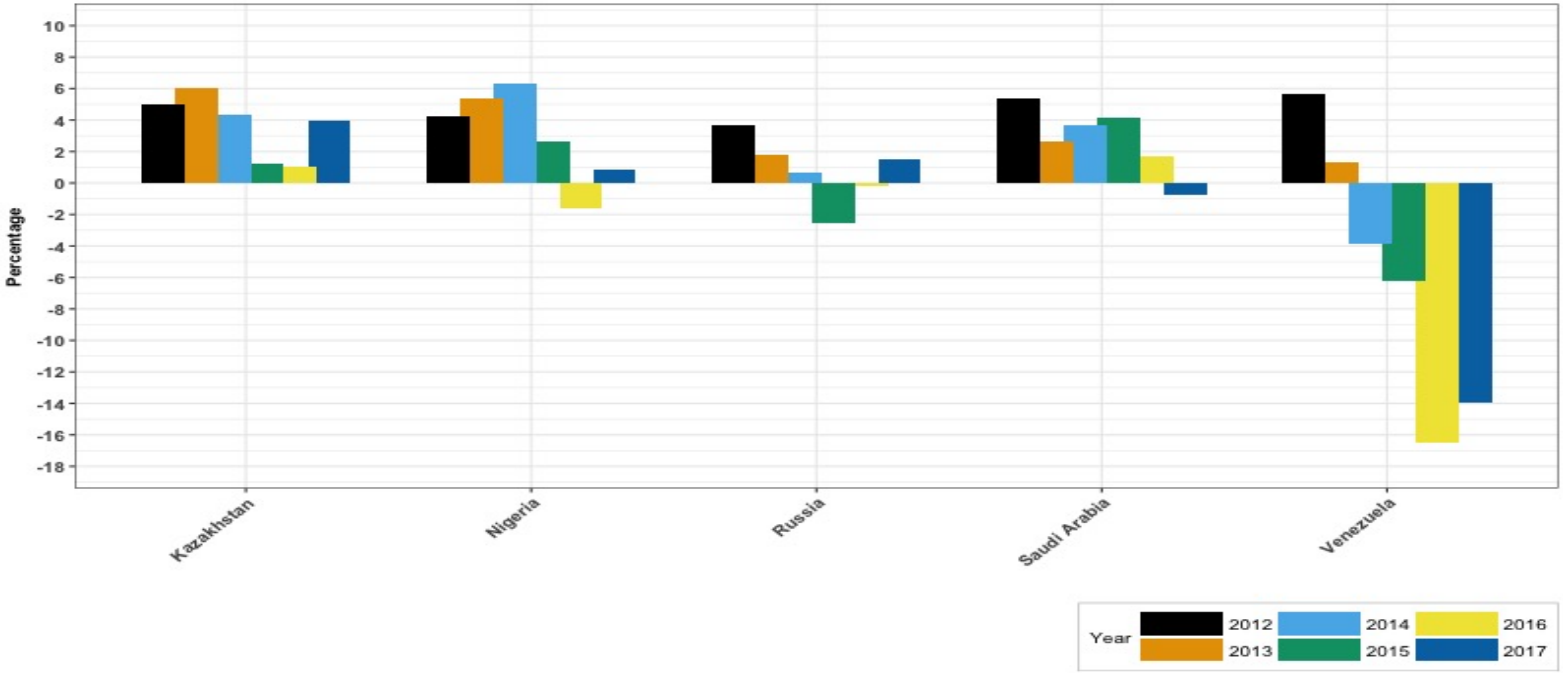
GDP growth, selection of OPEP+ producers, 2012-2017



Source: IMF

Most producers are vulnerable yet pay no credible effort to economic diversification especially since prices recovered

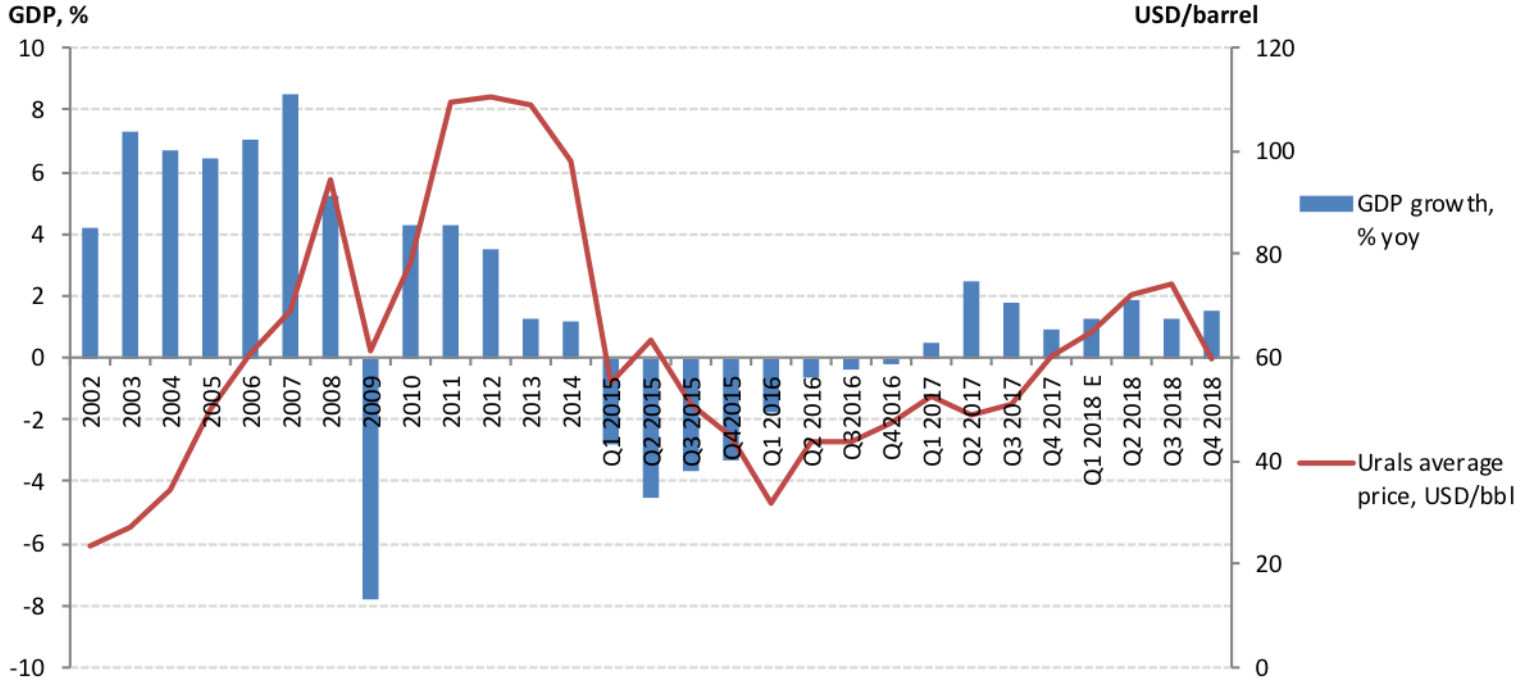
GDP growth, selection of OPEP+ producers, 2012-2017



Source: IMF

Russia's economy is stagnating, cautious budget but can public spending foster sustainable growth?

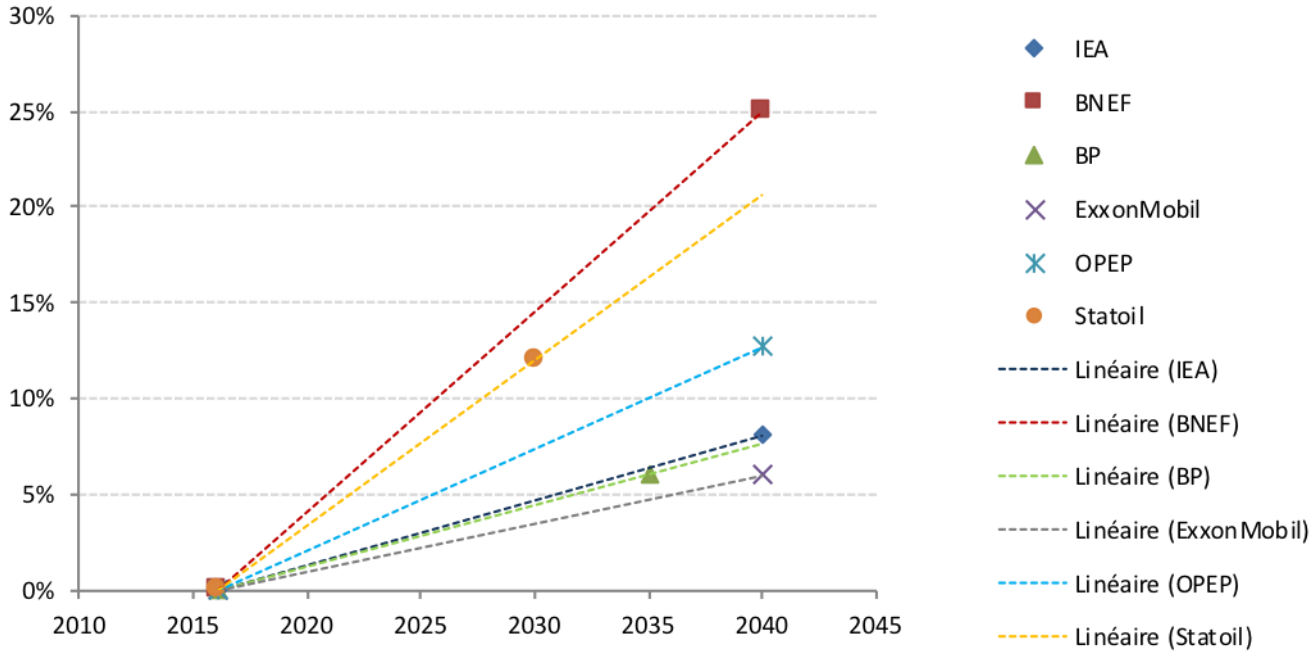
Evolution of Russia's GDP and oil prices, 2002-2018



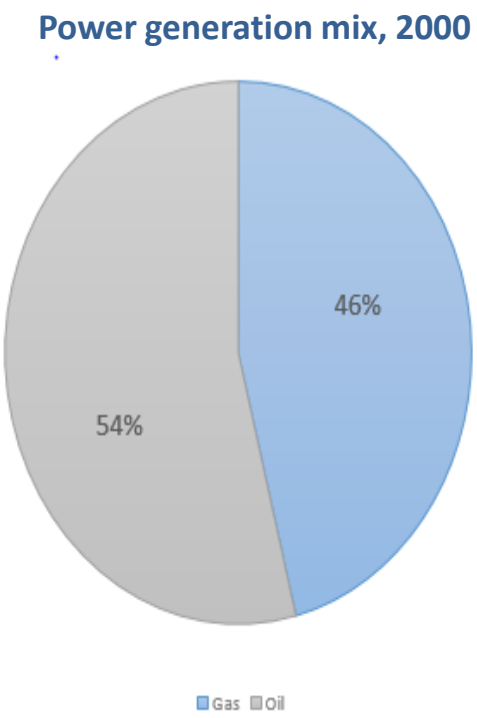
Source: IMF

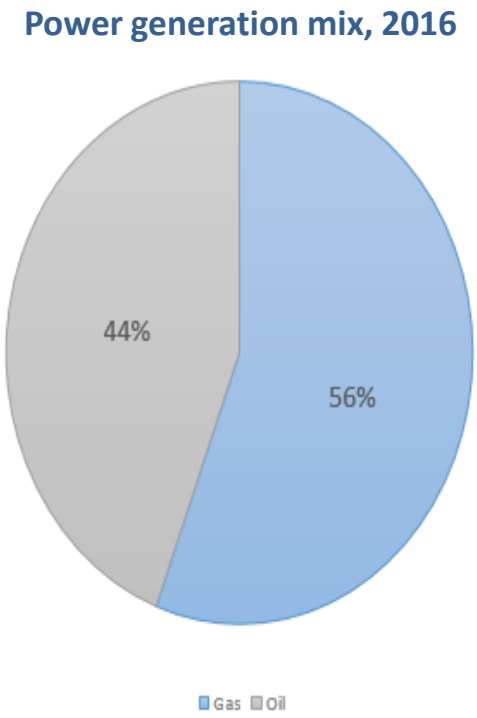
Demand peak not near, but could come quicker than many expect, while demand growth already slows

Share of EV or hybrid vehicles in the total global fleet, 2010-2050e



Saudi Arabia is working to free up more oil for exports, which creates new opportunities

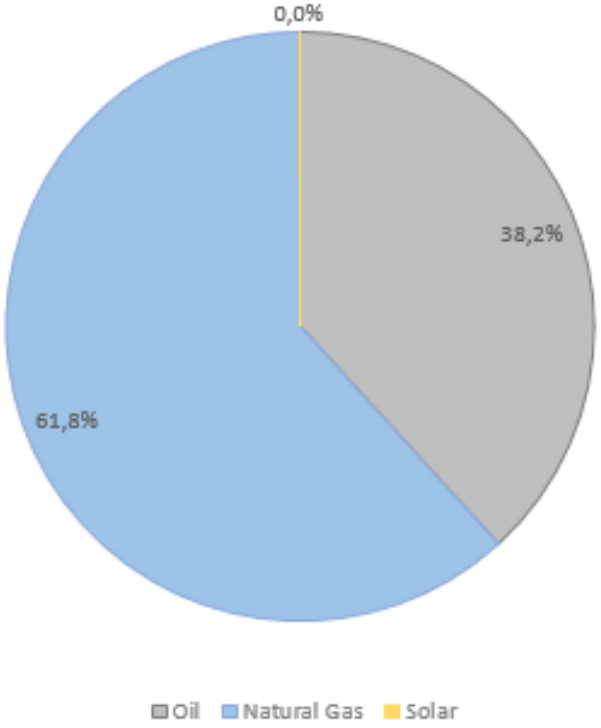




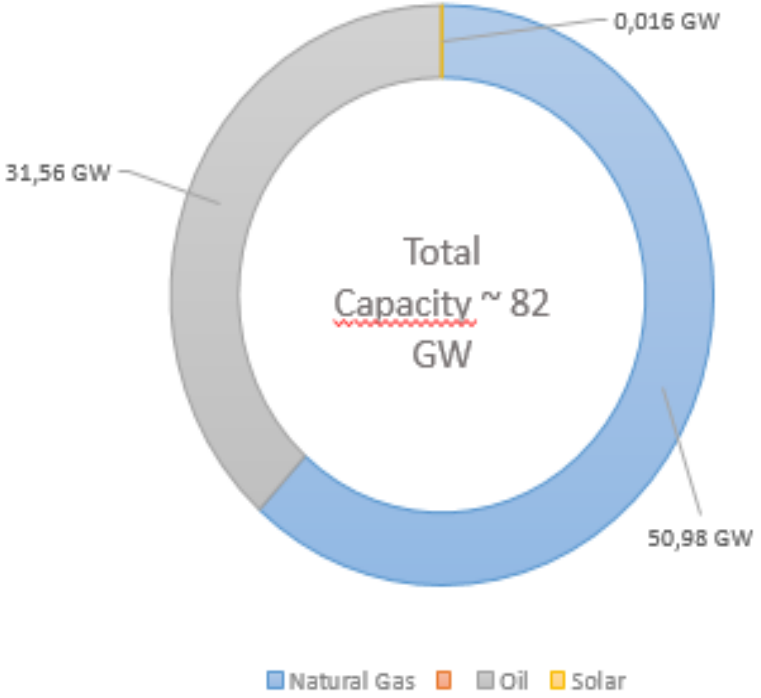
Source: IEA

31 GW of oil fired power generating capacity that could be progressively reduced to a summer peak load tool

Installed electric power capacity by fuel in %, 2017



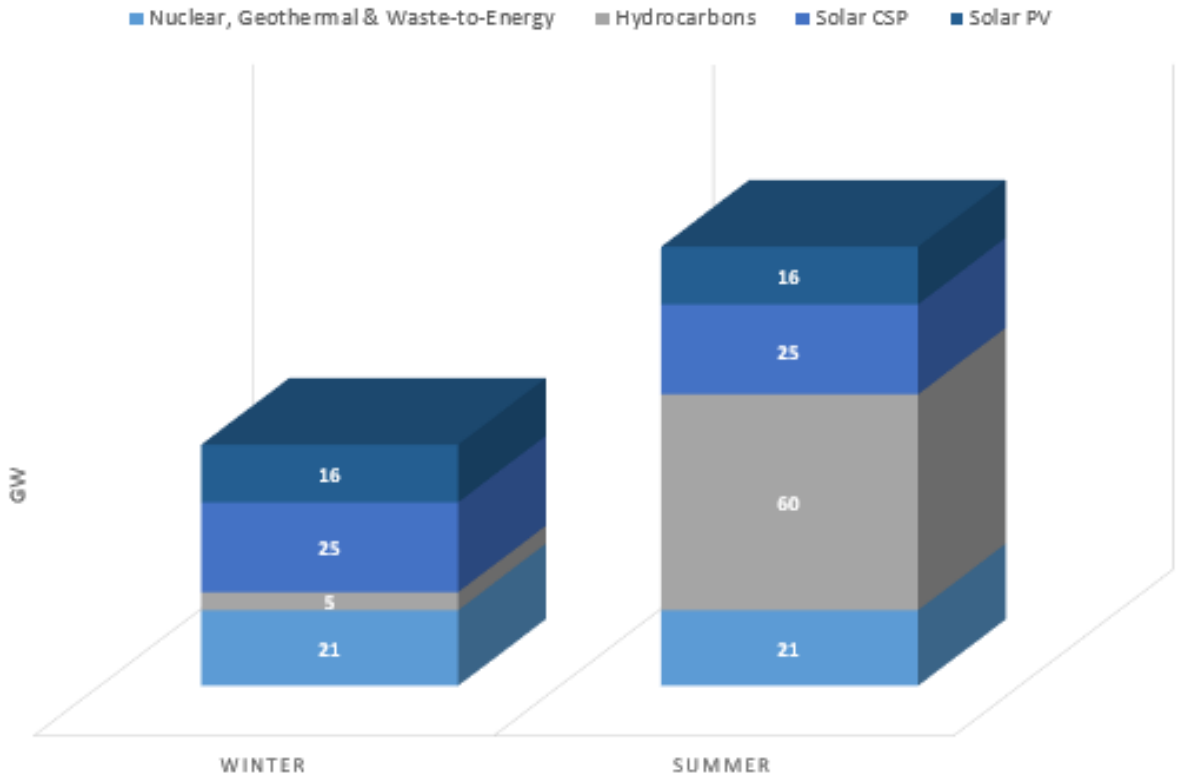
Installed electric power capacity by fuel in GW, 2017 (including desalination)



Source: KAPSARC

Saudi Arabia's power mix transformation will add spare export capacity & foster security but question its OPEC role

Potential longer term energy mix, summer and winter (GW)

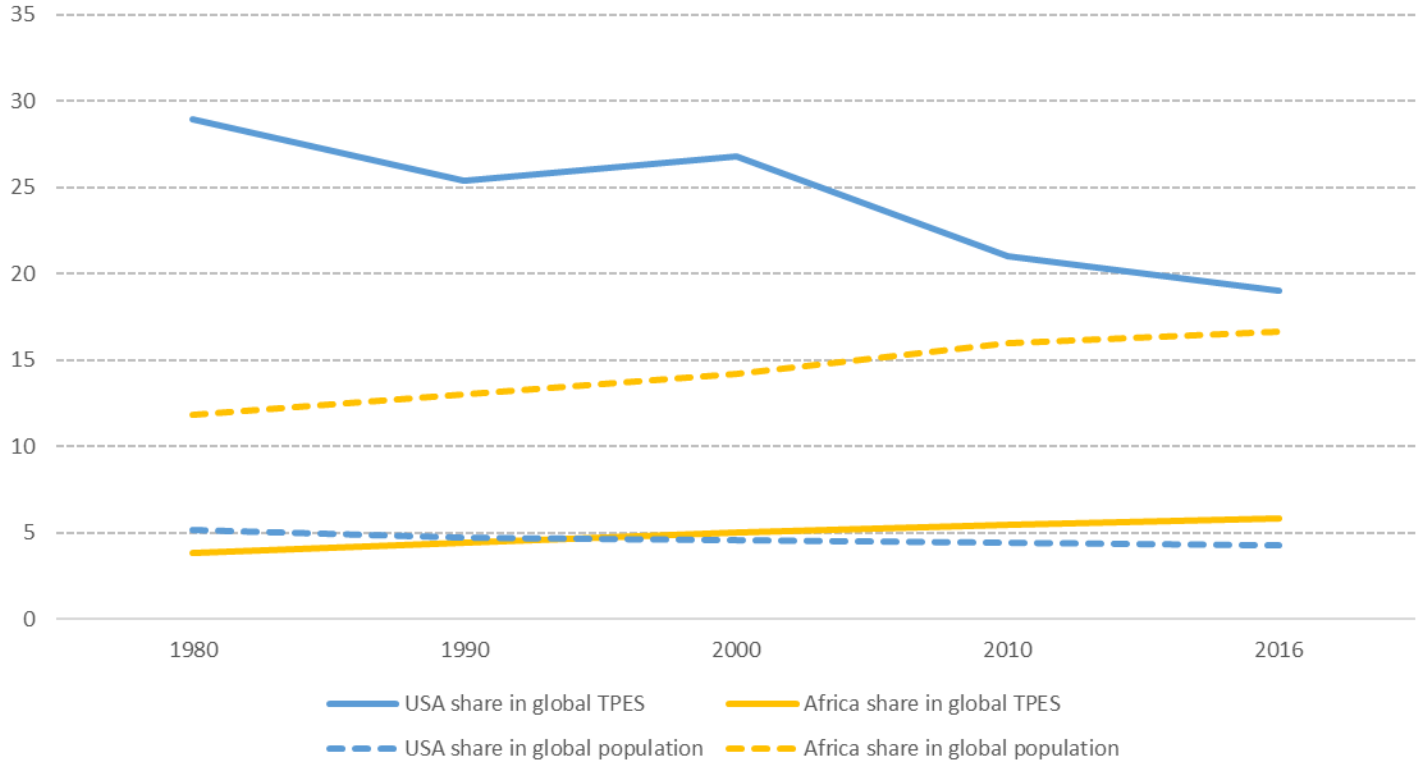


Source: King Abdullah City for Atomic and Renewable Energy K.A. Care www.kacare.gov.sa

Sustainable energy access in Africa

Africa is big in demography but small in energy and still marginal in greenhouse gas emissions

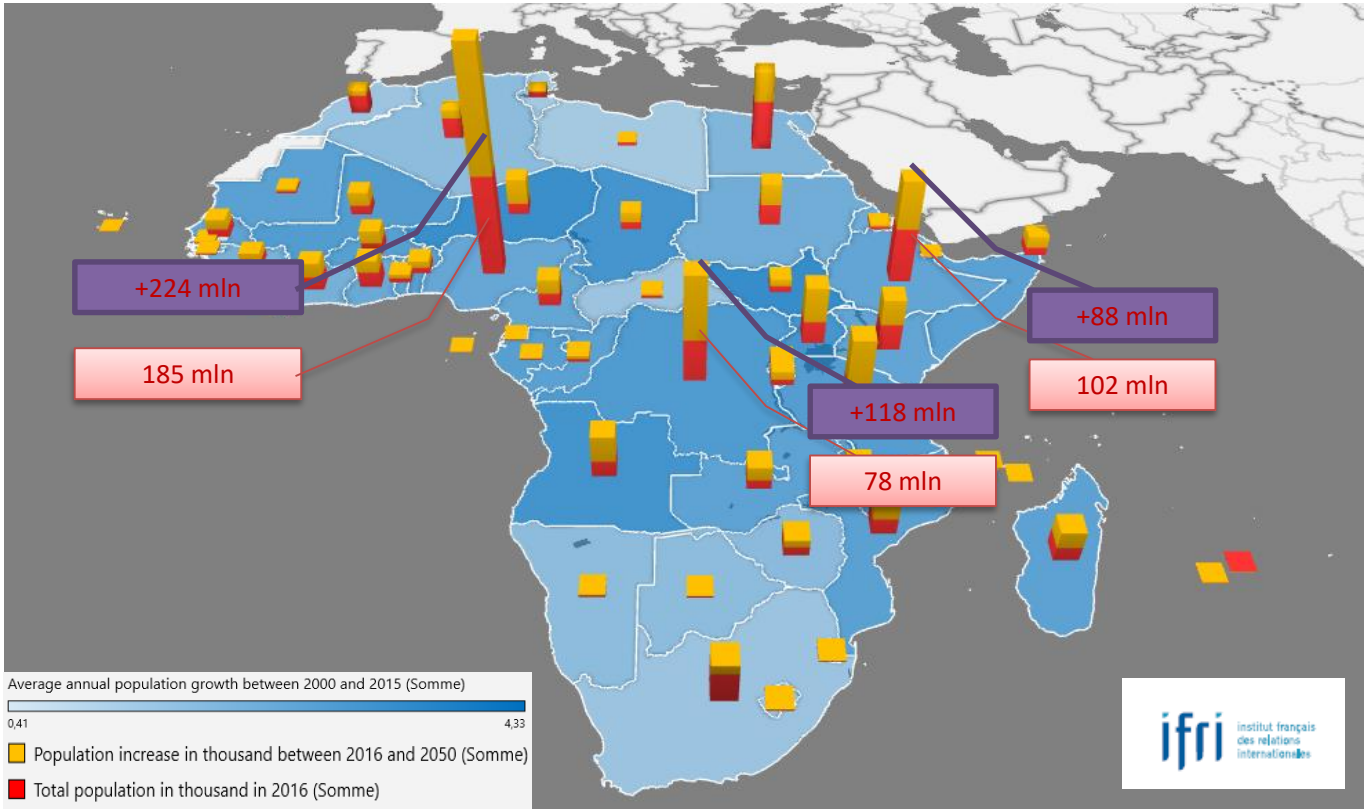
Comparison of Africa's and USA's share in global TPES and population, 1980-2016



Source: World Bank, UN Data

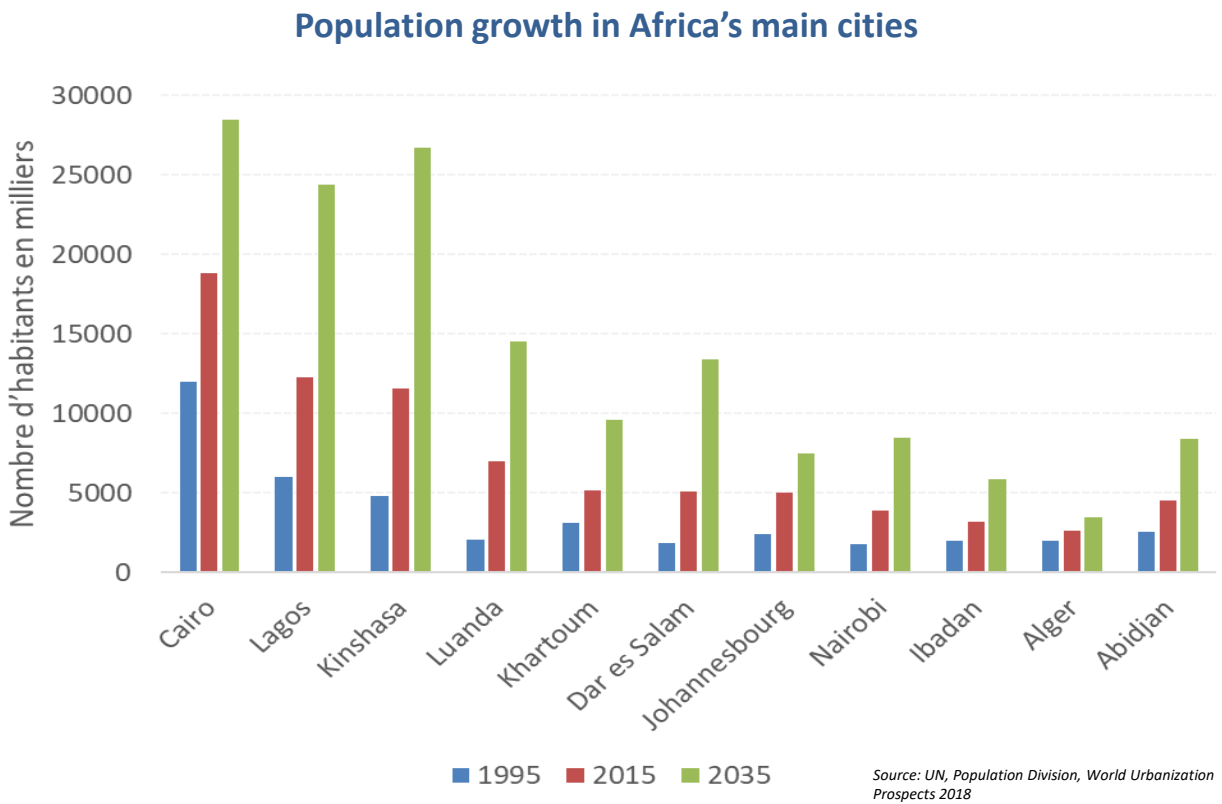
Explosive cocktail: surge in population, combined with climate change, water shortage, lack of access and poverty

Population Dynamics



Source: UN, Population Division, World Population Prospects 2017

Sustainable electricity for cities, public transport and energy efficiency will be key, especially with soaring cooling needs and air pollution



Source: UN, Population Division, World Urbanization Prospects 2018

The threat of inefficient air-conditioning equipment with growing cooling needs

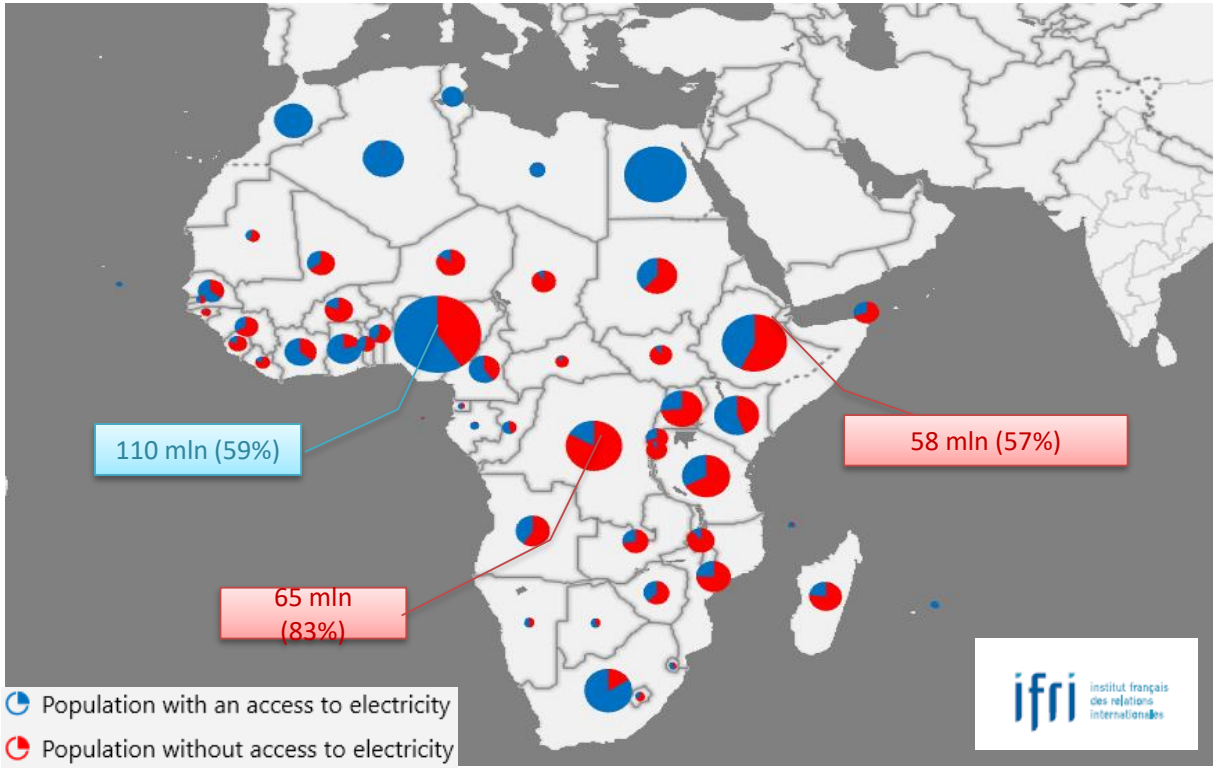
- Economical development, higher incomes, urbanization and global warming are all factors that will contribute to the surge in demand for fans (in a first time), and AC in middle and upper class homes and commercial spaces.
- Air conditioning tends to create demand peak which put strain on an already unstable electricity network
- In Africa today, less than 5%* of the population own an AC (large potential market, LG just launched its last AC energy efficient conditioner tailored for the Nigerian market).

- Energy use per capita for space cooling in 2016 was of 35kWh* for Africa and more than 500 kWh* for the Middle East.

Source: IEA, The Future of Cooling – Opportunities for energy-efficient air conditioning

Electricity access challenge unaddressed: around 550 millions without access, 700 million without clean cooking

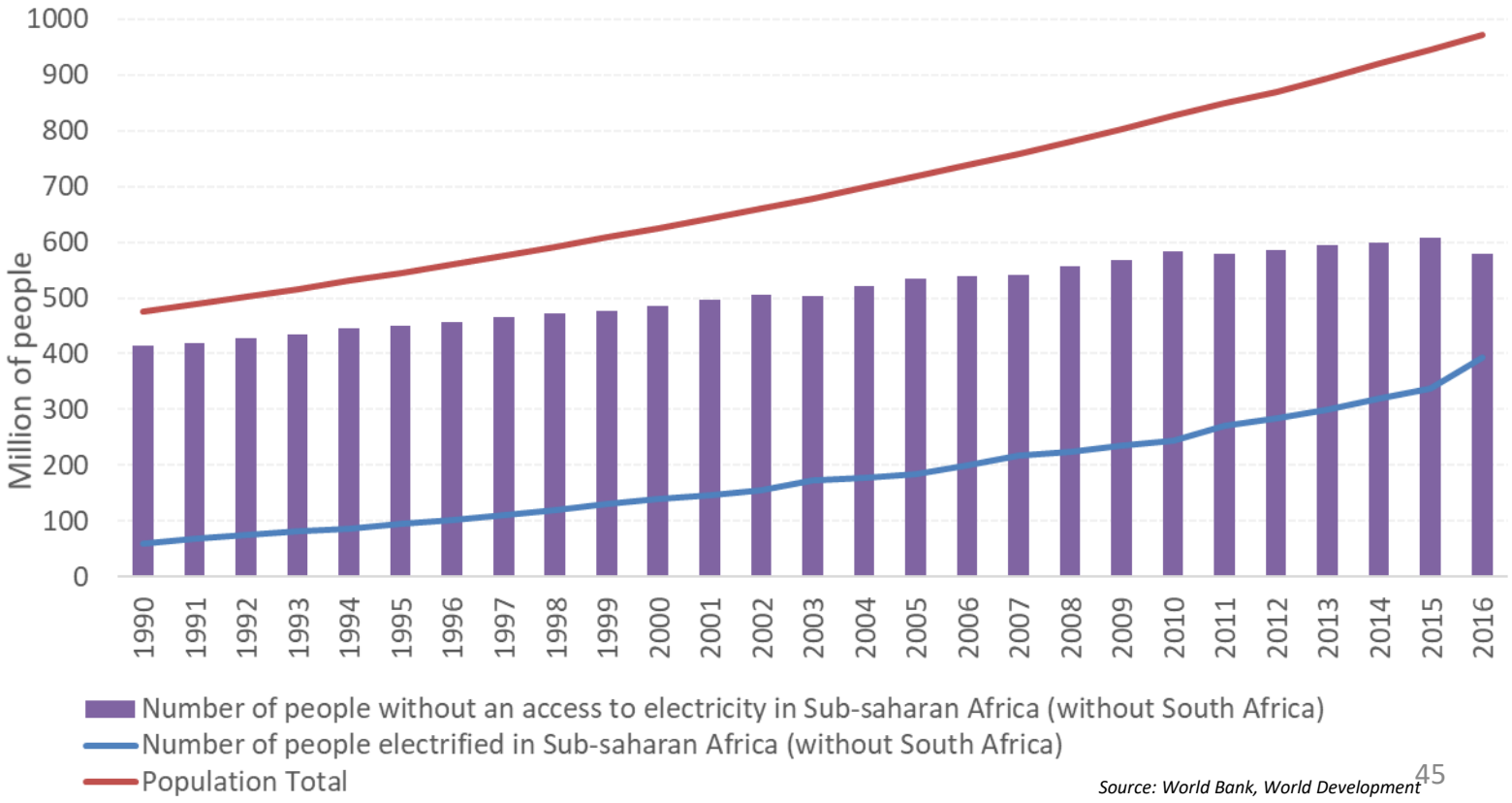
Access to electricity (% of population) in 2016



Source: World Bank, World Development Indicators

Sub-Saharan Africa: Population increase is stronger than energy access progress

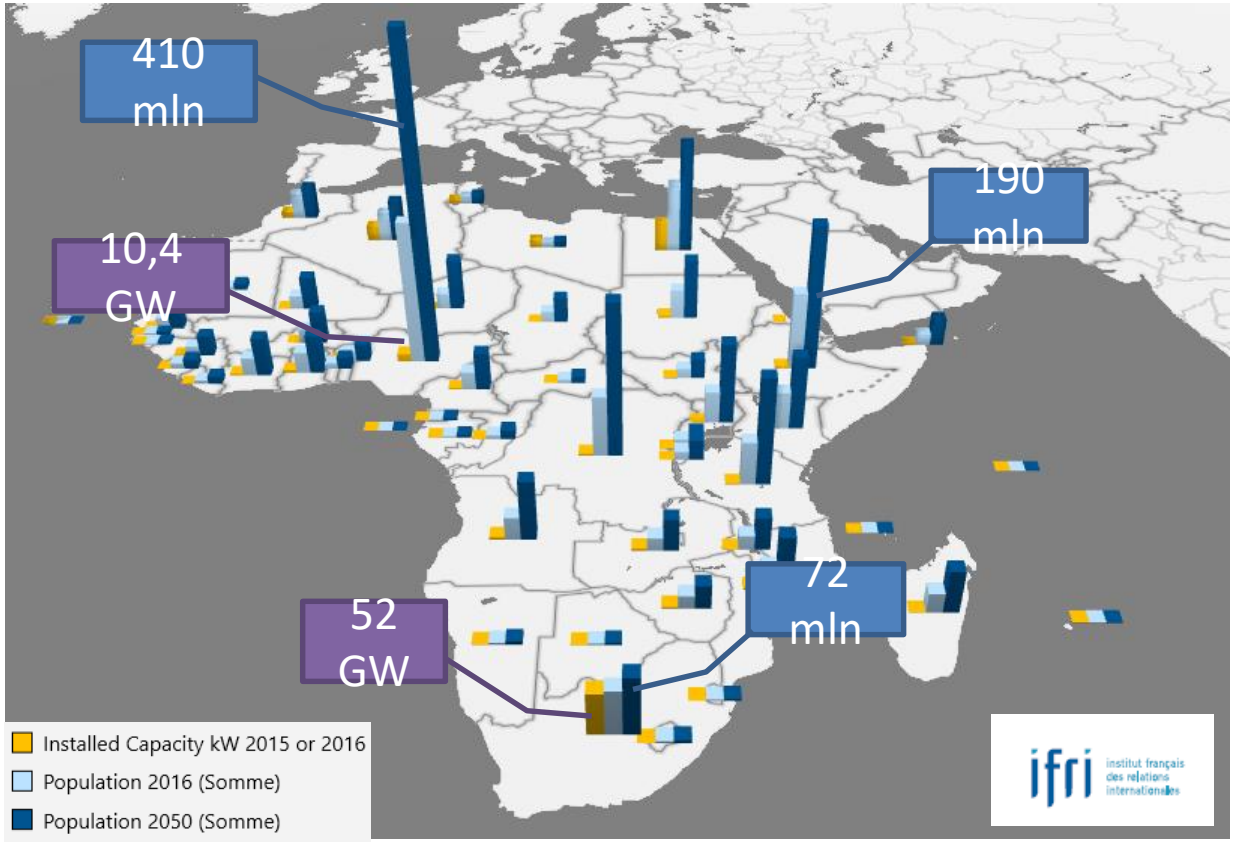
Number of people with and without electricity in Sub saharan Africa (without South Africa)



Source: World Bank, World Development Indicators, and own calculations

Tiny installed power generation capacity, less than Germany

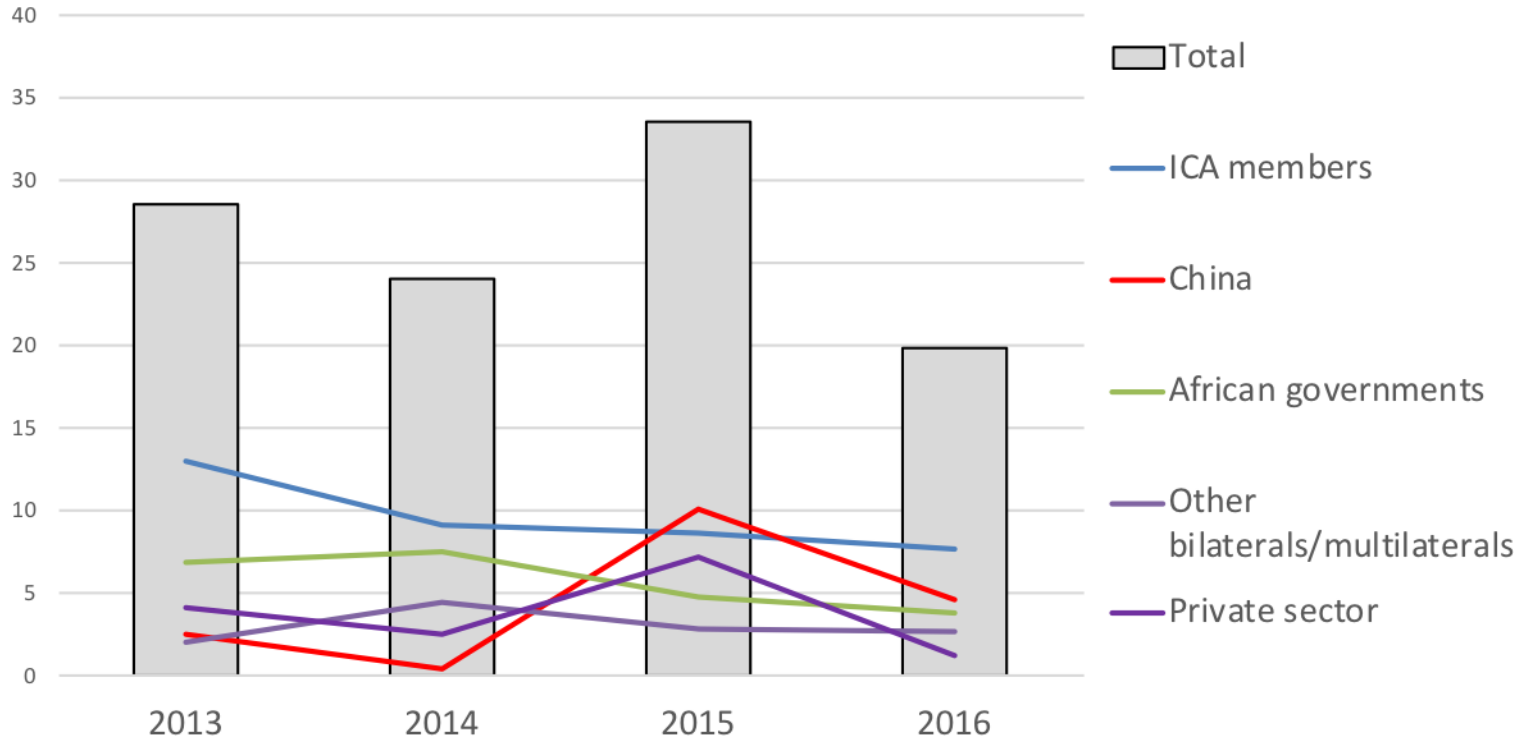
Installed capacity, actual and projected population



Source: World Bank, World Development Indicators, United Nations' Database, UN Population Division World Population Prespects 2017

2,5 times more power sector investments needed per year, private sector investment is dominated by South Africa

Power sector investments in Sub-Saharan Africa, 2013-2016 ($ billion)



Source: Infrastructure Consortium Africa

International initiatives helpful but only private sector investments can scale up electrification

- ✓ UN Sustainable Development Goals (2015)- Sustainable Energy for All (SE4All), hosted by ADB
- ✓ NEPAD, Programme for Infrastructure Development in Africa (African Union/ADB), focusing on eight African regions
- ✓ World Bank
- ✓ Power Africa
- ✓ Sutainable Energy Fund for Africa
- ✓ African Development Bank (ADB)/ The New Deal for Energy in Africa (2015): full electricity access by 2025
- ✓ Electrification Financing Initiative (ElectriFI) – European Union
- ✓ Partenariat Afrique-UE pour l'énergie (PAEE)
- ✓ Bilateral development aid and support programmes (Afd, Norad, GIZ, DevCo)

All key to provide funding and structure bankable projects, but slow, unefficient, insufficient…

Scaling up and accelerating RES is now possible, need of greater private investment

- ✓ No silver bullet, no unique solution: combination of technologies, business models tailored to specific needs
- ✓ Combination of demand side and supply side measures needed!
- ✓ Technical conditions are in place: innovations, technology costs are down, business models work, best practices and numerous pilot projects &larger scale deployment exist
- ✓ Foreign aid, grants, guarantees and credits are important but will not be enough and cannot be enough
- ✓ Need for much greater private investment
- ✓ Need to make more cheap funding available
- ✓ Private entrepreneurship is already successful !
- ✓ Need of greater coordination among donors and greater focus on Sub-Saharan Africa
- ✓ Need to overcome the finance bottleneck with a reform of the global financial system

Local governments must do more, need for strategic approach with climate adaption

- Governance of public institutions and state-owned companies
- Investment framework: robust banking and financial sector
- Regional cooperation and interconnections, capacity building at the local, national and regional level
- Regulation, land registries
- Need for tariff reforms
- Improved tax collection, higher saving rate, higher share of domestic investments key, especially of pension funds

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