

Trends & assumptions for a socially equitable energy transition in Mexico

Concepts for discussion

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BERLIN, APRIL 8, 2019



Structure

1.

Global trends that shape the energy transition

2.

Renewable Energy as the fundament of future prosperity

3.

Conceptual scenarios for discussion

10 Megatrends that will shape energy policy in the next decade:

1. Decarbonization challenge

As climate change accelerates, societal pressure to act increases

2. Deflation of fossil fuel prices

Coal, oil and gas prices will remain low, but become more volatile

3. Decrease in costs

Clean-energy technologies are becoming cheaper than conventional and fossil technologies

4. Digitalization

Energy and transport systems are becoming smarter and better networked

5. Electrification

The power, transport and heating sectors are increasingly interconnected

6. Dominance of fixed costs

Future energy systems will be dominated by investment costs

7. Influential cities

More people in cities means that urban decisions are becoming more important for enabling low-carbon lifestyles.

8. Demographic and economic change in rural areas

Many regions must cope with ageing and shrinking populations and face shifting economic opportunities

9. Decentralization

Small-scale solutions enable but also require proactive energy consumers

10. Interdependence

Progressive integration of European economies and energy systems is demanding more coordination between countries

European Energy Transition 2030: The Big Picture

Ten Priorities for the next European Commission to meet the EU's 2030 targets and accelerate towards 2050

IMPULSE

Agora
Energiewende

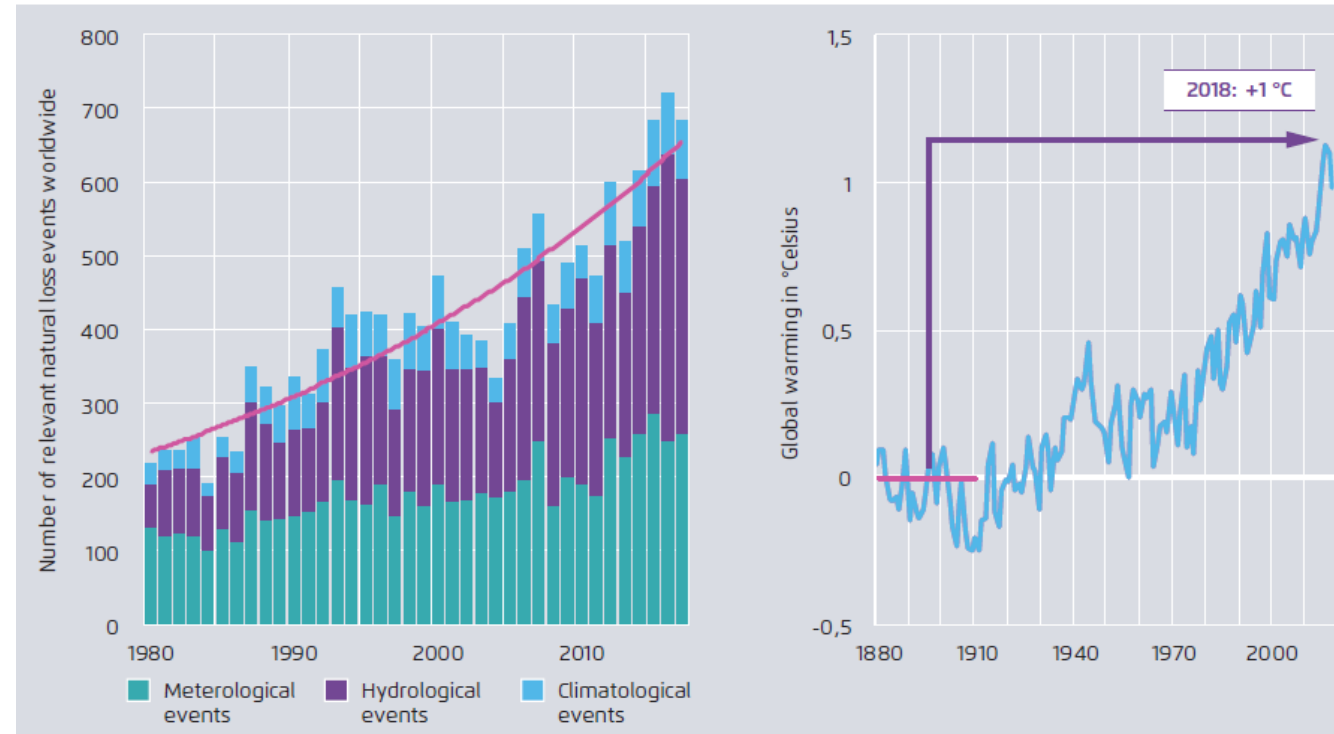


Megatrend #1: Decarbonisation

As climate change accelerates, societal pressure to act increases

Climate change is real: since 1970 the rate of global warming has accelerated, and since 1980 extreme weather events have tripled

Figure 1



MunichRE (2018): NatCatSERVICE

WMO (2018)

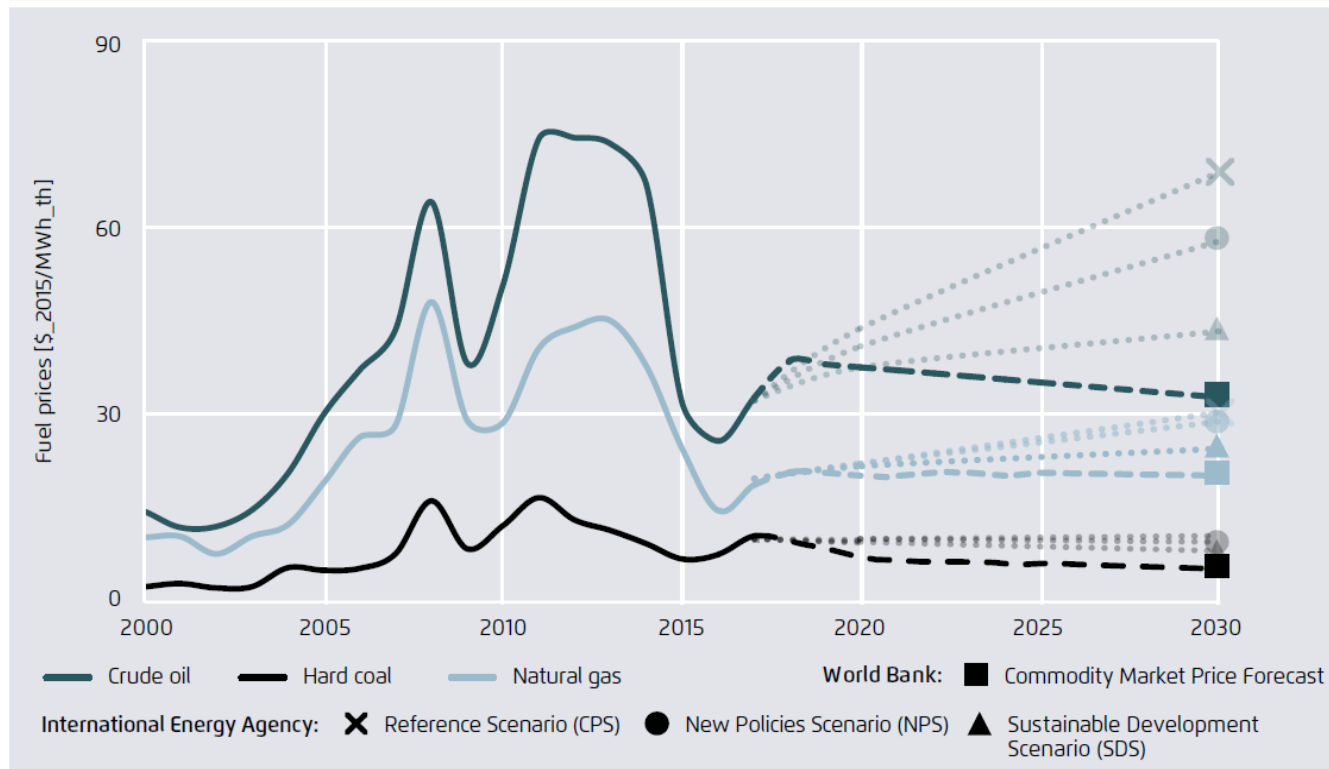
- The 2015 Paris Agreement aims to limit warming to well below 2°C
- National pledges so far are not adequate to achieve this goal
- Increasing impacts of climate change will amplify societal pressure to reduce emissions
- Pressure is coming from citizens, NGOs, but also investors and businesses
- Positive and negative incentives will force mitigation

Megatrend #2: Deflation of fossil fuel prices

Coal, oil and gas prices will remain low, but become more volatile

Fossil fuel price projections forecast low to moderate price levels to 2030

Figure 2



IEA (2016), World Bank (2017a) and World Bank (2017b)

Prices for fossils stagnate as:

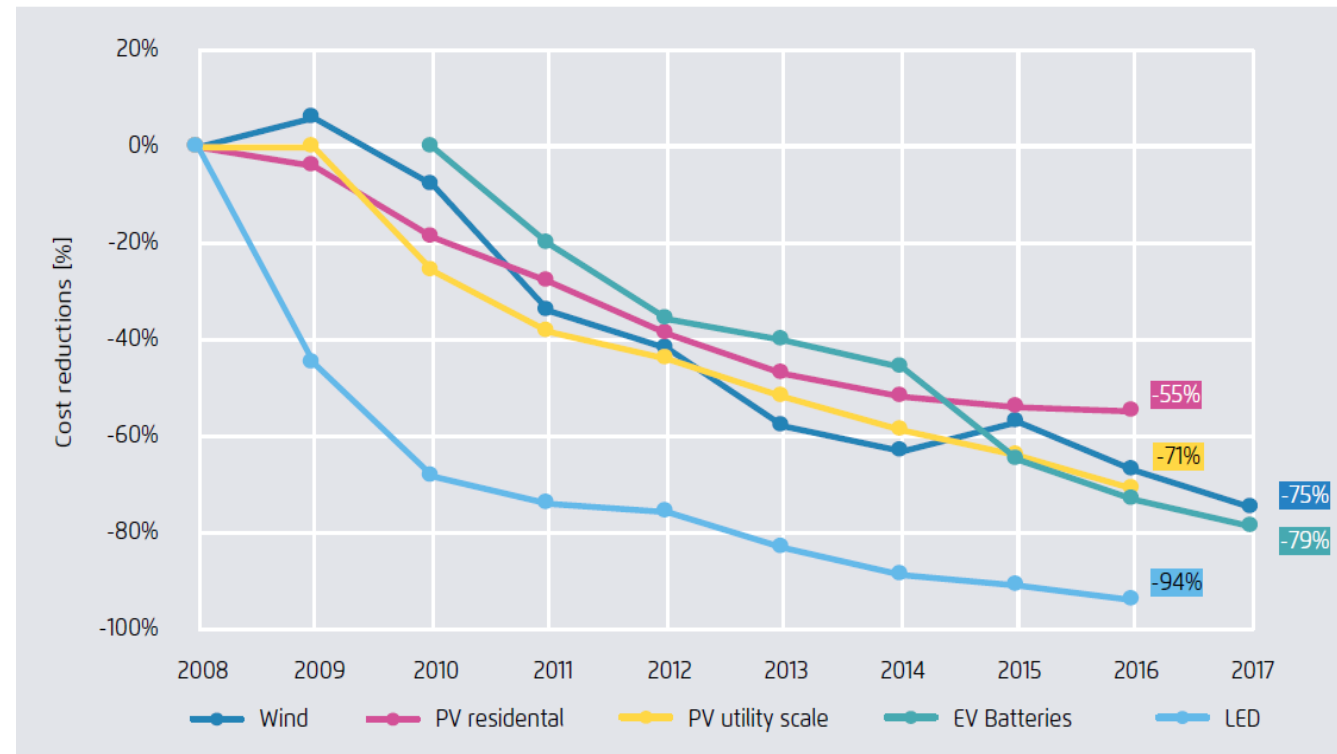
- Technology reduces cost for exploiting oil, gas and coal
- Low-cost renewables define price ceiling
- Carbon Pricing increases cost for consumer and strand high cost producers
- In a scenario of limiting climate change to well below 2 degrees there is an unexploitable abundance of fossil fuel reserves.

Megatrend #3: Decrease in costs for clean energy solutions

Wind, Solar, Batteries, Efficiency technologies are now cheaper than conventional and fossil technologies

Cost reductions in major clean-energy technologies from 2008–2017

Figure 3



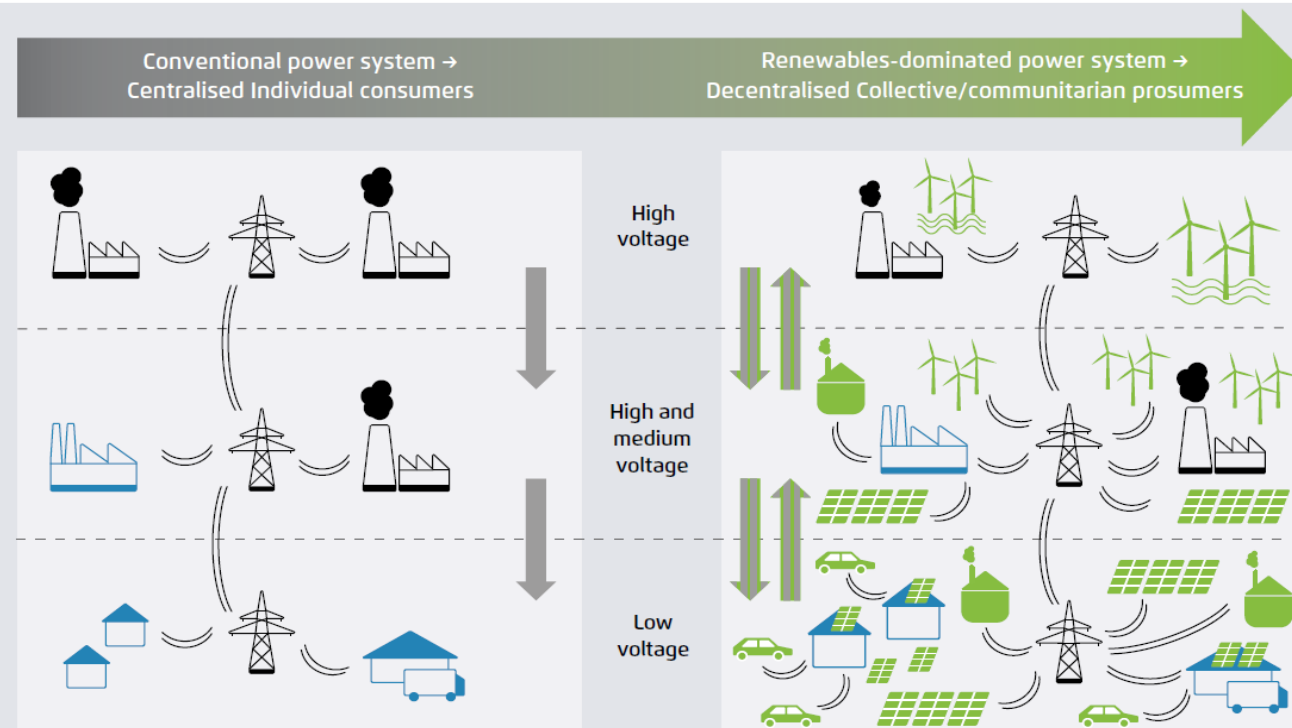
NRDC (2018) Revolution now

- The cost for wind and solar power has fallen dramatically over the last decade: new wind and solar plants are now cheaper than any other new built power technology
- Over the next decade, *new* wind and solar plants will become cheaper than operating *existing* coal and gas plants
- A similar drop in costs is underway for batteries and in consequence also for electric vehicles

Megatrend #4: Decentralization: Small-scale solutions enable but also require pro-active energy consumers

The power system's "one-way street" is replaced by a decentralised, networked structure

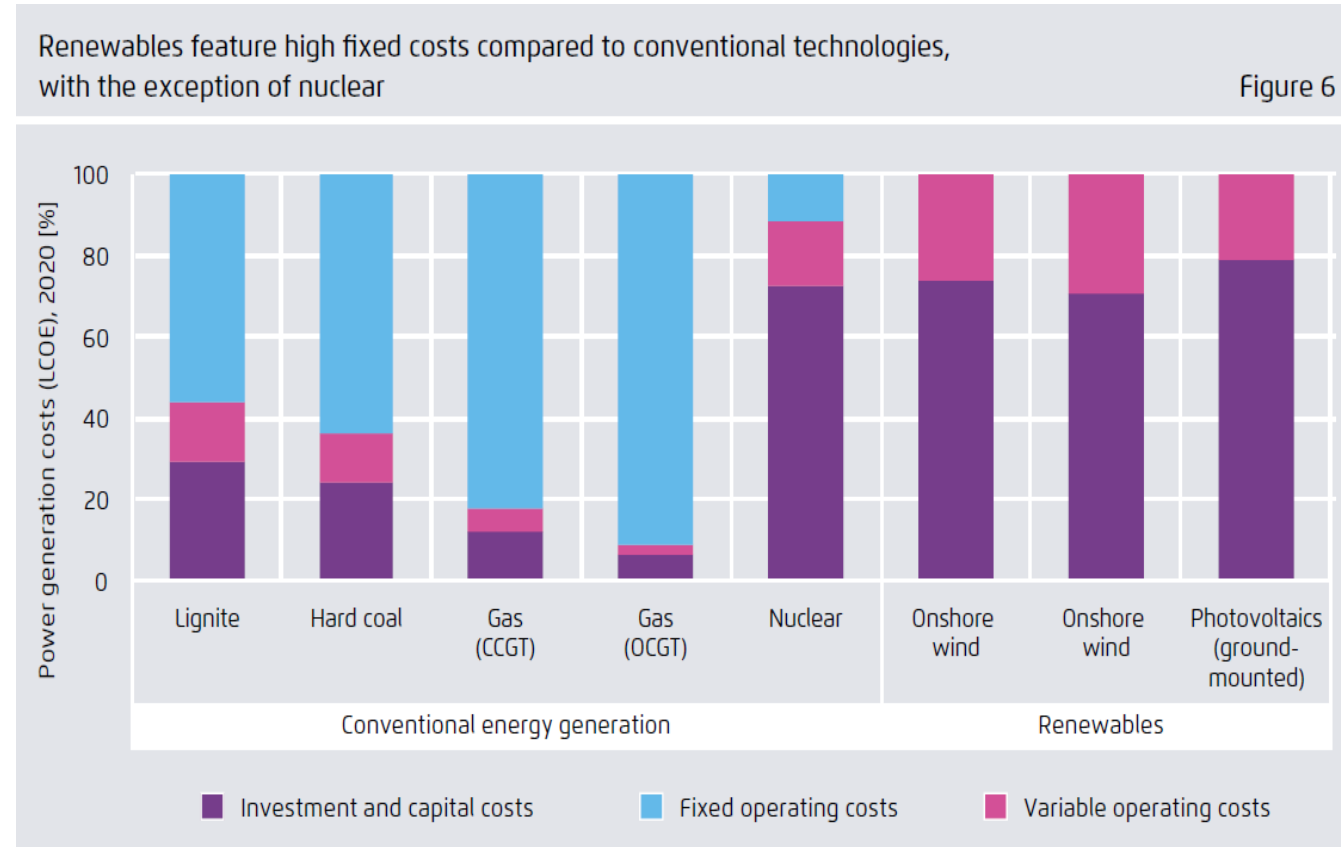
Figure 9



- Renewable energies are more decentralized than conventional power plants
- Efficiencies of scale are related to aggregate, not individual capacity
- Consumers, cooperatives and businesses evolve to prosumers
- Opportunity for democratization synergies with productive activities
- The energy transition may act as a driver for regional development

Megatrend #5: Dominance of fixed costs

Future energy systems will be dominated by investment costs



- Renewable technologies have a high share of investment, but very low operational costs
- This new finance structure challenges existing business models and market arrangements
- Mobilizing large volumes of capital at low costs is key, but results in perpetuate low cost energy supply
- Robust and stable regulation and long-term objectives are necessary to attract investors.

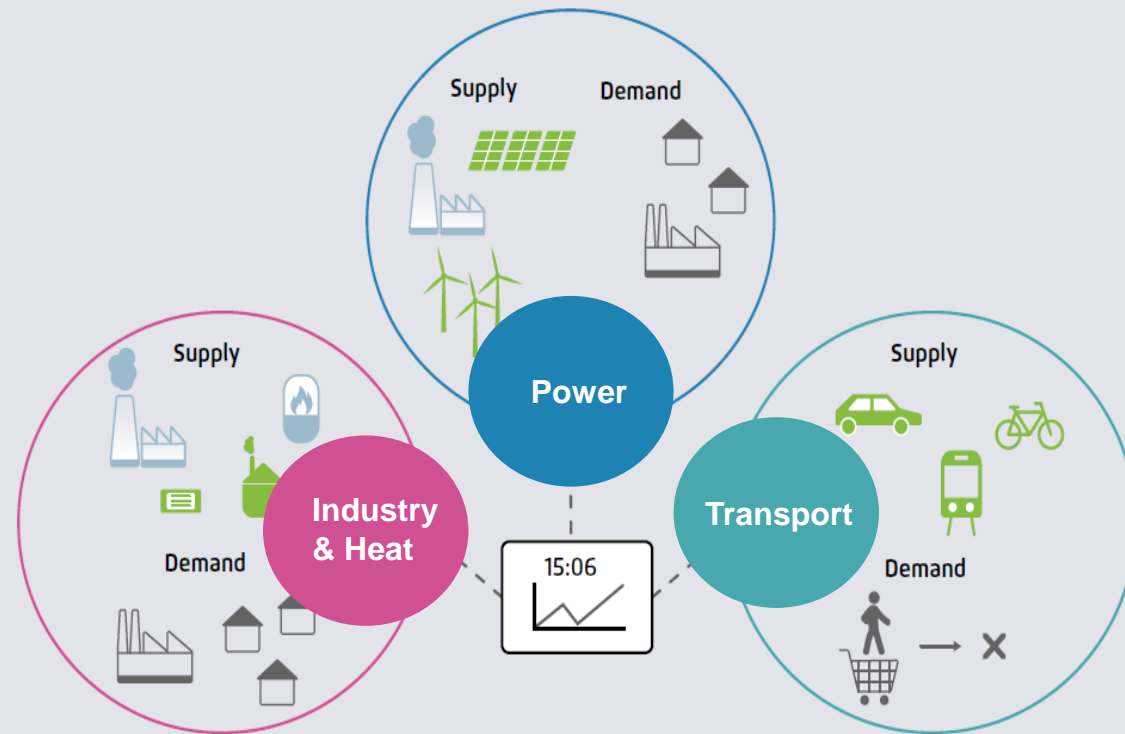
Calculations by Agora, based on IEA/NEA (2015)

Megatrend #6: Electrification

The power, transport, industry & heat sectors are converge

Electrification is the key driver of a stronger coupling of power, heat and transport systems

Figure 5

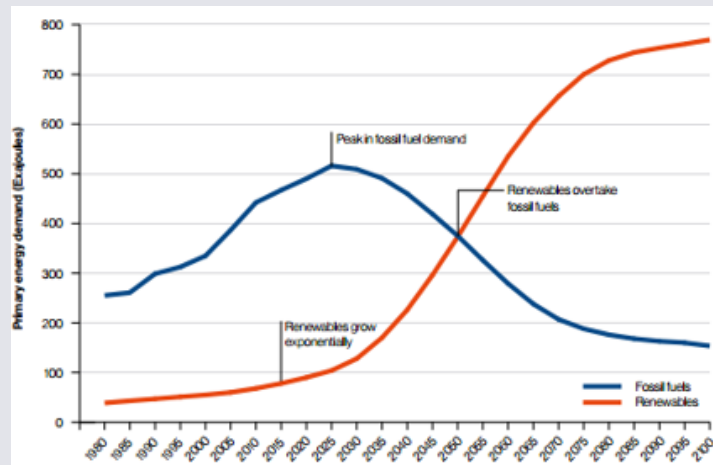


- Low cost renewable electricity allow to substitute more expensive and polluting fossil fuels in other sectors.
- Electric vehicles and industrial electrification offer opportunities for innovation, efficiency and increasing productivity.
- Synthetic fuels (PtG/PtL) represent a pivotal opportunity for countries with abundant low cost renewable energy potential

Renewable Energy: Fundament for prosperity & geopolitical strength

The energy transition framework

- Speed of the transformation is unclear
- RE grow exponentially and lead to electrification of the economy
- Fossil fuel consumption will peak and then decline slowly



RE will transform geopolitics and trade

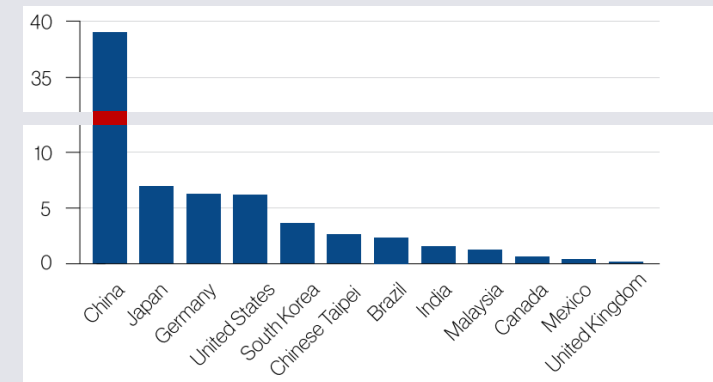
- RE are distributed & change trade
 - RE are perpetuate flows with zero marginal cost
 - A market for electro-fuels represents an opportunity for countries with rich renewable energy endowment
 - Fossil fuel producing countries need to transform their economies
- Diversification plans of Gulf countries:

Year	Country	Plan
1995	Oman	Oman 2020: Visions for Oman's Economy
2008	Bahrain	Economic Vision 2030
2008	Qatar	Qatar National Vision 2030
2009	Kuwait	State Vision Kuwait 2035
2010	UAE	Vision 2021
2016	Saudi Arabia	Saudi Vision 2030
2017	Kuwait	New Vision 2035

New productive arrangements emerge

- Democratization due to distributed nature of RE
- Regional and industrial integration
- Innovation, technology and manufacturing are fundamentals for competitiveness.

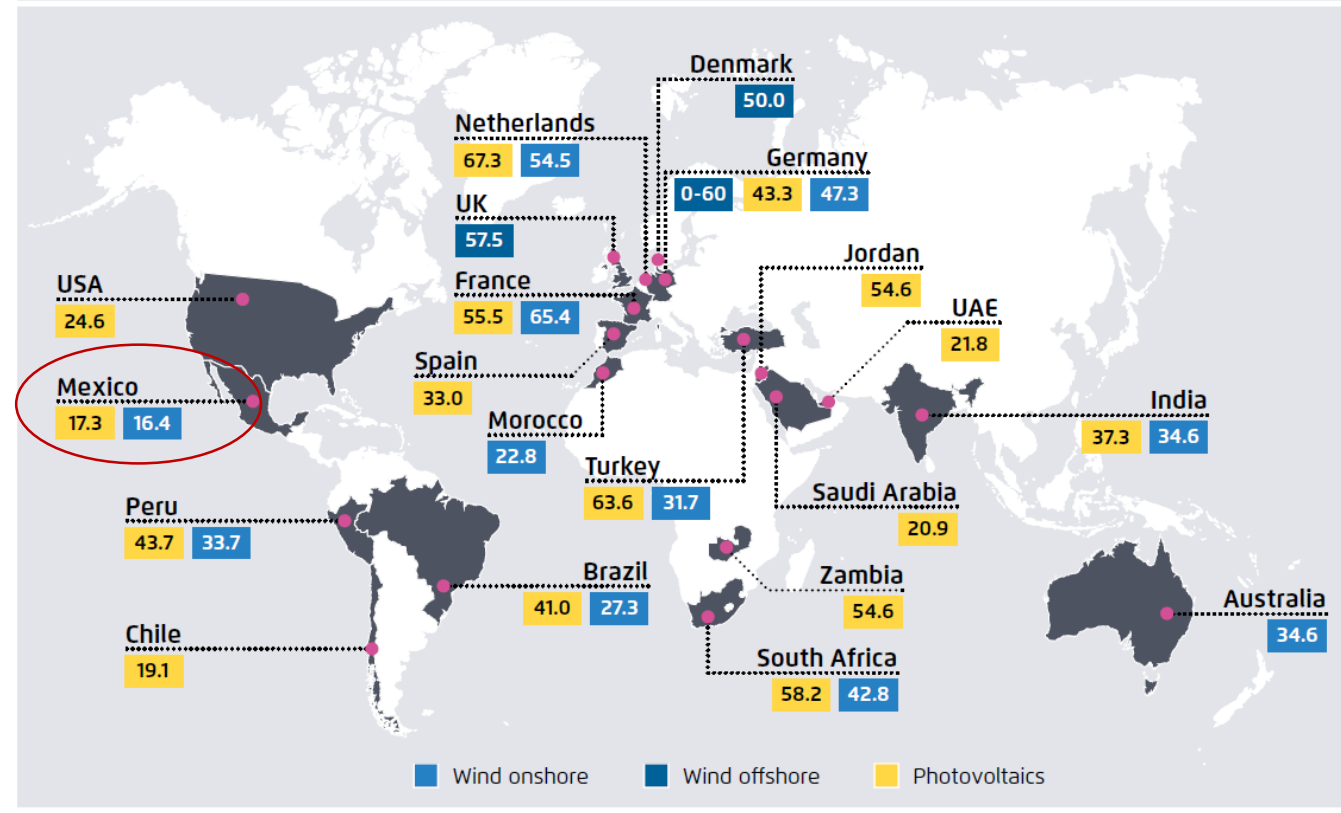
Clean Energy manufacturing value added (2014)



Mexico has demonstrated to have among the world's most attractive renewable energy resources

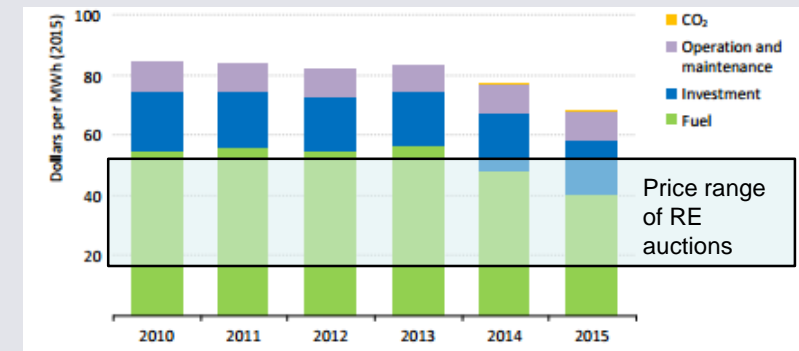
Select results of competitive auctions and power purchase agreements 2016–2018 in €/MWh

Figure 35



Own illustration based on BMWi, BNetzA, etc.; PPA or lowest/ average, volume weighted awarded bid values (Europa)

Composition of wholesale electricity costs in Mexico



IEA Mexico Energy Outlook 2017

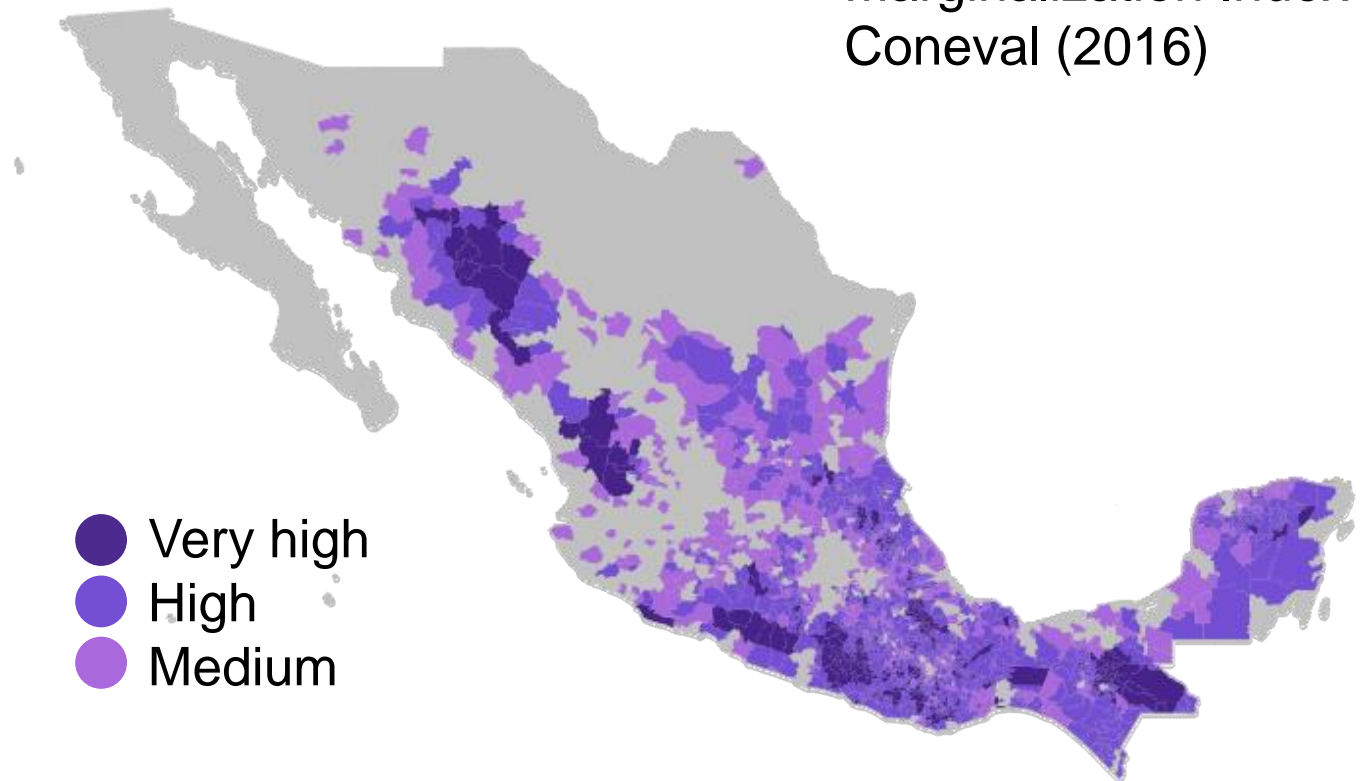
ELECTRIC POWER **S&P Global**
Platts
Mexico's growing renewable
generation could cut power
prices by 40%: study

Based on a study developed by Cespedes 2018

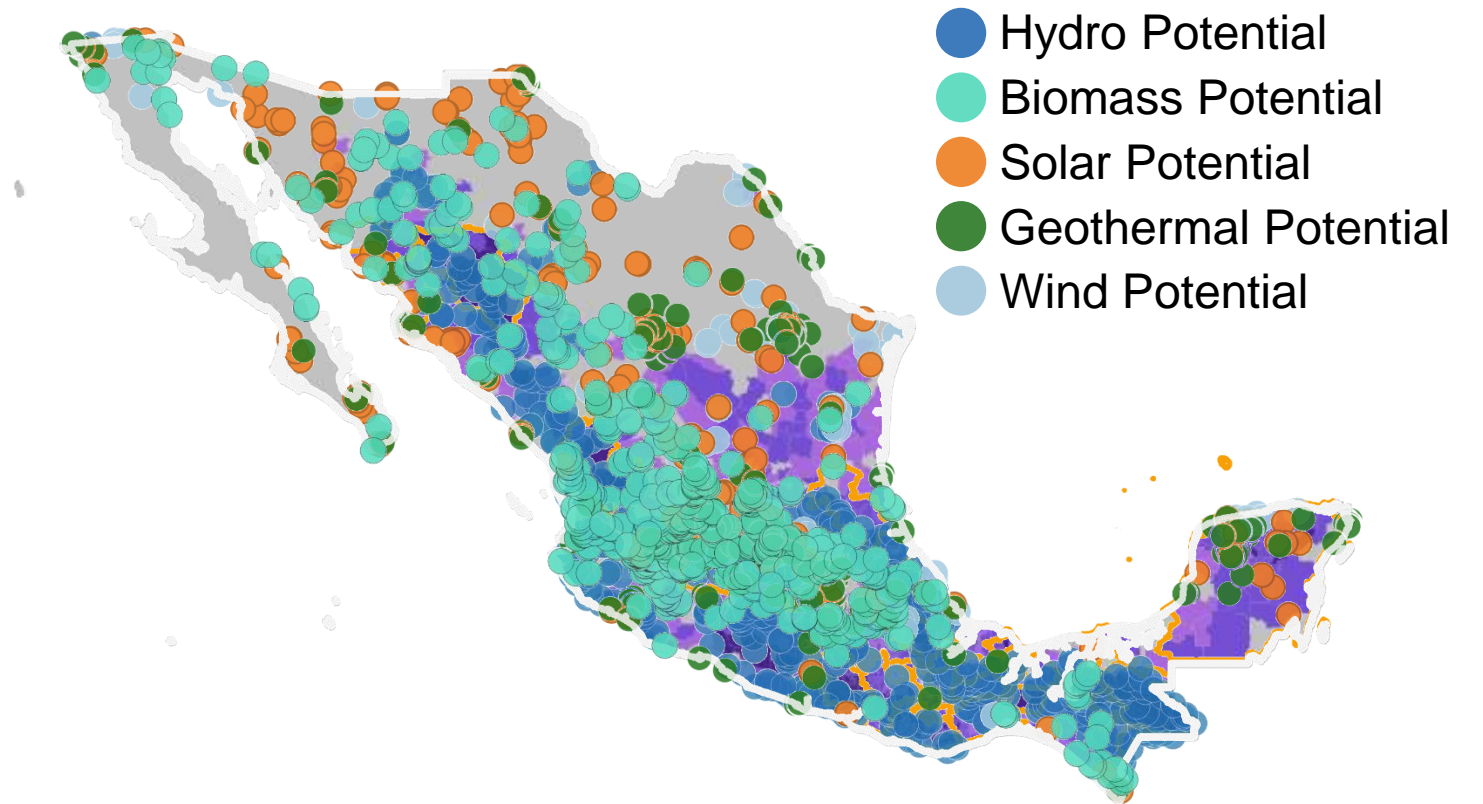
Renewable Energy Potential and SDG



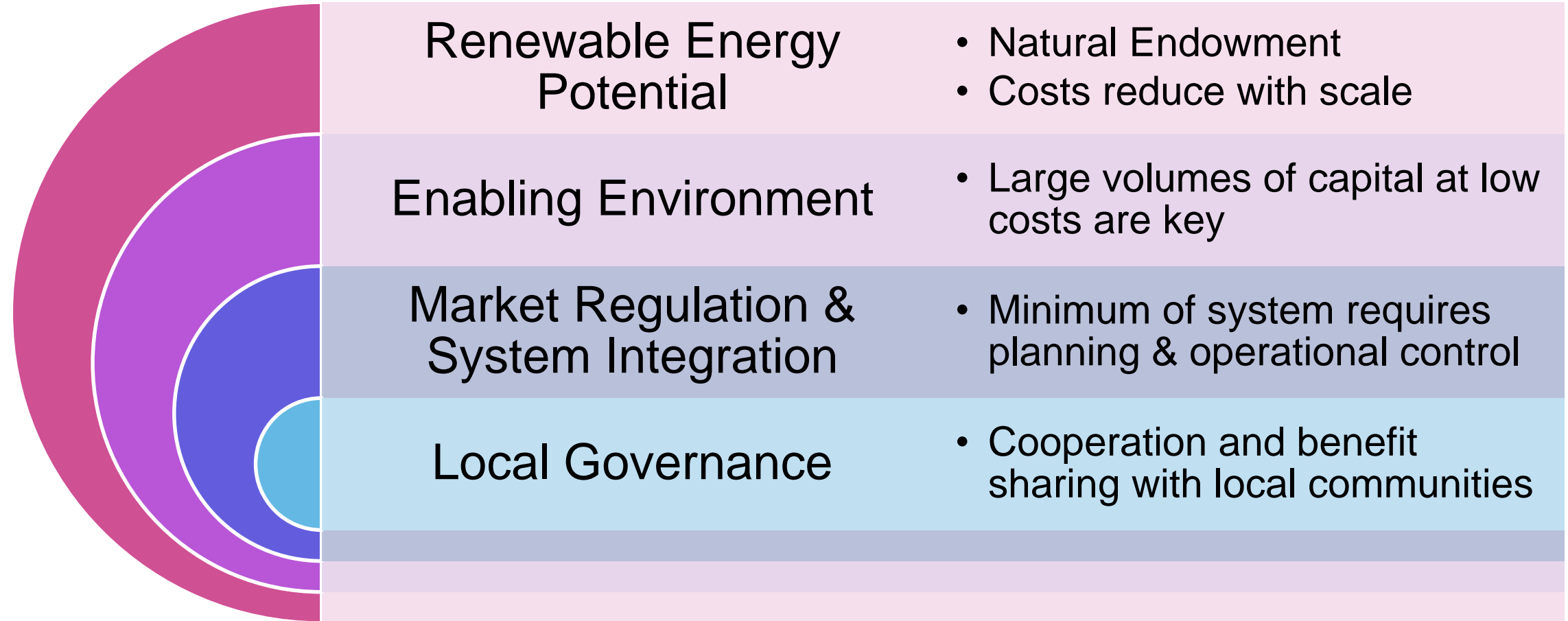
Marginalization Index
Coneval (2016)



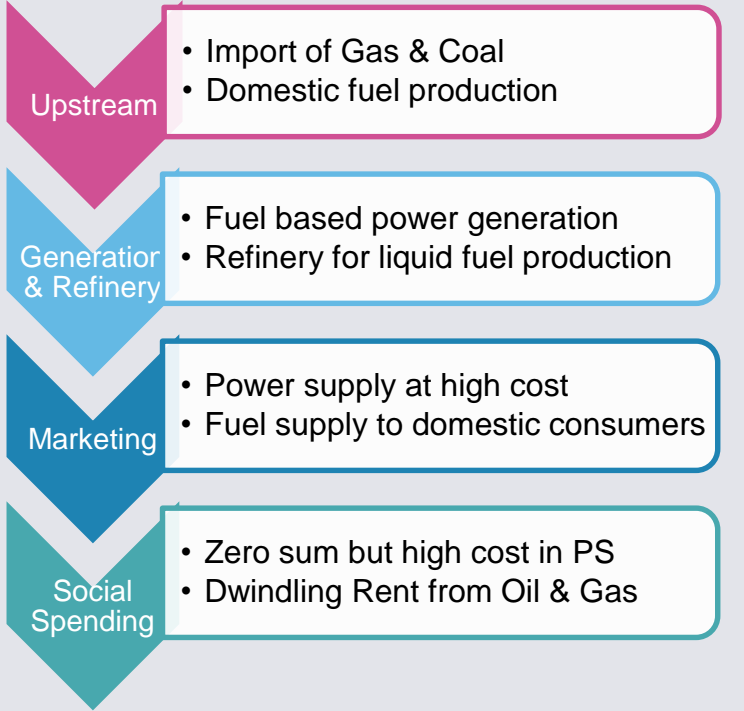
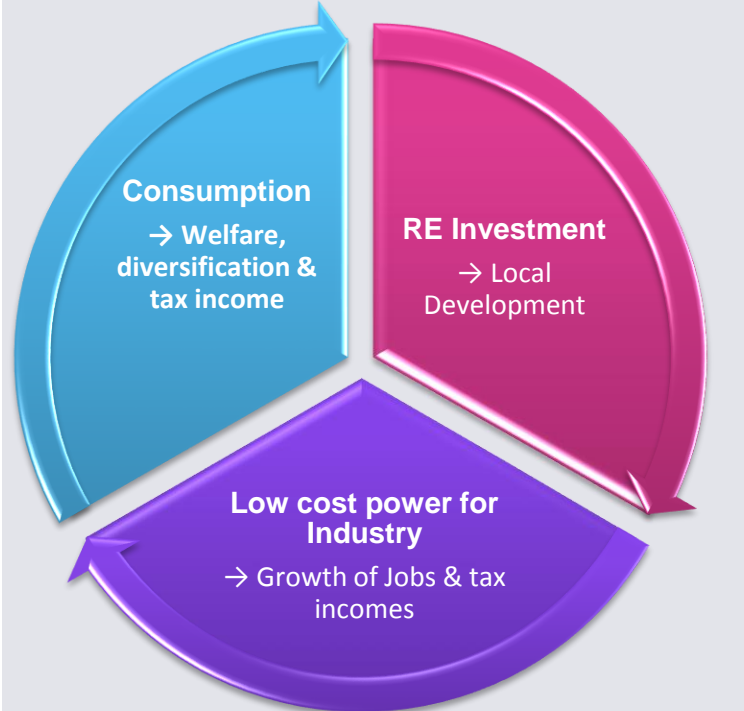
Renewable Energy Potential and SDG



Strategic Pillars for prosperity and social equity





Complementary Development scenarios for discussion and economic modelling

Development with Linear Logic	Development with Circular Logic	Hypothesis for discussion
 <p>Upstream</p> <ul style="list-style-type: none"> • Import of Gas & Coal • Domestic fuel production <p>Generator & Refinery</p> <ul style="list-style-type: none"> • Fuel based power generation • Refinery for liquid fuel production <p>Marketing</p> <ul style="list-style-type: none"> • Power supply at high cost • Fuel supply to domestic consumers <p>Social Spending</p> <ul style="list-style-type: none"> • Zero sum but high cost in PS • Dwindling Rent from Oil & Gas 	 <p>Consumption → Welfare, diversification & tax income</p> <p>RE Investment → Local Development</p> <p>Low cost power for Industry → Growth of Jobs & tax incomes</p>	<ul style="list-style-type: none"> • Reducing energy costs spurs economic growth • Renewable energy investments have rapid maturity & economic benefits in short & long term • Shift to renewable model will limit fossil fuel imports, spur regional development & diversify the economy. • Diversification will limit risks of investing in stranded assets
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Thank you for your attention!

Questions or Comments? Feel free to contact me:
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