Trends & assumptions for a socially equitable energy transition in Mexico

Concepts for discussion

Philipp Hauser
BERLIN, APRIL 8, 2019
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
Megatrend #1: Decarbonisation
As climate change accelerates, societal pressure to act increases

- 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

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.

IEA (2016), World Bank (2017a) and World Bank (2017b)
Megatrend #3: Decrease in costs for clean energy solutions
Wind, Solar, Batteries, Efficiency technologies are now cheaper than conventional and fossil technologies

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

→ 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

Renewables feature high fixed costs compared to conventional technologies, with the exception of nuclear

→ 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.
Megatrend #6: Electrification
The power, transport, industry & heat sectors are converge

- 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Oman</td>
<td>Oman 2020: Visions for Oman’s Economy</td>
</tr>
<tr>
<td>2008</td>
<td>Bahrain</td>
<td>Economic Vision 2030</td>
</tr>
<tr>
<td>2008</td>
<td>Qatar</td>
<td>Qatar National Vision 2030</td>
</tr>
<tr>
<td>2009</td>
<td>Kuwait</td>
<td>State Vision Kuwait 2035</td>
</tr>
<tr>
<td>2010</td>
<td>UAE</td>
<td>Vision 2021</td>
</tr>
<tr>
<td>2016</td>
<td>Saudi Arabia</td>
<td>Saudi Vision 2030</td>
</tr>
<tr>
<td>2017</td>
<td>Kuwait</td>
<td>New Vision 2036</td>
</tr>
</tbody>
</table>

New productive arrangements emerge

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

IRENA 2019: A New World: The Geopolitics of the Energy Transformation

Clean Energy manufacturing value added (2014)
Mexico has demonstrated to have among the world’s most attractive renewable energy resources.
Renewable Energy Potential and SDG

Marginalization Index
Coneval (2016)

RE Data Explorer NREL 2019, Coneval 2016
Renewable Energy Potential and SDG

Hydro Potential
Biomass Potential
Solar Potential
Geothermal Potential
Wind Potential

RE Data Explorer NREL 2019, Coneval 2016
Strategic Pillars for prosperity and social equity

- Renewable Energy Potential
  - Natural Endowment
  - Costs reduce with scale

- Enabling Environment
  - Large volumes of capital at low costs are key

- Market Regulation & System Integration
  - Minimum of system requires planning & operational control

- Local Governance
  - Cooperation and benefit sharing with local communities
### Complementary Development scenarios for discussion and economic modelling

<table>
<thead>
<tr>
<th>Development with Linear Logic</th>
<th>Development with Circular Logic</th>
<th>Hypothesis for discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upstream</strong></td>
<td><strong>Consumption</strong></td>
<td>• Reducing energy costs spurs economic growth</td>
</tr>
<tr>
<td>• Import of Gas &amp; Coal</td>
<td>→ Welfare, diversification &amp; tax income</td>
<td>• Renewable energy investments have rapid maturity &amp; economic benefits in short &amp; long term</td>
</tr>
<tr>
<td>• Domestic fuel production</td>
<td></td>
<td>• Shift to renewable model will limit fossil fuel imports, spur regional development &amp; diversify the economy.</td>
</tr>
<tr>
<td><strong>Generation &amp; Refinery</strong></td>
<td><strong>Low cost power for Industry</strong></td>
<td>• Diversification will limit risks of investing in stranded assets</td>
</tr>
<tr>
<td>• Fuel based power generation</td>
<td>→ Growth of Jobs &amp; tax incomes</td>
<td></td>
</tr>
<tr>
<td>• Refinery for liquid fuel production</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marketing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power supply at high cost</td>
<td><strong>RE Investment</strong></td>
<td></td>
</tr>
<tr>
<td>• Fuel supply to domestic consumers</td>
<td>→ Local Development</td>
<td></td>
</tr>
<tr>
<td><strong>Social Spending</strong></td>
<td><strong>Social Spending</strong></td>
<td></td>
</tr>
<tr>
<td>• Zero sum but high cost in PS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dwindling Rent from Oil &amp; Gas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Agora Energiewende

Agora Energiewende

Agora Energiewende
Thank you for your attention!

Questions or Comments? Feel free to contact me:
philipp.hauser@agora-energiewende.de

Agora Energiewende is a joint initiative of the Mercator Foundation and the European Climate Foundation.