Pathways to Deep Decarbonisation in Mexico

APERC Annual Conference 2017

Grand Prince Hotel Shin-Takanawa

Tokyo, 16-17 May 2017

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Low-emission pathways must show (indicative) sectorial targets & timelines for 1.5-2°C, starting now

- Low-emission pathways must contain timelines with 5y milestones all the way from today to 2050 or beyond

  - Timelines not only of emissions (lagging indicator) but of drivers such as regulation, investment, consumption patterns (leading indicators)

  - Timelines must show how planned changes drive evolution of real operating fleet standards etc. Steep curves suspect/expensive

  - Targets must respond to 1.5-2°C ambition, so clearly < 2 tCO2e/cap by 2050 on trajectory to near-zero net emissions. **TRANSFORMATIONAL**

  - Indicative sectorial breakdowns are required to link on-going policy discussions ("*So you want less ambition in this sector? That´s fine but, in order be consistent with the target, which other sectors should increase it?*")

- Credible plans also need political levers to place environmental & energy concerns at core of financial, economic and infrastructure planning

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Deep Decarbonisation Pathways Project
General Methodology

- **DOWNWARD ATTRACTOR** = 1.6 tCO_2/person by 2050

- **BACK-CAST** extrapolation from 2050 to present state

- **PILLARS OF DECARBONISATION** of energy systems
  1. High energy efficiency
  2. Electrification of end uses of energy
  3. Ultra low-C electricity (emission factor $\sim$30 gCO_2/kWh)

- Information process prior modelling
  - Literature review: diagnosis, future official trends & potentials
  - Expert opinion: niche technologies and complex drivers
  - New indicators: gaps in information
 - Future vision: gaps in structured planning

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Deep Decarbonisation Pathways
Mexico Results 0. Emissions consistent with 2°C

Reduced mitigation contribution from some sectors or branches (industry & freight transport) is due only to *present lack* of sectorial characterisation and definition of deep decarbonisation potential

Energy-related CO_2 emissions. DDPP scenario
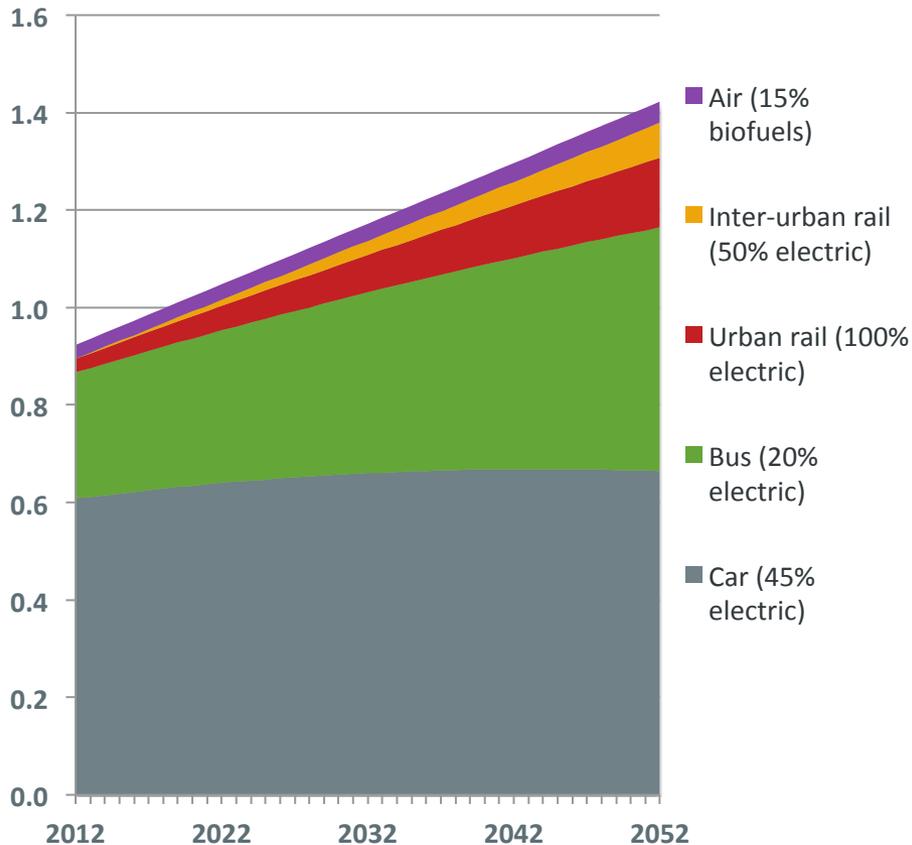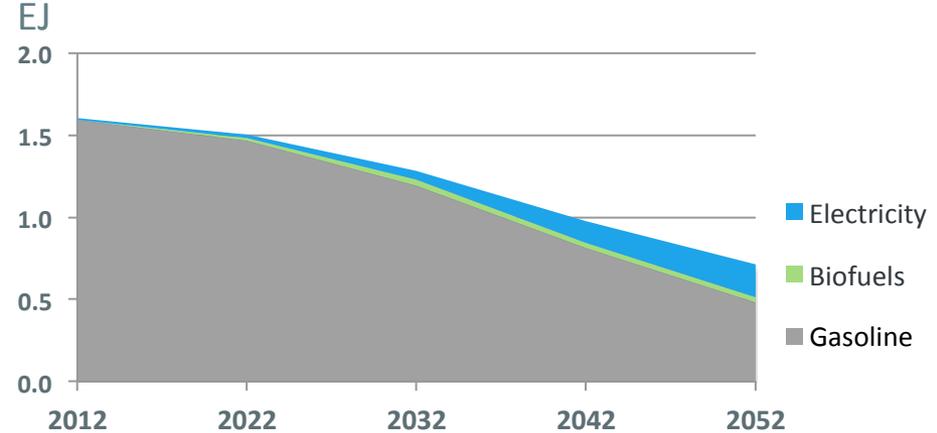$MtCO_2e$
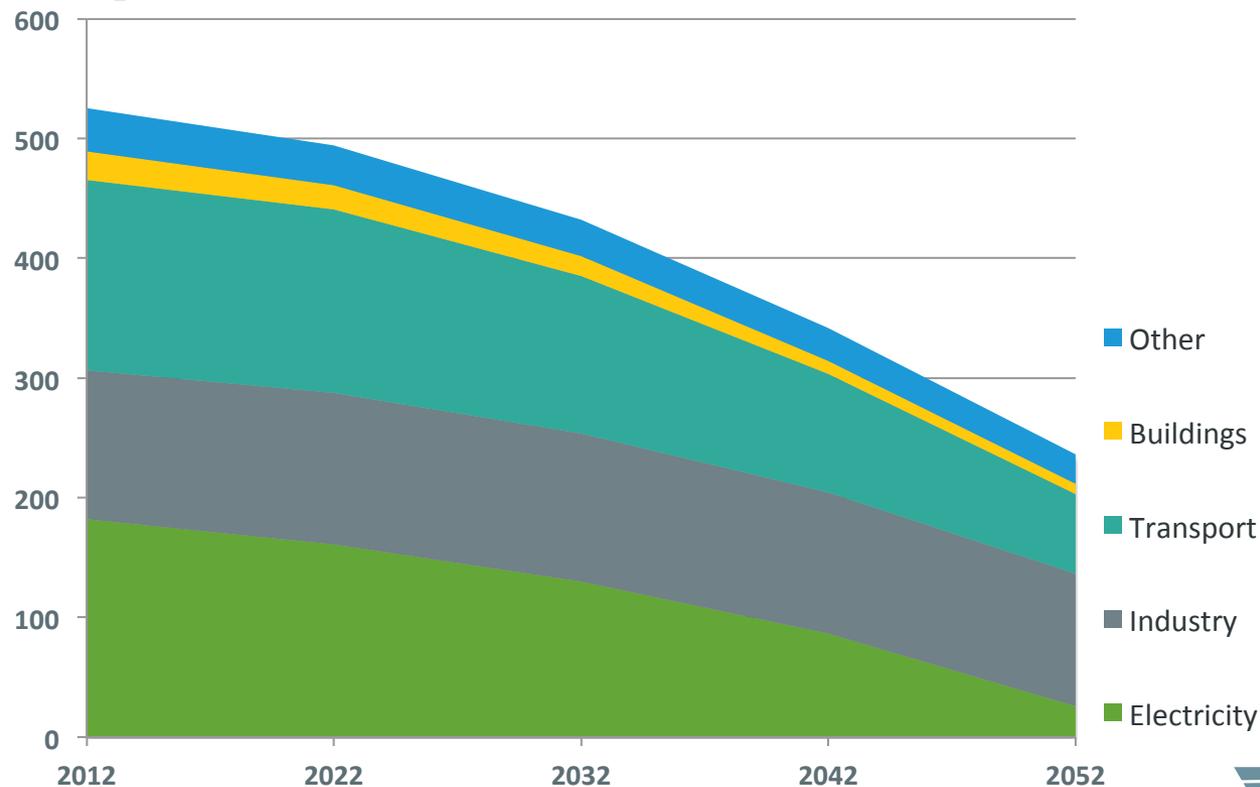
Deep Decarbonisation Pathways
Mexico Results 1. Energy efficiency

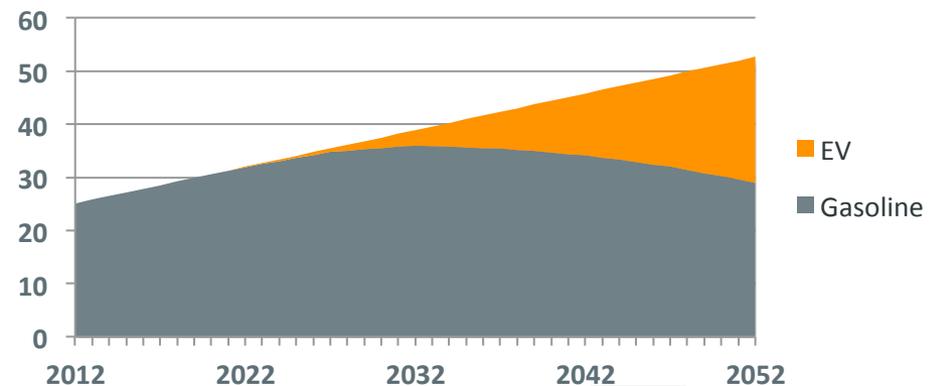## Sectorial interventions have implications in energy, emissions and infrastructure roll-out

Passenger transport mode
Trillion passenger-km

- Air (15% biofuels)
- Inter-urban rail (50% electric)
- Urban rail (100% electric)
- Bus (20% electric)
- Car (45% electric)

Passenger transport energy demand
EJ

- Electricity
- Biofuels
- Gasoline

LDV fleet composition
Million vehicles
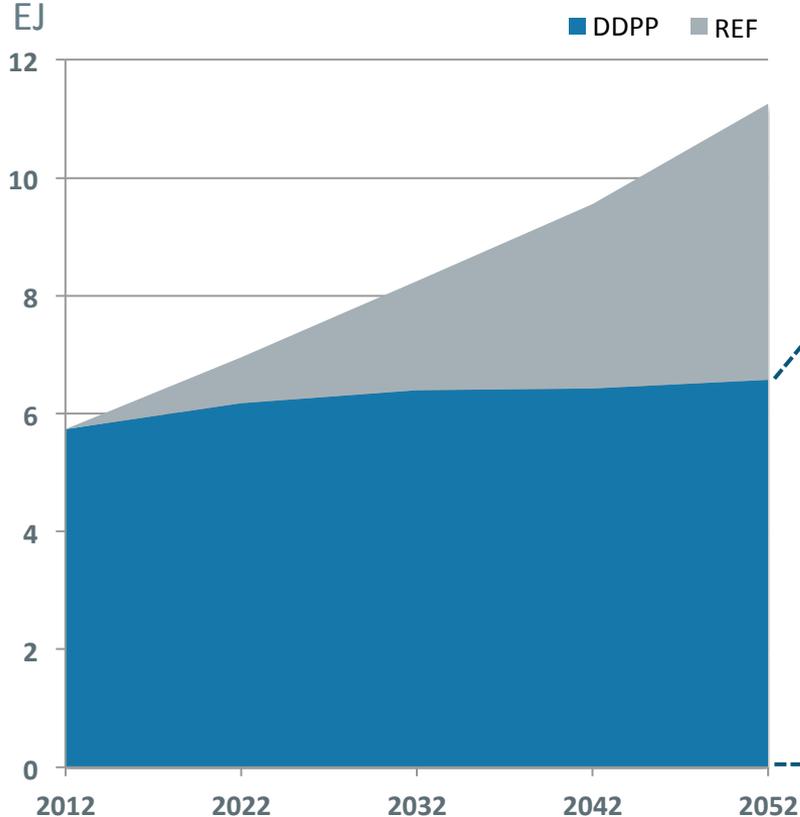

- EV
- Gasoline

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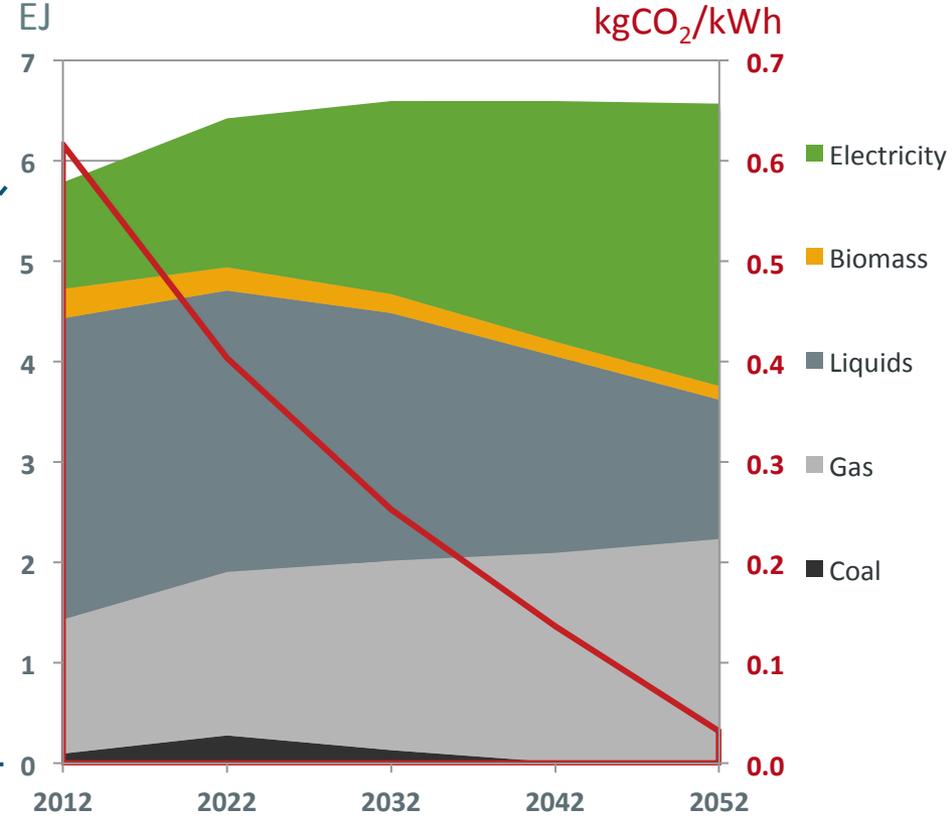
Deep Decarbonisation Pathways
Mexico Results 2. Electrification of end uses

Electrification of end uses of energy should be done on the basis of coincident energy efficiency increase and power decarbonisation

Final energy demand per scenario
EJ

DDPP REF

Final energy supply. DDPP scenario
EJ   kgCO$_2$/kWh

Electricity
Biomass
Liquids
Gas
Coal

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Deep Decarbonisation Pathways
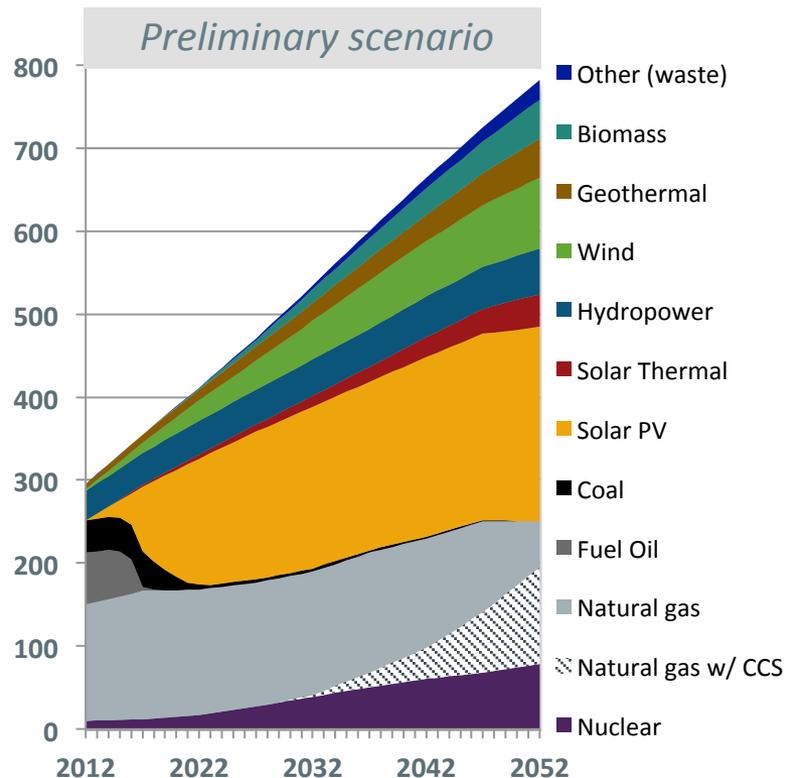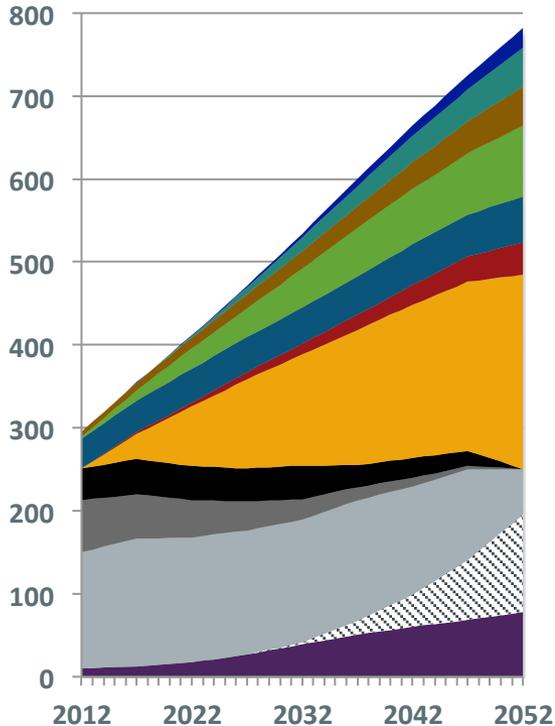## **Mexico Results** 3. Electricity deep decarbonisation

Higher resolution in power sector to highlight short-term official plans vs. alternative focusing in both, long-term **decarbonisation** and **energy security**

Reference
High NGCC + late nuke

DDPP updated
CCS only after 2030

MILES Energy Security
Short-term high renew

Electricity generation
TWh

Preliminary scenario

Legend:
- Other (waste)
- Biomass
- Geothermal
- Wind
- Hydropower
- Solar Thermal
- Solar PV
- Coal
- Fuel Oil
- Natural gas
- Natural gas w/ CCS
- Nuclear

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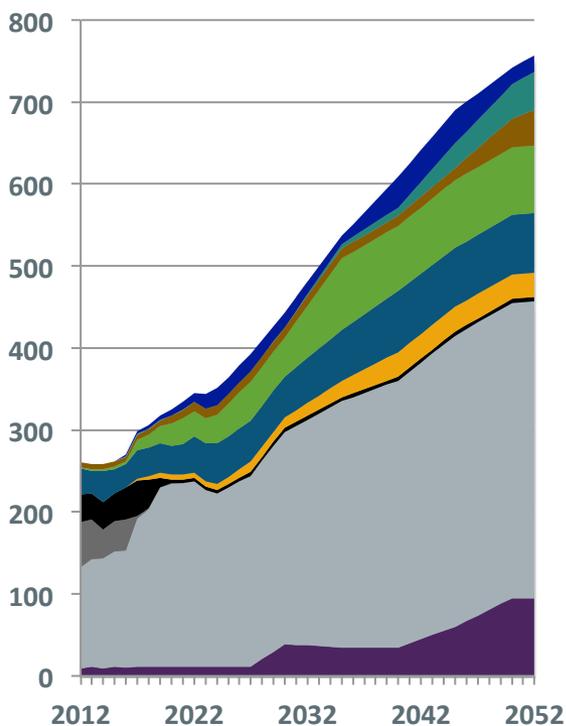
Deep Decarbonisation Pathways / MILES* Project
Current work in Mexico

- Detailed modelling of the evolution of power infrastructure
  - Grid integration & balancing of early high-SPV to avoid NGCC build-up
  - Infrastructure cost of alternative pathways and sensitivity to NG prices

- Deep analysis of transportation's main dynamics to strengthen DDPP tools (*dashboard*) to structure dialogue between policy makers and transport and energy experts

- Dynamic modelling of structural transformations
  - Rigorous analysis of changing dynamics and system evolution in Mexico
  - Interactions of supply & demand flexibilities: grid architecture evolution, large balancing areas, demand management, novel business models

- Macroeconomic modelling to assess impacts of pathways in sectorial GDP, job creation, response to price signals, etc.

* Modelling and Informing Low-Emission Strategies (MILES), a research continuation of DDPP and a EU initiative implemented by IDDRI-France, seeks to develop the capacities to conduct, in all participating countries, analyses at the degree of detail that is necessary to plan for investments and policies, and understand the socio-economic implications of policy choices.

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Deep Decarbonisation Pathways
Mexico Challenges & Opportunities

| Challenge faced	Solution / opportunity
• Detailed data missing	• Develop new indicators
• No official support to other message than NDC	• Found independent research think-tank (Tempus Analítica A.C.)
• Very limited resources as independent think-tank	• Generate high-value research-network structure (EE, UN-SDSN, IDDRI, Gov.)
• More data missing for detailed modelling	• Go to Japan & meet with experts – expand network

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Key messages about value & practicality

- Incremental changes to energy systems will not decouple them from CO_2 in time to meet Paris targets –> **a transformative plan is needed**

- A DDPP style study provides a quick, yet useful exploration of **technology scenarios** to achieve emissions consistent with 2°C, and the **inter-sectorial dependencies** involved, by combining detailed country information and expert knowledge

- Even at early stages, results include **indicators of strategic importance** to countries and these scenarios show what potentially-disruptive high-value future technologies and markets could look like; this is particularly relevant to policy-making

- Formulation of deep decarbonisation pathways towards 2050 can help identify not only a **low-carbon development route map** consistent with mitigation goals, but also the **research agenda** needed for sustained involvement of private sector, academia and organisations of society

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For example, current discussion in Mexico around NG

Even at an aggregate stage, this kind of analysis helps highlight relevant high-level conclusions, such as the potential burden of future stranded assets under different scenarios

NGCC installed capacity per scenario
GW

Legend: OFFICIAL, MILES, NGCC-CCS
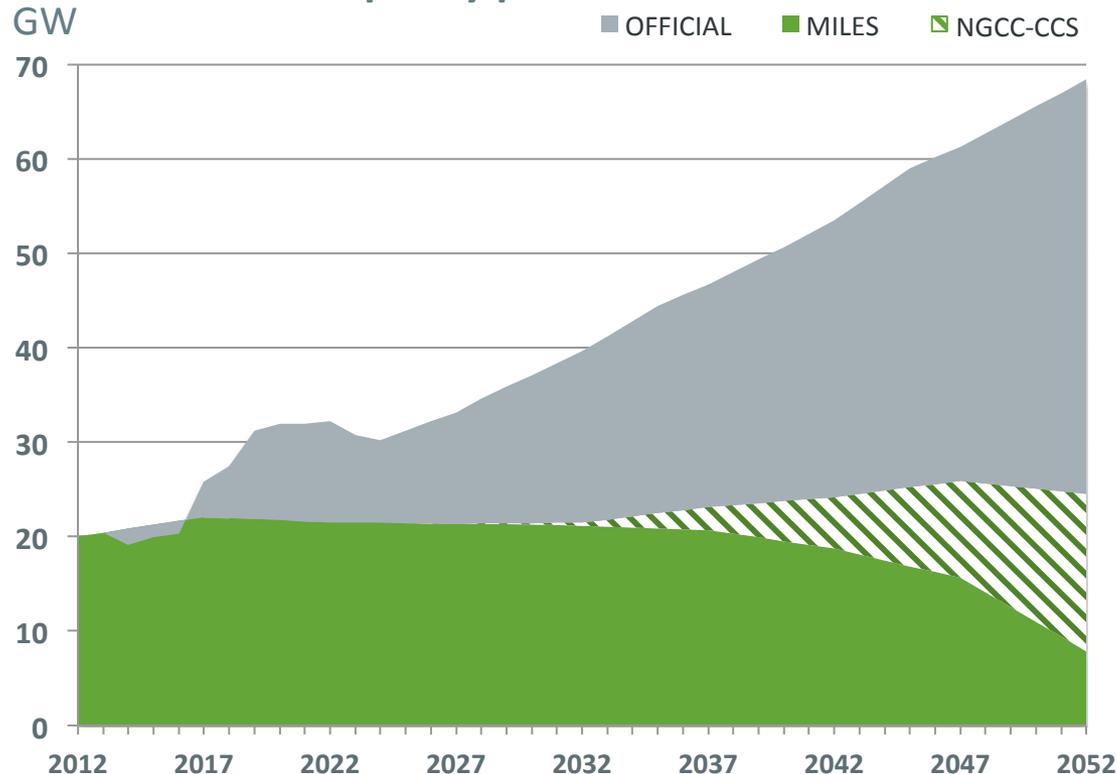
Potential negative impacts

- High (possibly lost) infrastructure costs

- Technologic and emissions lock-in beyond mid-century (+40 years)

- Competing divestment from renewables and grid upgrade to fossils

- Societal lock-in in past *instead* future of technologies

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Thank you

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About Tempus Analítica A.C.

- New climate, energy and innovation think-tank, based in Mexico with links to US, France, and Latin America (AILAC)

- Established to develop and communicate tools, analyses and strategies for the transition to a sustainable economy

- Technical professionals with public and private sector experience in climate policy, energy system planning, corporate strategy and technological innovation

- Staff involved in Mexico´s climate and energy policies and documents since 2012 General Climate Change Law

- Authors of DDPP Mexico

- More information at www.tempus-analitica.org

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