GECF

Accelerating energy transition

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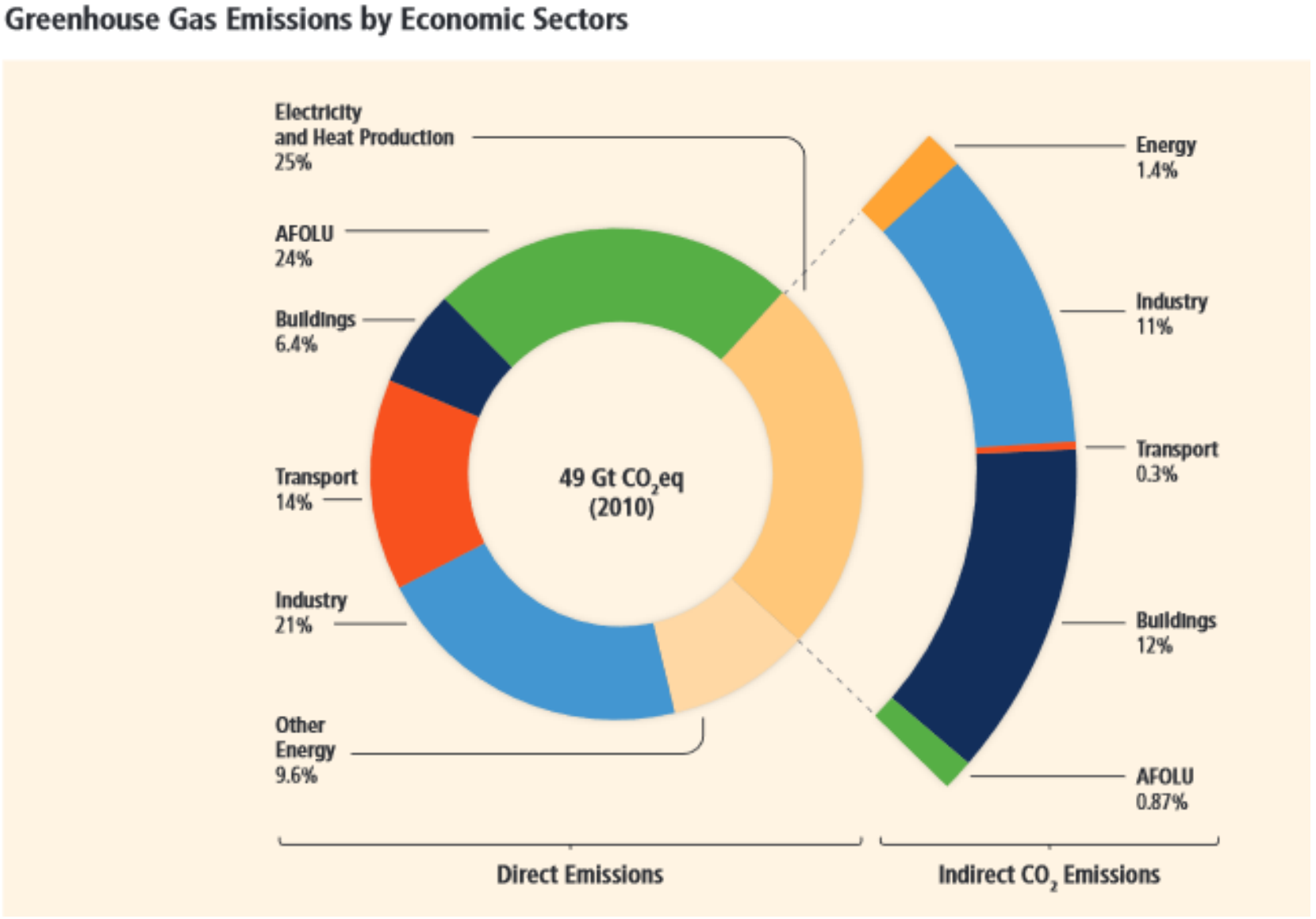
*disclaimer: the presentation reflects personal opinion that might be different from GECF of GECF Secretariat position

How the ideal energy system should look?

- *Energy technologies contest*:
  - renewables + smart grids + batteries (or other carrier like P2G),
  - OR (later) a hydrogen economy,
  - and it used to be all-nuclear future 60 years ago
- *Non-energy sectors:*
  - agriculture (25% methane emissions) – technological development in agriculture is key to zero emissions (cell printer?)
  - zero-energy buildings
  - (almost) zero-emission vehicles
- *Negative emission tech*: carbon use (e.g. in concrete production – real OGCI case)

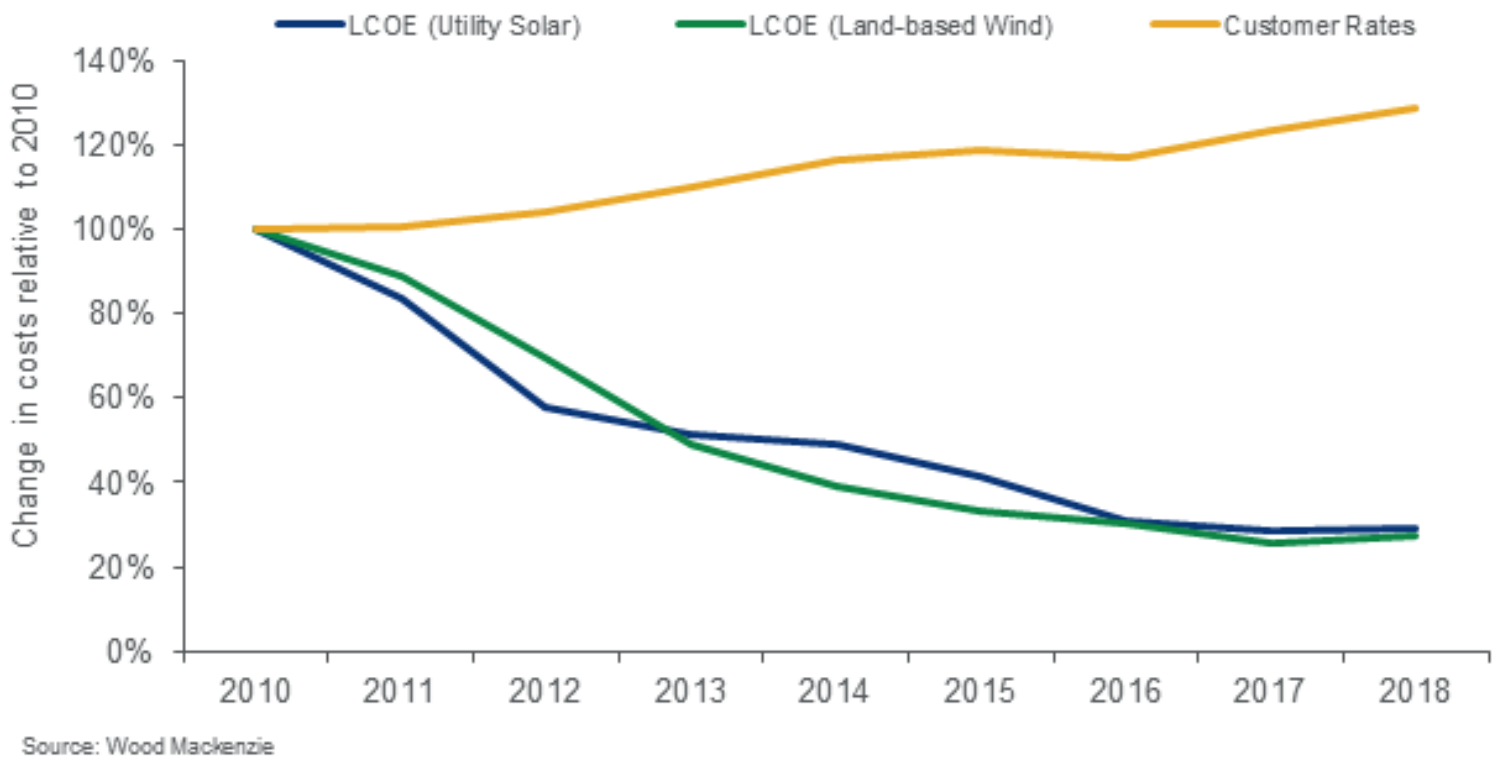
The energy transition: uphill battle against emissions



The case of the US: cost of RE100

- Approx. 1060 GW total capacity, including 130 GW of wind and solar
  - considering lower utilization, about 1600 GW new solar capacity needed, costing $1.5 trillion
  - plus 900 GW (~16 TWh) of storage to balance intermittency at $4.0 trillion
  - plus doubling of high voltage transmission (220 000 miles) at $700 bn
- That is before even considering subsequently stranded assets

LCOE is NOT the price of transition…the customer rates are



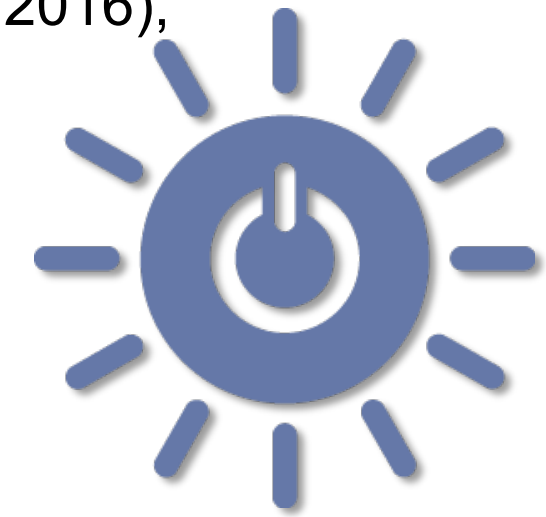
Source: GECF Secretariat based on data from the GECF GGM

Considering our options as of mid-2019

- *Energy technologies are not ready*:
  - grids are not ready for penetration of renewables
  - batteries are underdeveloped, even though costs are going down
  - hydrogen economy is a research concept with a few prototypes
  - global nuclear technology progress has stalled since Fukushima (exceptions)
- *Non-energy sectors are not ready:* agriculture (25% methane emissions) – technological development in agriculture is key but no ZE approach so far
- *Market-based approaches are decreasing emissions but lead nowhere near RE100*: carbon taxes/"cap-and-trade" mostly stop increasing emissions

The Priorities

- *SDG#7 "Ensure access to affordable, reliable, sustainable and modern energy for all"*
- *IEA World Energy Access (2017)* by 2040 – still far off as:
  - clean cooking facilities are unavailable to 1.9 bn people (3 bn in 2016), with **0.5 mn premature deaths per annum**
  - 0.7 bn will be without access to electricity
- Do ecology and clean air need to be prioritized before climate?
- Definitions of "affordable, reliable, sustainable and modern " – does SDG#7 relate to decarbonisation and/or is unattainable?
- *Clean energy and climate research*: not enough tech investment (no commercial CCUS, no zero-emission transport, more funds like OGCI needed)
- *Full decarbonisation:* one-step full decarbonization is not feasible, bridges are necessary



Gas Exporting Countries Forum (GECF)

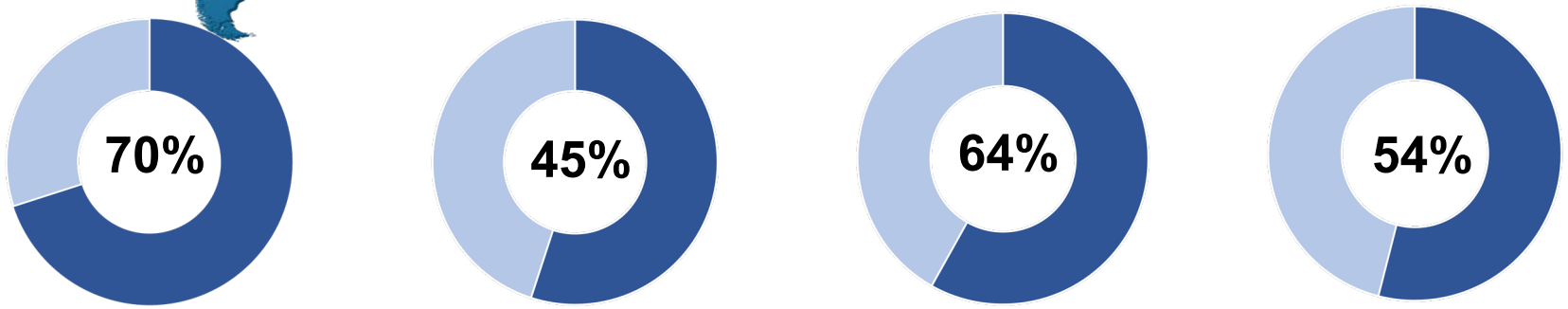
GECF

MEMBERS

- Algeria
- Bolivia
- Egypt
- Equatorial Guinea
- Iran
- Libya
- Nigeria
- Qatar
- Russia
- Trinidad and Tobago
- United Arab Emirates
- Venezuela

OBSERVERS

- Angola
- Azerbaijan
- Iraq
- Kazakhstan
- Norway
- Oman
- Peru



Gas Reserves (144 tcm)

Gas Production (1,650 bcm)

Pipeline Gas Exports (447 bcm)

LNG Exports (156 Mt)

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