

Kenya NDC and renewables: TIAM-ECN model results

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Outline

- Goals
- Kenya: background & model assumptions
 - Population and GDP projections
- Some results
 - Emission trajectories
 - Energy use by sector & fuel
 - Power generation mix
- Wrap up & sneak peak



Goals

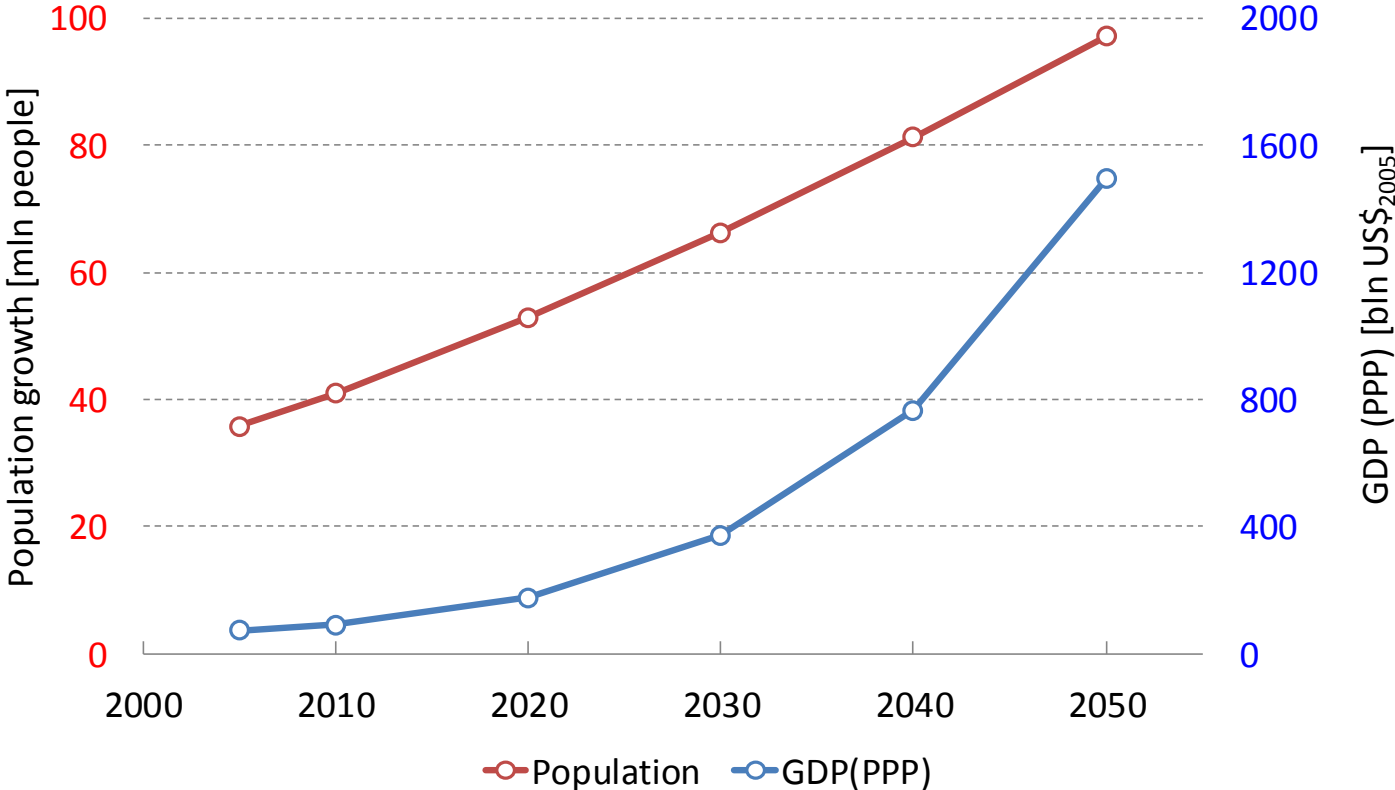
- Kenya NDC: 30% GHG reduction in 2030 wrt business as usual projection;
- Analyze the Kenyan NDC from an energy-system perspective;
- Assess the implications of NDC emissions projection until 2030;
- Explore the necessity of large-scale RE deployment wrt Kenya's GHG abatement ambitions (NDC);
- Inspect long-term climate policy scenarios until 2050;

Kenya: background info

- Area: 580.000 km²
- Population: 50 mln
 - 75% in rural areas
 - 30% grid connected
 - 70% cooking on traditional biomass
- GDP (PPP): 130 bln\$
- FEC: 0.6 EJ
 - (traditional) biomass
 - oil
 - electricity
- Good wind, solar and geothermal potentials



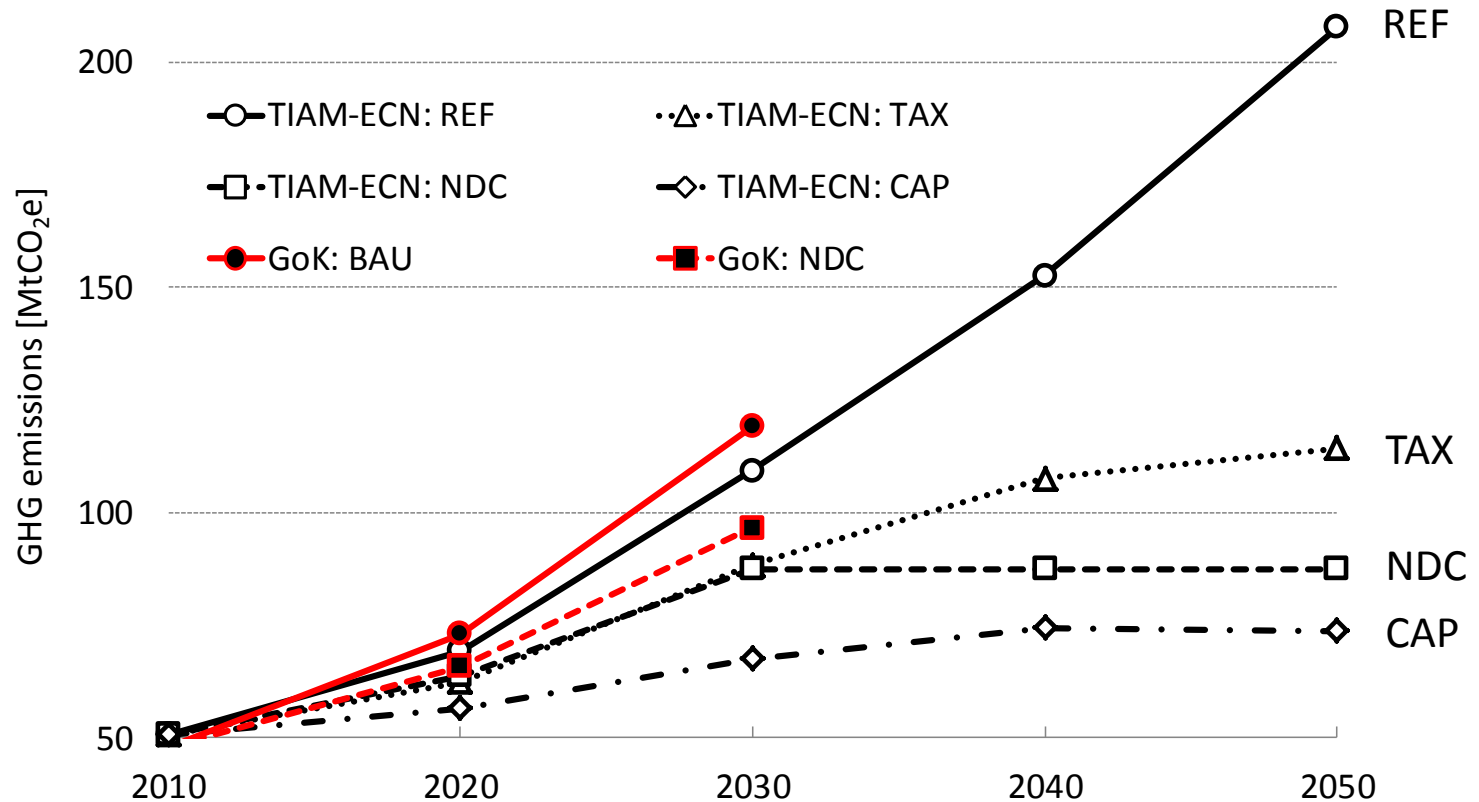
Model assumptions: Population & GDP projections



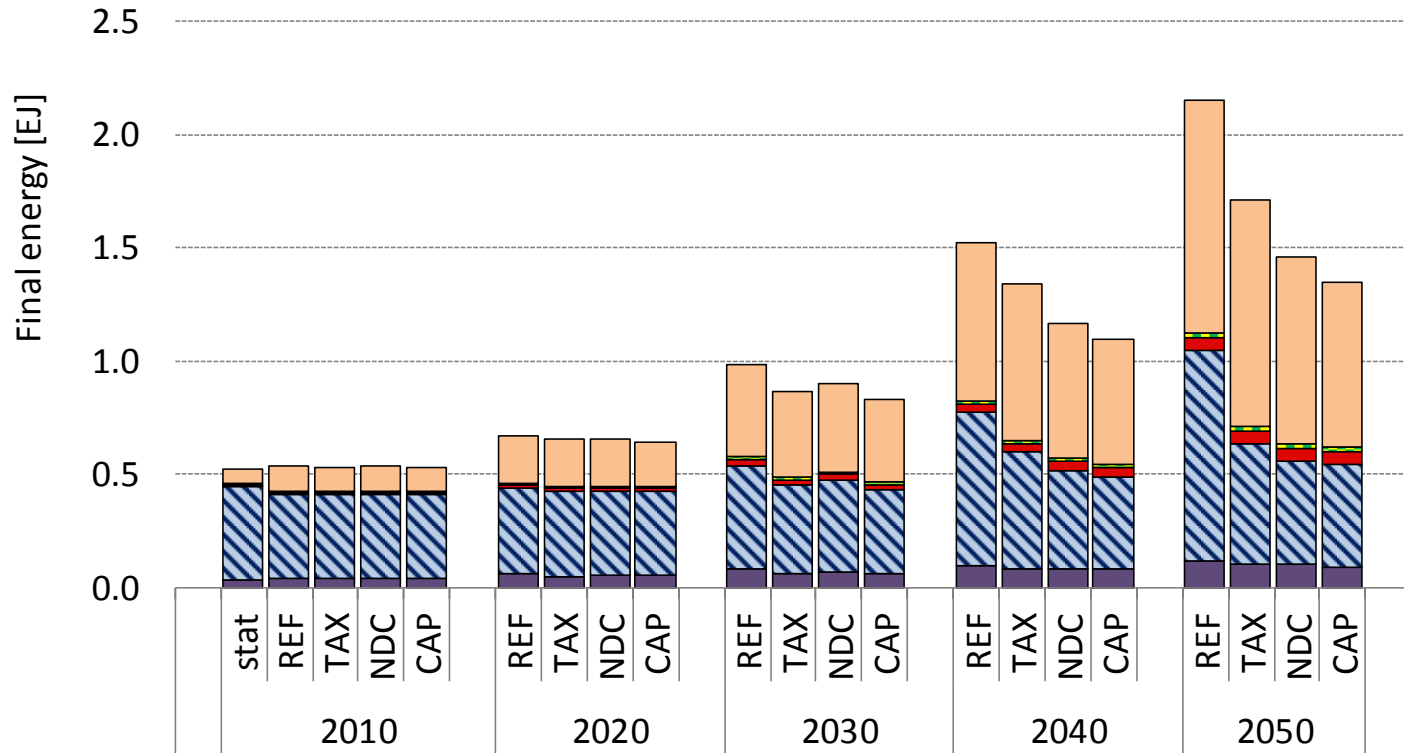
Scenarios

- **Reference (REF):** No GHG emission reduction policies after 2010;
- **High carbon price (TAX):** Global carbon market with exogenous CO₂ prices;
- **Kenya NDC (NDC):** 20% emission reduction in Kenya in 2030 (in comparison to REF scenario, LULUCF excluded). Maximum allowed emissions constant until 2050;
- **Carbon cap (CAP):** Global cap-and-trade system to reduce global GHG emissions in 2050 by 30% in comparison to 2010; endogenous CO₂ prices.

Emission Trajectories: All Scenarios

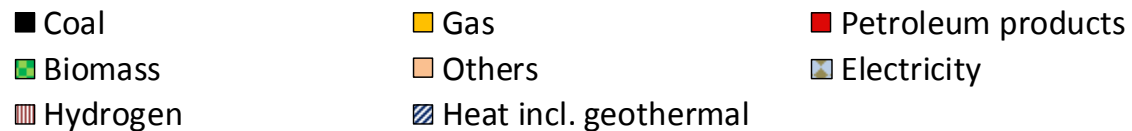
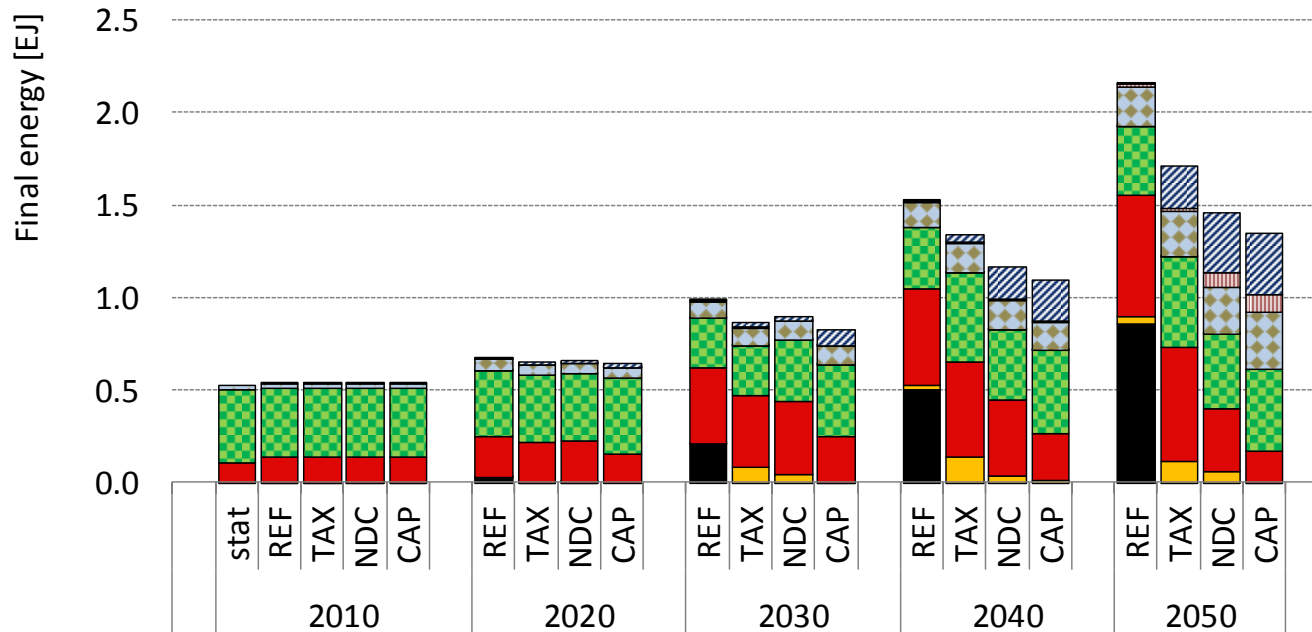


Final Energy by Sector [EJ]



Industry
 Residential
 Commercial
 Agriculture
 Transportation

Final Energy by Fuel [EJ]



Key messages

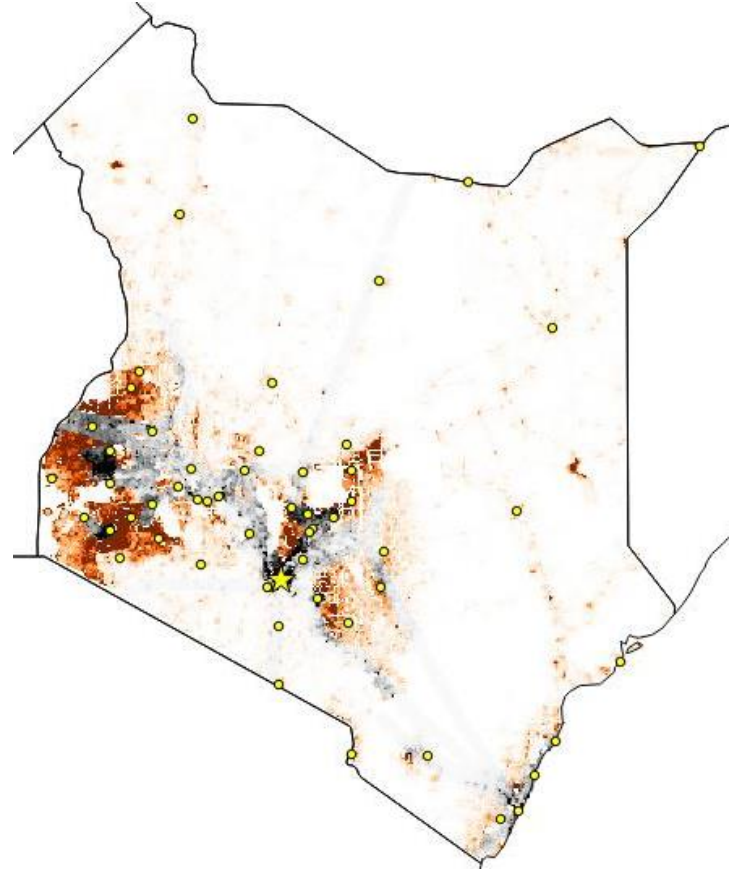
- Kenya's NDC target is achievable with a timely deployment of RE;
- The power sector can expand with low-carbon technologies even without GHG abatement targets.
- Stringent climate policies needed in residential and transport sectors;
- Additional annual system costs in 2050 between 0.5% and 2% of GDP in our scenarios;

Policy implications & open questions

- Need for clarity on contribution of LULUCF to GHG emissions and abatement;
- Large use of biofuels: land-use competition between energy and agriculture?
- Large changes in energy mix: what impacts can we expect on society?
 - Ongoing TRANSrisk case study on public perception
- Electrification of remote areas
 - Ongoing efforts to upgrade TIAM-ECN

Sneak peak

- Improve representation of residential electricity demand (rural vs urban)
- GIS analysis of potentials for grid expansion vs stand-alone / minigrids
- Improve TIAM-ECN portfolio of stand-alone / minigrid techs
- ... to be continued...

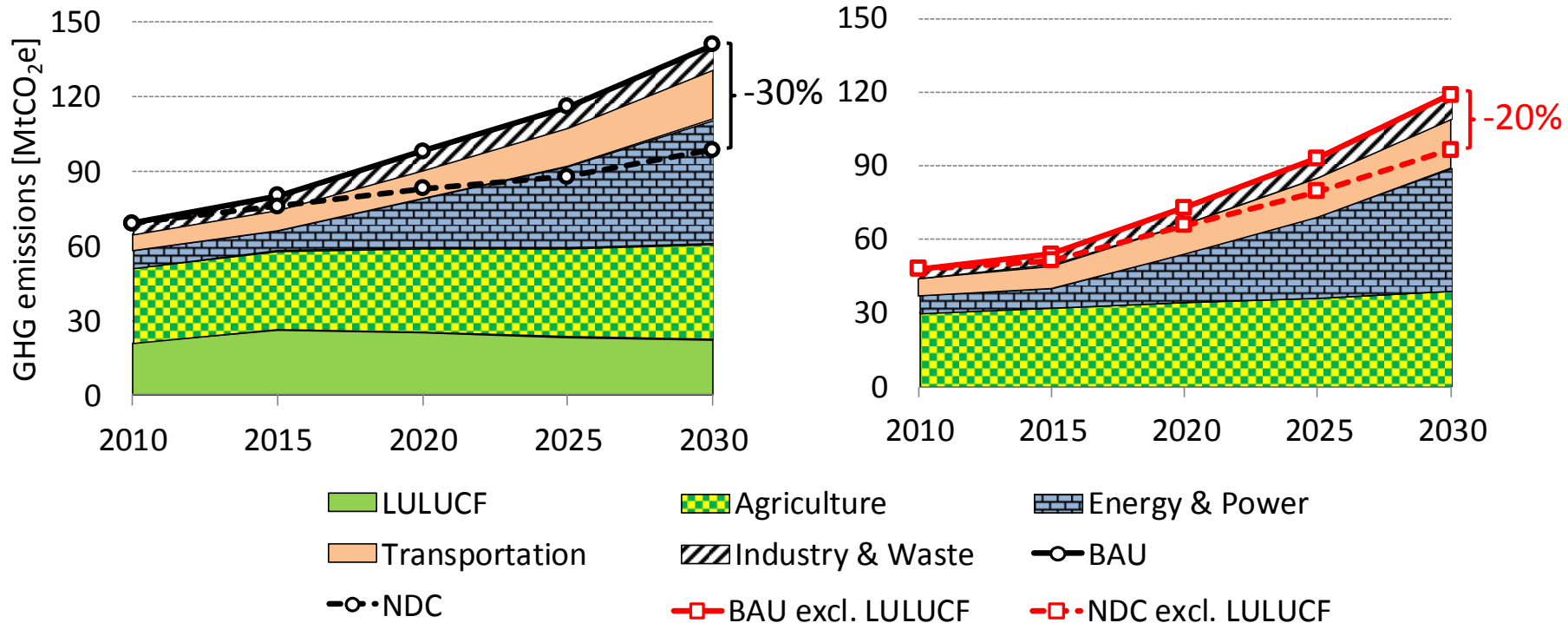


Thank you!

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Backup slides

Kenya's NDC

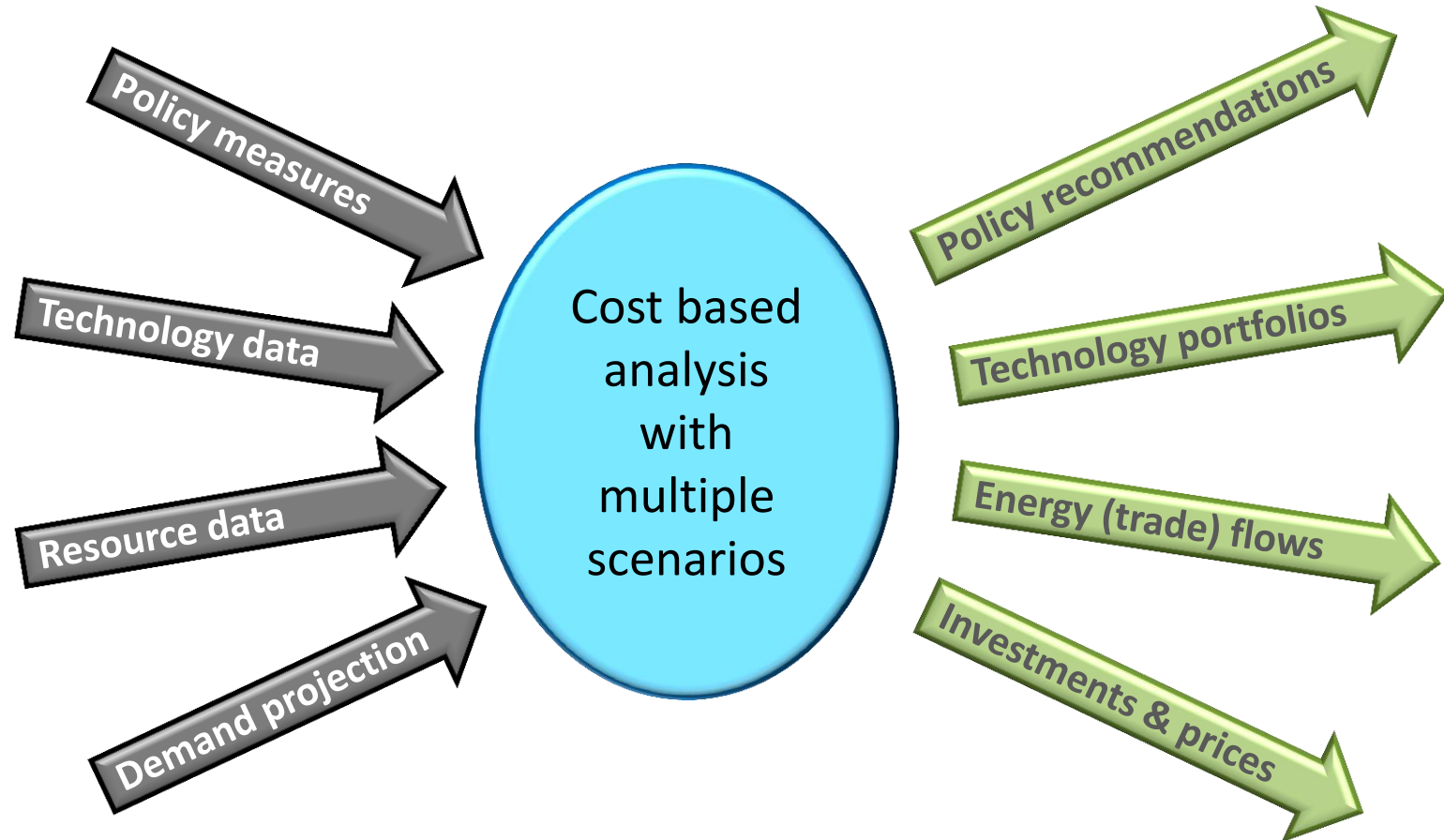


TIAM-ECN in a nutshell

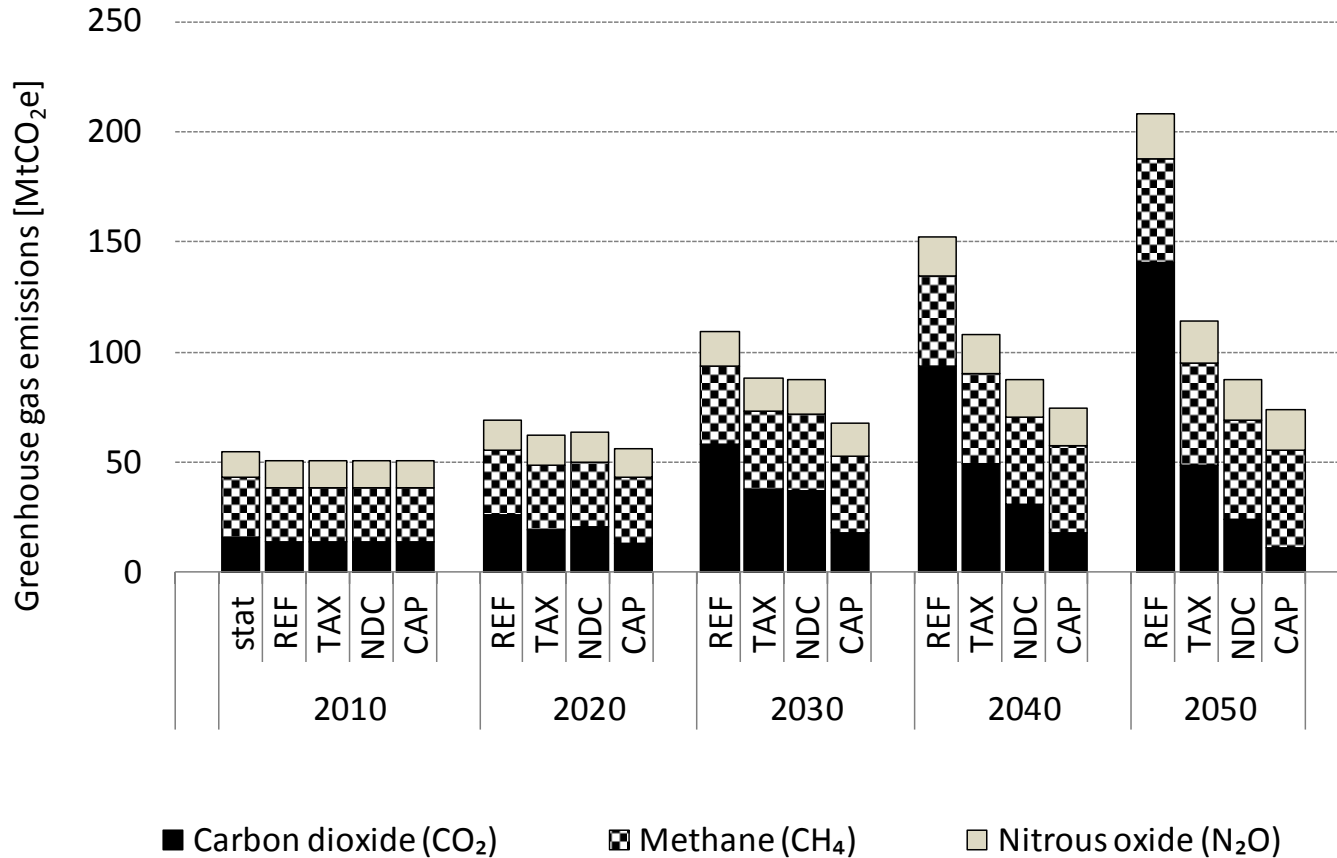
- TIMES Integrated Assessment Model
- Hundreds of technologies and energy-related processes
- Constrained cost optimization (minimizes system costs)
- World subdivided into 36 regions
- Bilateral commodities trade between regions
- (Global carbon market)

- → Capture global and regional trends, rather than specific local realities
- → Assess local policy measure in the context of global scenarios

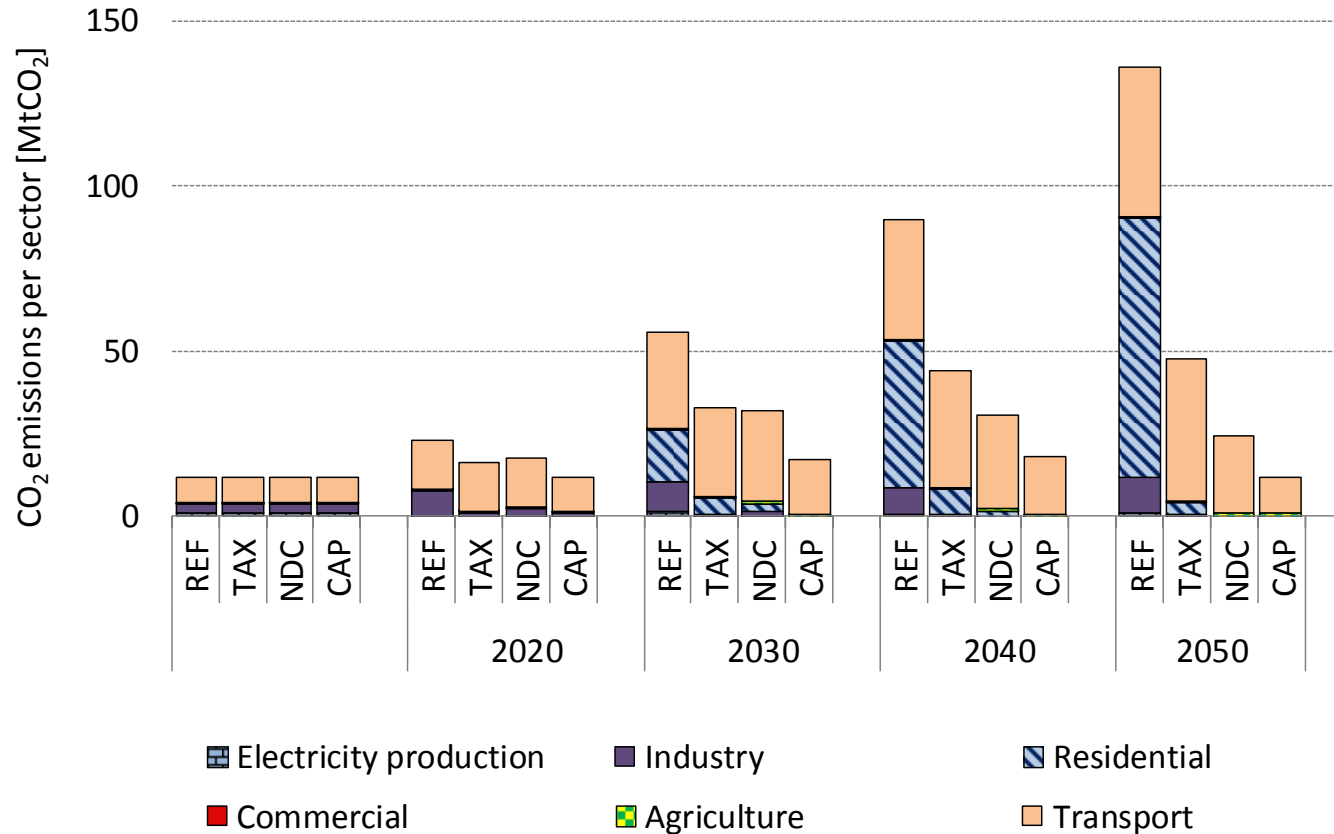
TIAM-ECN inputs and outputs



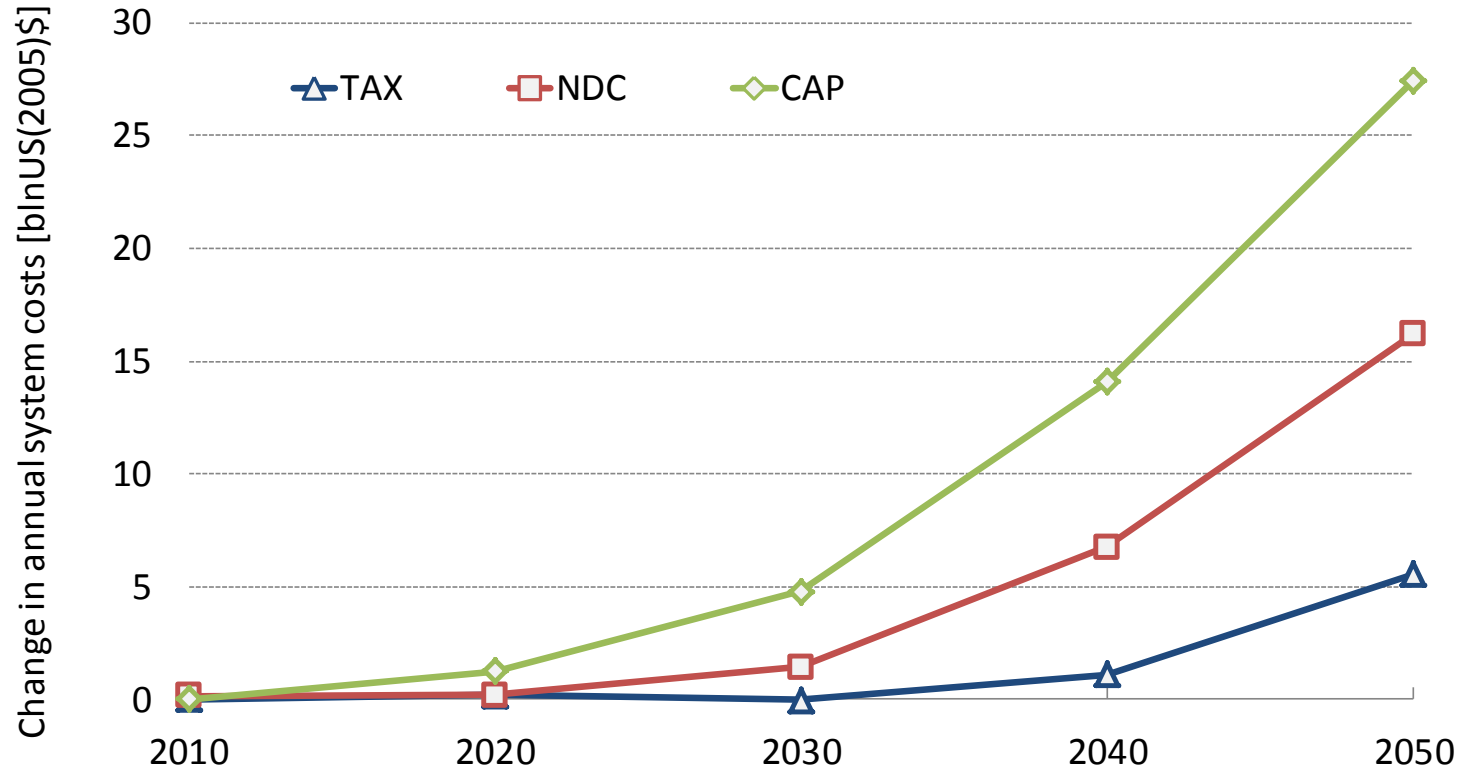
TIAM-ECN Results: GHG Emissions



TIAM-ECN Results: CO₂ Emissions per Sector



Additional annual system costs wrt REF

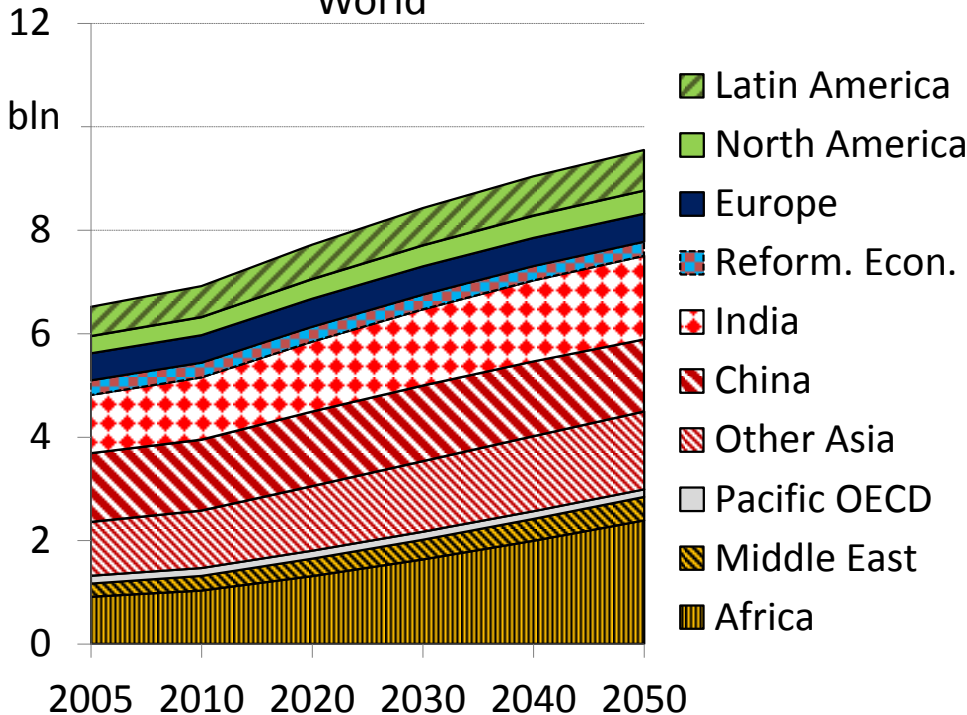


Scenarios

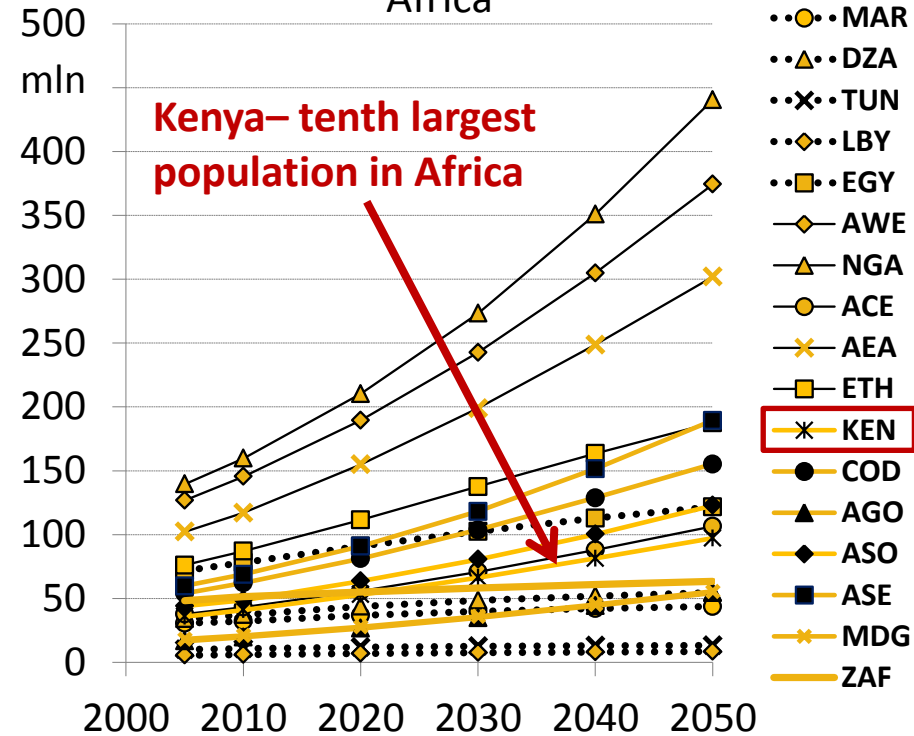
- **Reference (REF):** No GHG emission reduction or renewable energy deployment policies enacted or proposed after 2010;
- **High carbon price (TAX):** Global carbon market with exogenously assigned CO₂ prices, increasing from 50 US\$/tCO₂e in 2020 to 162 US\$/tCO₂e in 2050;
- **Kenya NDC (NDC):** 20% emission reduction in Kenya in 2030 (in comparison to the REF scenario, without considering LULUCF). Maximum allowed emissions level kept constant until 2050. In the rest of the world a cap-and-trade system is in place with a global target for 2050 to reduce GHG emissions by 20% in comparison to 2010;
- **Carbon cap (CAP):** Global cap-and-trade system with a target to reduce global GHG emissions in 2050 by 30% in comparison to 2010; CO₂ prices are endogenous, and the target is also achieved separately in Africa.

Population

World



Africa



Gross Domestic Product

