Energy Transition Monitoring (EnerTraM)

EnerTraM-10 – Emerging Countries Analysis

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Webinar, 17 December 2019

Agenda

- Introduction – webinar organisation
- EnerTraM methodology presentation
- Case study : South Africa
- EnerTraM-10

  a synthesis of 10 key developing countries EnerTraM reports
- Q&A
- Next steps

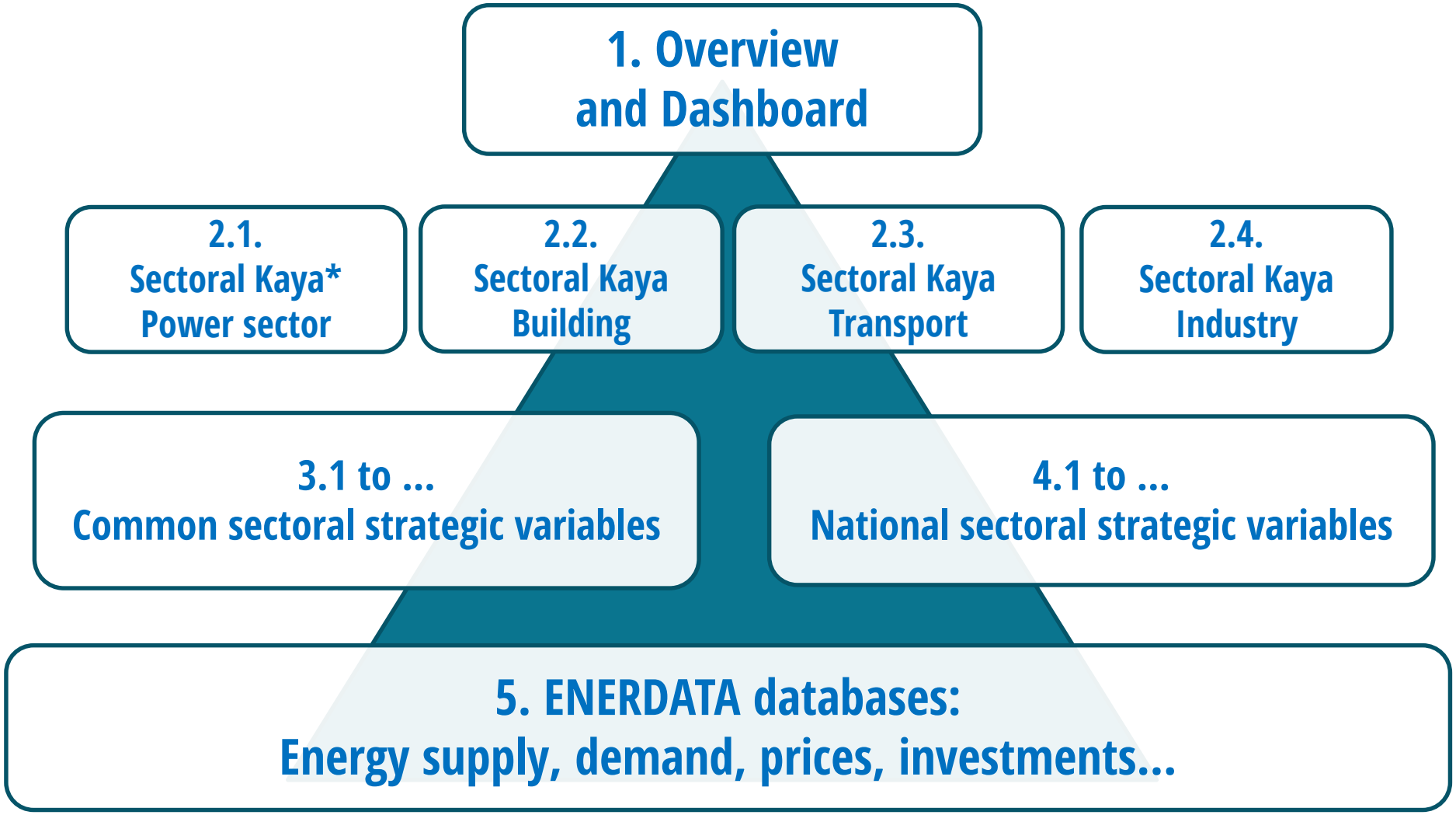
Content Table

Introduction to EnerTraM Information System

EnerTraM

- The goal of EnerTraM is to develop an information system on national energy transitions with dashboards on: i. on-going trends, ii. sectoral targets and iii. transformation trajectories
- The concept is consistent with the one of Nationally Determined Contributions (NDCs) as identified in the Paris Agreement
- It will be more and more strategic in the future, with the entry into the phase of climate policy implementation and evaluation
- The combination of the international databases for historical data and of the EnerFuture scenarios, make Enerdata well equipped to ensure the international monitoring of energy transitions

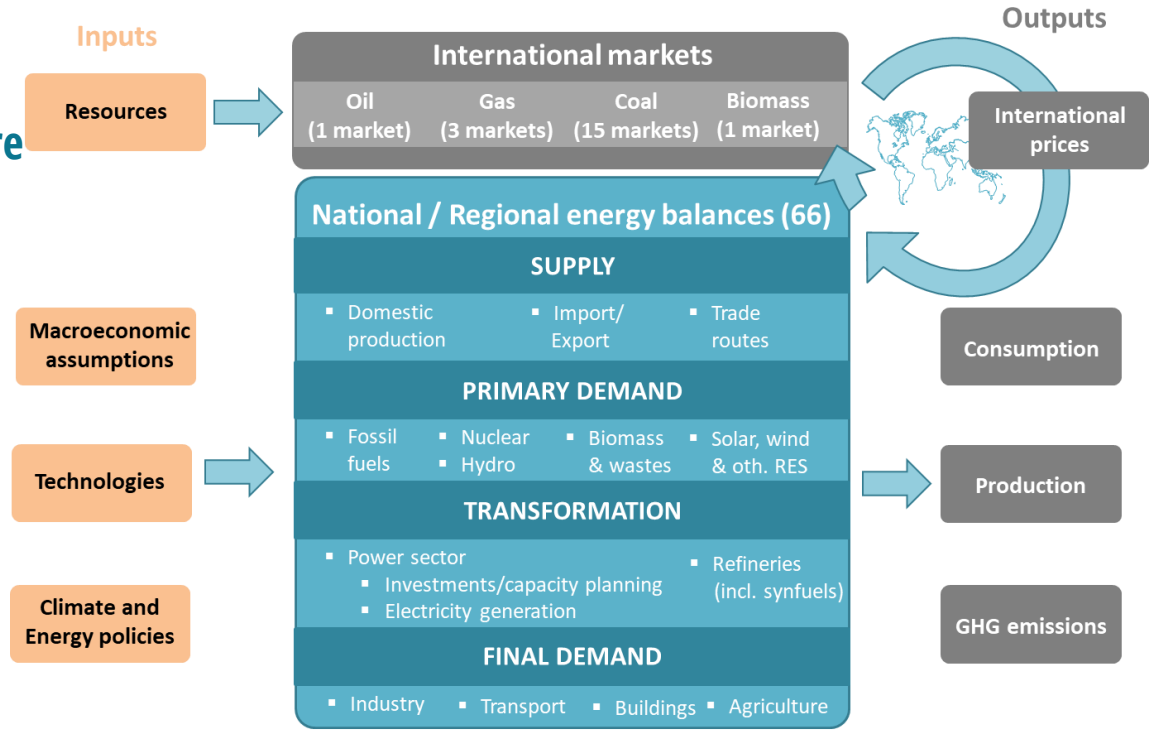
EnerTraM: a set of dashboards



**The Kaya identity identifies the carbon content of energy and the energy content of GDP as key drivers of emissions*

POLES: an integrated world energy model

- POLES is a world energy model initially developed for the EU Commission and currently used at CNRS, JRC-IPTS and Enerdata
- The model represents 66 country energy models, connected together through international energy market modules
- The model is used to produce Enerdata's annual outlook EnerFuture
- Currently EnerFuture simulates 3 scenarios:
  - ✓ EnerBase: fossil intensive
  - ✓ EnerBlue: NDC compatible
  - ✓ EnerGreen: 2°C compatible



The EnerFuture Scenarios

EnerBase 	EnerBlue 	EnerGreen 
Climate-energy policies		
▪ Limited GHG emissions mitigation efforts ▪ Low ambition policies, not compatible with NDCs	▪ Reinforced GHG mitigation efforts ▪ Climate policies in line with NDC objectives	▪ Strong GHG mitigation efforts ▪ Ambitious climate policies, with revised NDCs
Energy demand		
▪ Limited energy efficiency improvements ▪ Strong energy demand	▪ Energy efficiency improvements ▪ Limited increase in energy demand	▪ Regular updates of energy efficiency targets ▪ Global stabilization of energy demand, decrease in OECD
Energy supply and prices		
▪ Fossil fuels dominant ▪ Moderate development of renewables ▪ High international fuel prices	▪ Diversification with increased renewables ▪ Slowly increasing international fuel prices	▪ Full phase-out of fossil fuel subsidies ▪ Strong renewables ▪ Carbon taxations balance stable fuel prices
Temperature increase between 5°C and 6°C.	*Temperature increase between 3°C and 4°C.*	*Temperature increase between 1.5°C and 2°C.*

1. Country introduction

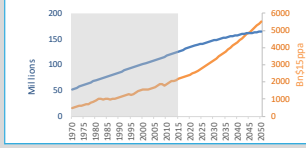
Country conditions at first glance:

- National data
  - Socio-economic situation
  - Energy and climate
- Synthesis on NDC with CO2 (GHG) emissions and projections for different scenarios
- Identified policies and targets

Mexico

Socio-economic data 2015

Population:	126 M
Population growth since 2000:	24 %
Density:	64 cap/km2
Urbanization rate:	79 %
GDP:	2171 Bn$15ppa
Share of industry in GDP:	36 %
Share of services in GDP:	55 %
Share of agriculture in GDP:	3 %



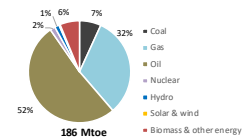
Source: Enerdata

Key energy & climate data 2015

Energy consumption per capita:	1.47	tep/cap
Electrification rate:	99.17	%
Electricity consumption per capita:	2044	TWh/cap
CO2 emissions (excl. LULUCF):	480.1	MtCO2
CO2 emissions (excl. LULUCF) per capita:	3.8	tCO2/cap

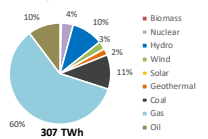
Highlights :

Primary energy mix in 2015



186 Mtoe

Electricity Generation Mix in 2015



307 TWh

Source: Enerdata

Paris Climate Agreement commitment

Target type	Trend	Form	Scope	Nature	Unconditional	Conditional	Reference year
Relative to BAU	Reduction	%	National	GHG (excl. black carbon)	22%	36%	BAU 2030

GHG coverage: CO2, CH4, N2O, HFCs, PFCs, SF6, (Black Carbon)

Sector coverage: Energy, Industrial process and product use, agriculture, LULUCF and waste

Key documents

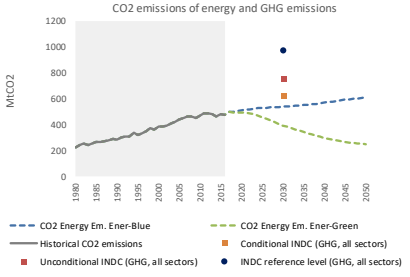
	Most recent version	Date
National Communication (NC)	Fifth National communication	06/12/2012
Bi-annual updated report	First Biennial Update Report	23/10/2015
(I)NDC	First NDC	21/09/2016

Key power capacity targets

Type	%
Year	2031
Source	PRODESEN

Total		7		15
	13		2	2

CO2 emissions of energy and GHG emissions



Source: Enerdata, INDC

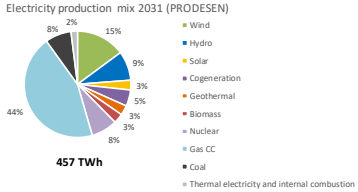
Main energy and climate policies

1st NDC (2016)
Commitments on Mitigation and Adaptation to Climate Change for the 2020-2030 Period (2015)
Infrastructure development Program for the National Electric System PRODESEN (Sistema eléctrico nacional) 2017-2031 (2017)
5th National Communication (2012)
Energy Transition Law (Ley de Transición Energética -LTE) (2015)

Demand Objectives
Electricity consumption expected to increase by 3.4%/y over 2016-2030

Supply Objectives
Clean energy generation targets of 25% by 2018, 30% by 2021, 35% by 2024, and an ultimate target of 50% by 2050

Electricity production mix 2031 (PRODESEN)



457 TWh

Capacity production objective 2031 (PRODESEN)

	Hydro	Wind	Solar	Coge.	Geoth	Biom.	Nucl.	Gas CC	Coal	Therm. el.
GW	15	17	8	7	2	2	6	44	5	8
%	13	15	7	6	2	2	5	39	4	7

Emissions Objectives
Target 2050: 50% reduction of GHG and short-lived climate pollutants compared to 2000
Emissions reduction target of 24,5% by 2020, GHG reduction (incl. LULUCF) of 22% (unconditional) to 36% (conditional) below BAU of 973 MtCO2e(incl. LULUCF), i.e. -18% to -33% for CO2 from fuel combustion and IPPU according to Enerdata by 2030
Reach a zero deforestation rate in 2030

Enerdata

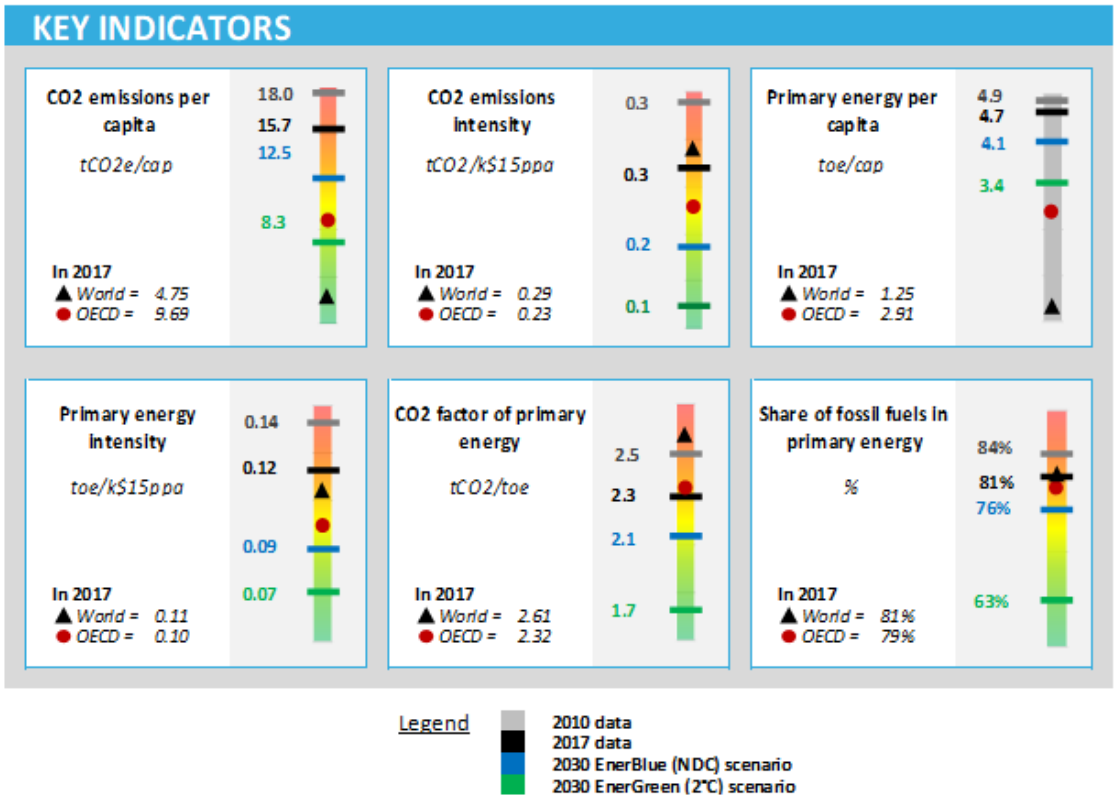
2. EnerTraM sectoral indicators

Headline	GHG emissions per capita	CO2 intensity of GDP	Carbon factor	Energy intensity of GDP	Primary energy per capita	Share of fossil fuels in primary energy
	(MtCO2e/cap)	**(tCO2/$)**	**(tCO2/toe)**	**(toe/$)**	**(toe/cap)**	**(%)**
Power sector	Electricity demand per capita	CO2 factor of the power sector	Electrification rate	Electrification of final energy mix	Installed coal capacities	Share of renewables in power generation (inc. large hydro)
	(kwh/cap)	**(gCO2/kWh)**	**(%)**	**(%)**	**(GW)**	**(%)**
Transport and industry	Transport CO2 emissions per capita	Private road transport CO2 emissions per km	CO2 emissions per km of new private vehicles	Kilometers per capita		Industry CO2 emissions intensity of VA***
	(tCO2/cap)	**(gCO2/km)***	**(gCO2/km)***	**(km/cap)**		**(tCO2e/$)**
Buidings, agriculture and LULUCF	Building CO2 emissions per capita	Residential building emissions intensity	Service building emissions intensity of VA***		Agriculture GHG emissions intensity of VA***	Carbon sinks intensity
	(tCO2/cap)	**(kgCO2/m2)****	**(kgCO2/$)**		**(tCO2e/$)**	**(MtCO2e)**

*Depending on data availability the private road transport indicators will be provided per "km", "veh" or "pkm"
**Depending on data availability the residential building emissions intensity will be provided as "kgCO2/m2" or kgCO2/household
***VA stands for Value Added, representing the contribution if a given sector to the region's overall GDP

3. EnerTraM international comparison dashboard

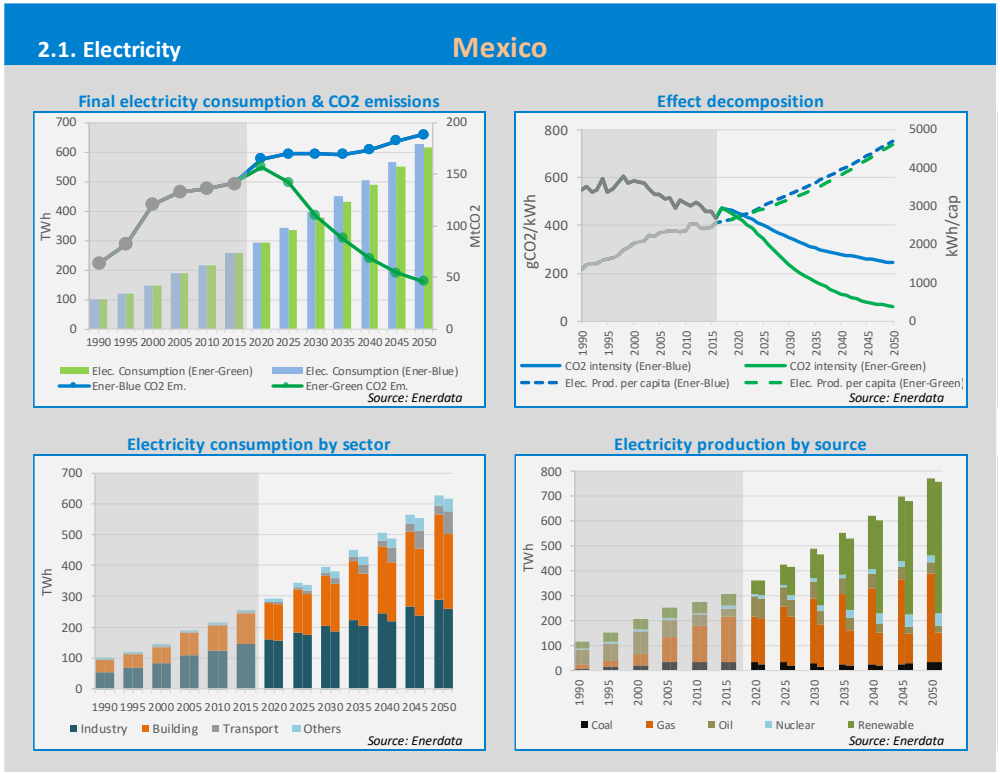
- **The indicator dashboard allows to compare the country performance with the one of other OECD or non-OECD countries**
- **This dashboard explores the different sectors:**
  - **Electricity**
  - **Building**
  - **Transport**
  - **Industry**



4. Sectoral graphs

- **Time-series:**
  - Historical time-series in EnerTraM cover 1970 to Y-2
  - Projections cover Y-1 to 2050 and leverage 2 EnerFuture scenarios: EnerBlue & EnerGreen

- **A series of graphs illustrate continuities /discontinuities in each sector**
- **This detailed sectoral approach allows to inform targets, policies and investment needs related to different scenarios**



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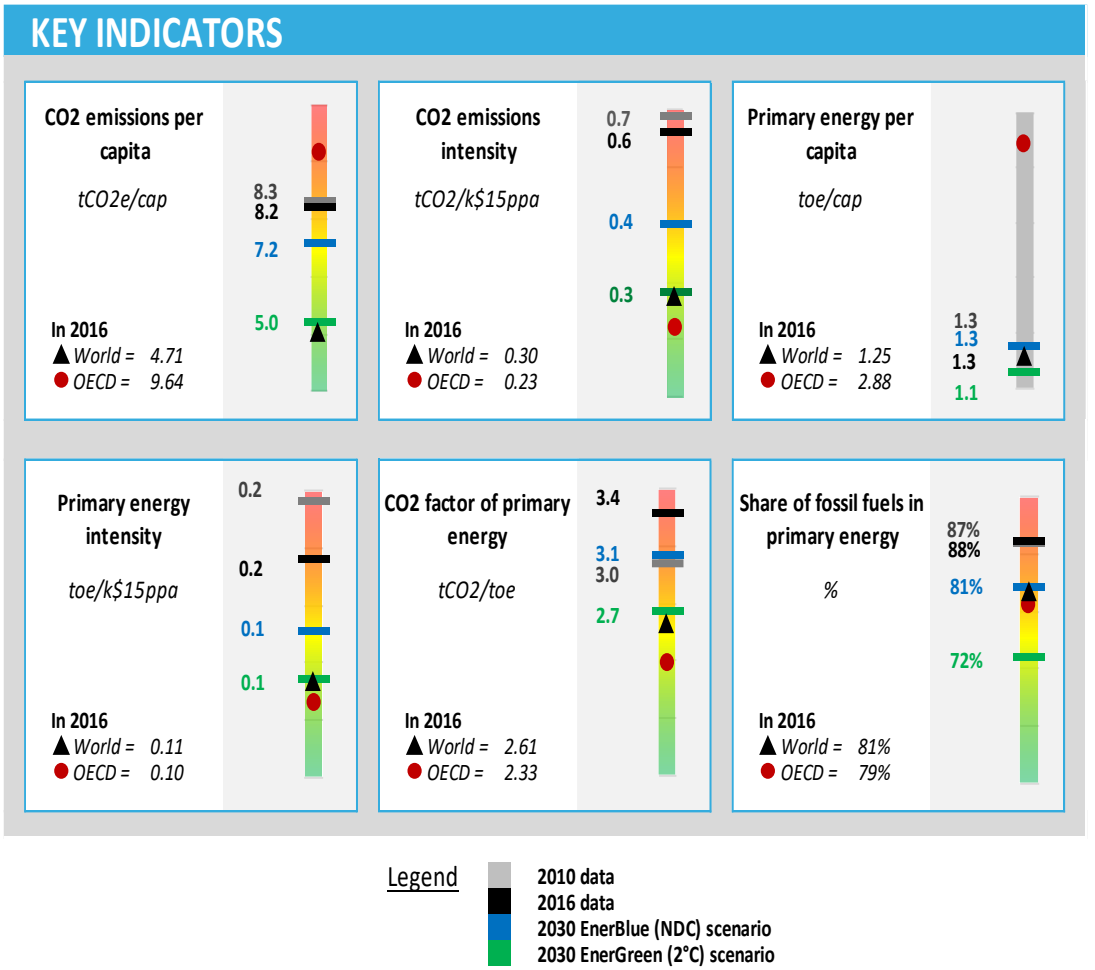
EnerTraM, a country case study:

South Africa

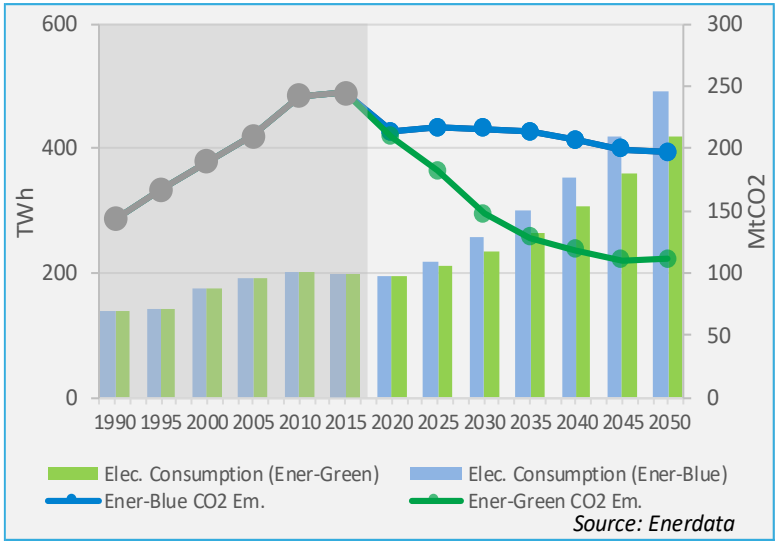
1. South Africa: overview

- With 8 tCO_2 per capita, South Africa's emissions are below OECD countries' average (9.5 tCO2/cap.), but well above those of the BRICS countries (4.5 tCO_2/cap.)
- Total CO_2 emissions have strongly increased in the past 20 years; CO_2 intensity of GDP is one of the highest in the world as the economy is coal-based
- Primary energy supply is indeed dominated by coal, which currently represents more than two thirds of total.

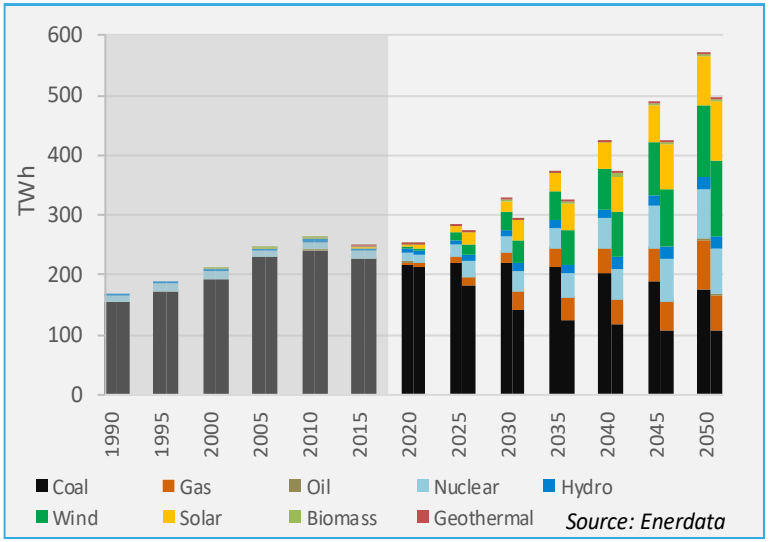


2. South Africa: the electricity sector

- **Electricity consumption has stagnated in the last decade, but is expected to grow by around 1.5-2%/yr in the future, mostly in the industry and buildings sectors**

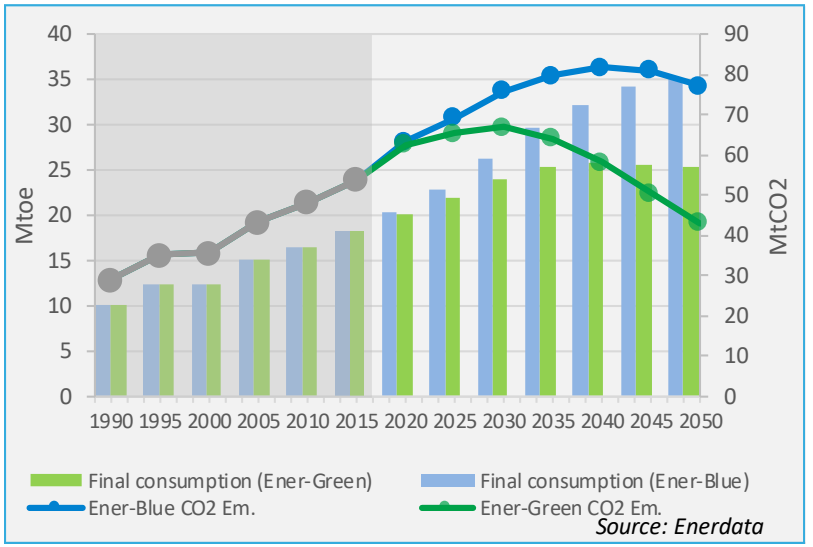


- **Coal has currently the dominant share in power generation. It would remain a major fuel in the NDC scenario, while it would be displaced by renewables in a more ambitious GHG abatement scenario**

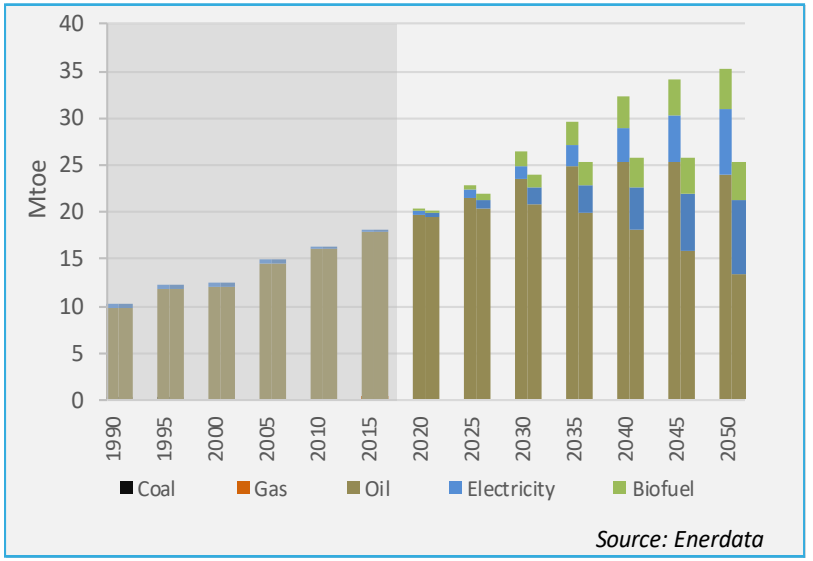


3. South Africa: the transport sector

- The transport sector represents 25% of final energy. In spite of investments for public transport, it is largely dominated by private road transport running on oil
- The NDC shows an opportunity for introducing biofuels and electric vehicles
- This is confirmed in a 2°C scenario, in which also consumption is stabilized. Low emission vehicles represent 50% of consumption by 2050.



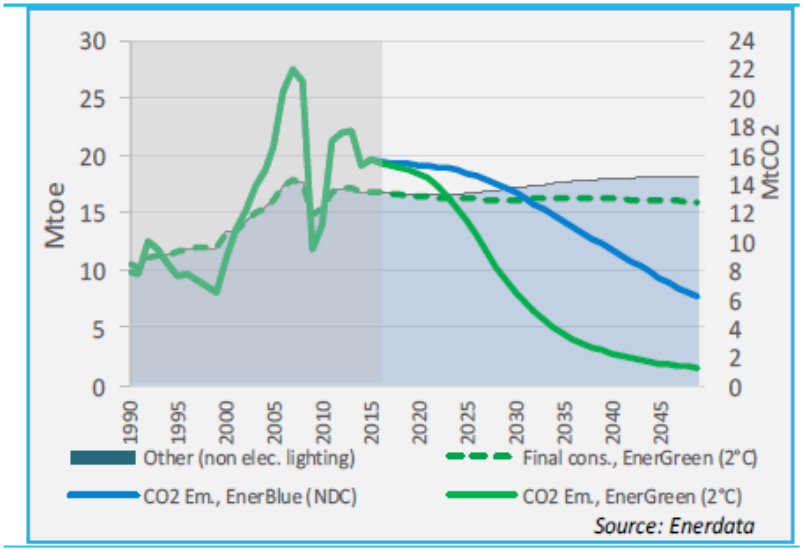
Source: Enerdata



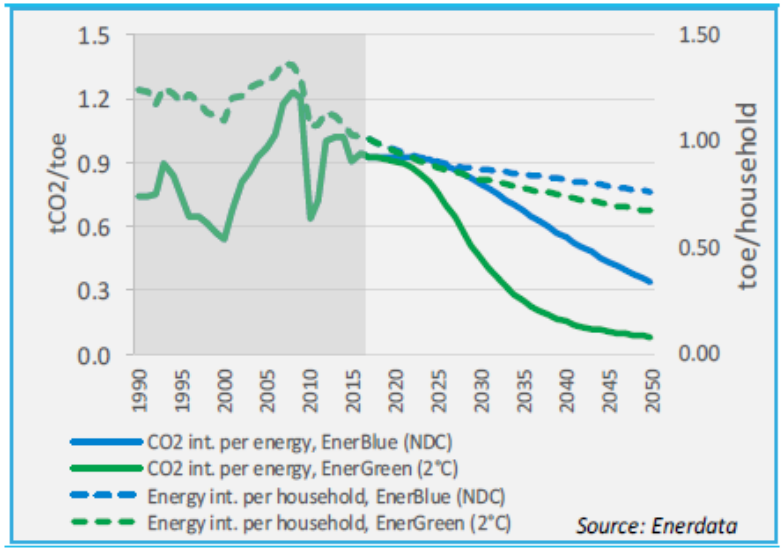
Source: Enerdata

4. South Africa complementary data: residential

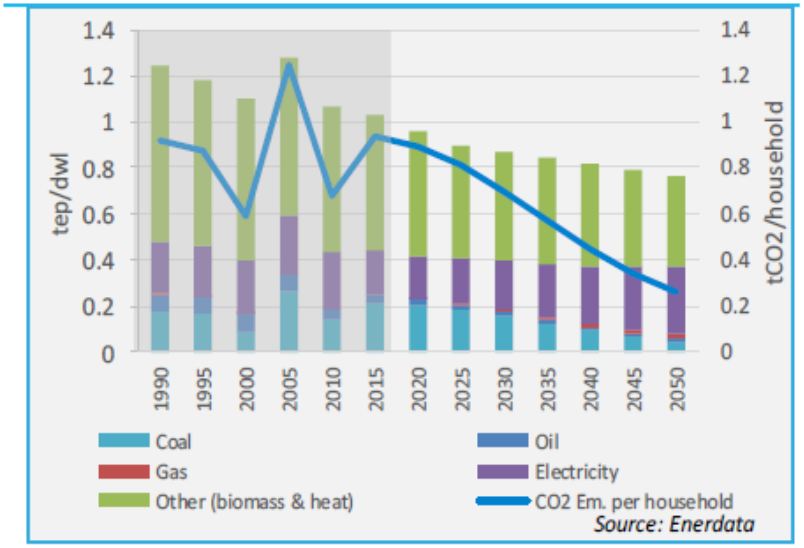
3.1.1. FINAL ENERGY & CO2 EMISSIONS



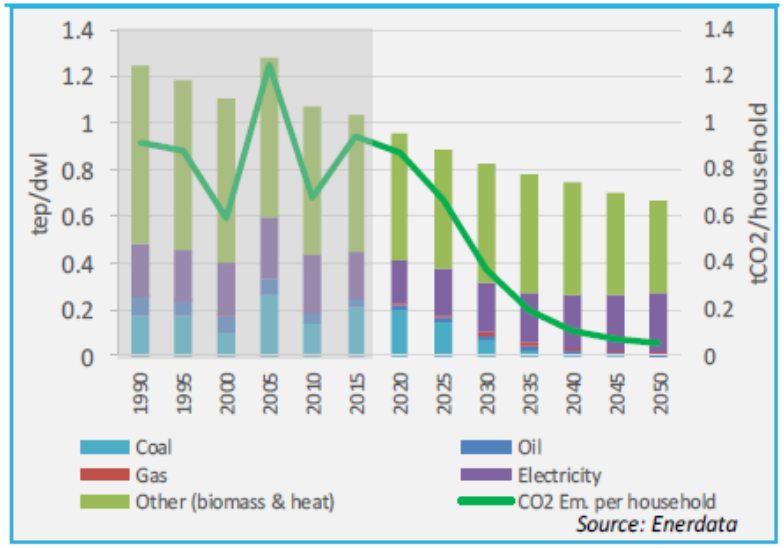
3.1.2. KAYA CO2 INDICATORS



3.1.3. ENERGY CONSUMPTION BY SOURCE - NDC SCENARIO (ENERBLUE)



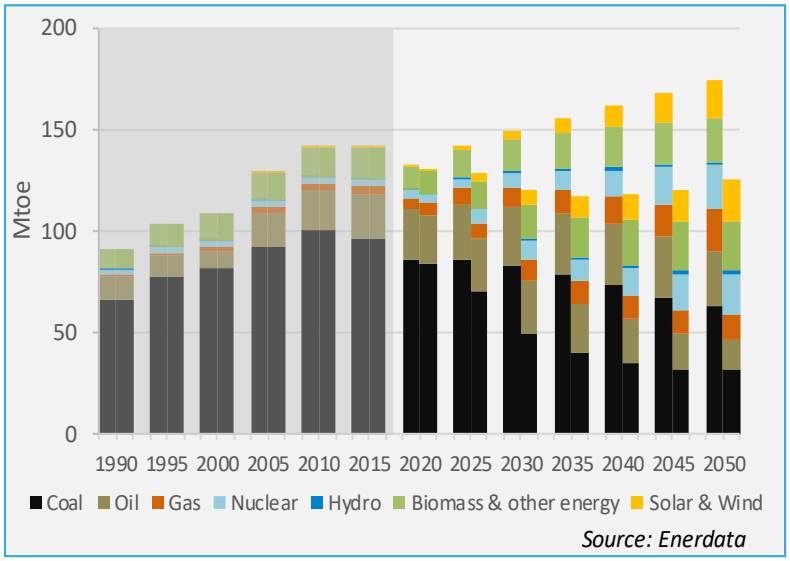
3.1.4. ENERGY CONSUMPTION BY SOURCE - 2°C SCENARIO (ENERGREEN)

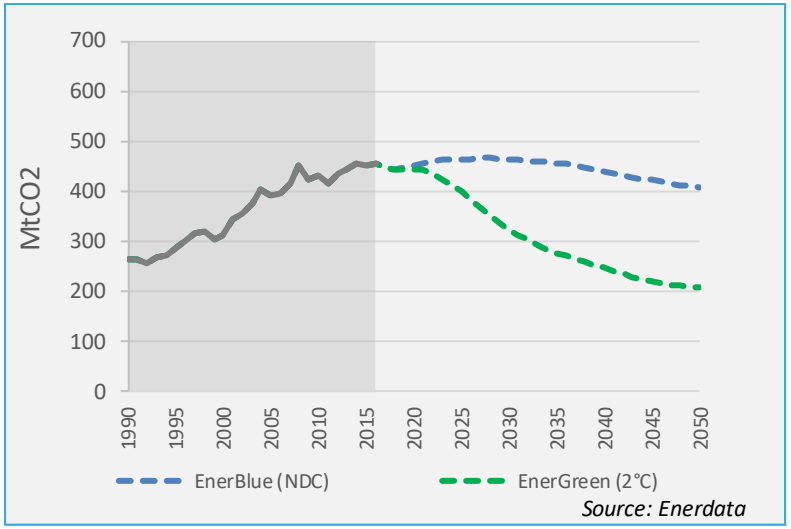


5. South Africa: total emissions

The NDC and 2°C scenario show very contrasted profiles:

- **In the NDC case primary energy grows until 2050 and coal remains a major supply (40%)**
- **In the 2°C case primary energy consumption is stable over the period, while the diversification is stronger: coal is brought down to 25% of total**
- **As a result, emissions plateau until 2050 in NDC, while they are reduced by 55% in 2°C**





Content Table

EnerTraM-10 Key Takeaways

Energy transition in 10 key developing countries

Content

- **10 countries** which represent a huge stake for the future of the world energy and associated GHG emissions
- **Current trends** analysis: GDP, energy demand, CO_2 emissions…
- **Current NDC** objectives are within reach but are not ambitious enough for a less-than-2°C scenario – by far!
- **News NDCs** to be delivered in 2020 should show clear breakthroughs and answer several challenges:
  - NDC targets, scope and methodology
  - Decoupling development and energy consumption
  - Rapid decarbonisation of the energy supply mix

The EnerTraM-10 countries

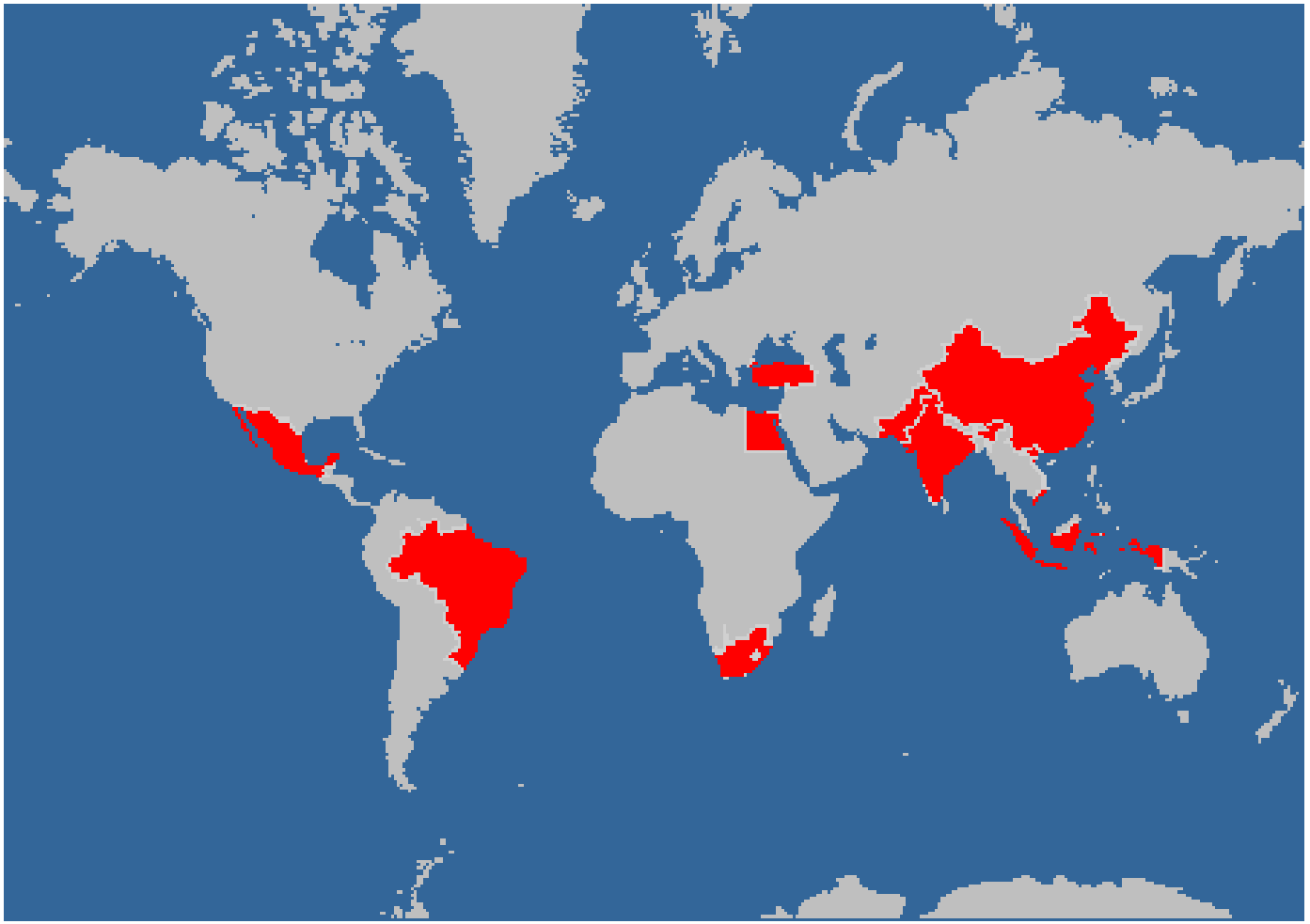
EnerTraM-8 + 2

1. Brazil
2. Egypt
3. Indonesia
4. Mexico*
5. Pakistan
6. South Africa
7. Turkey*
8. Vietnam

+

9. China
10. India

**** OECD countries***



Content Table

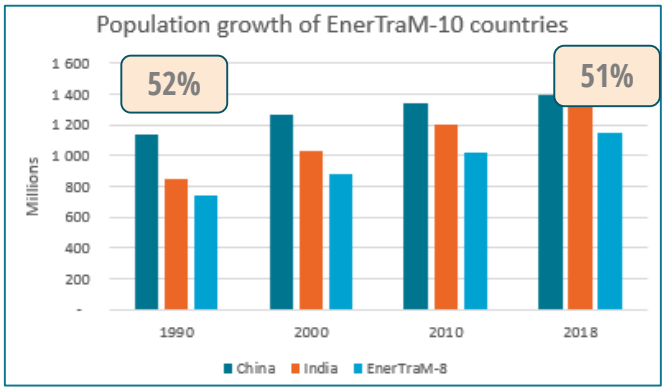
EnerTraM-10 Key Takeaways

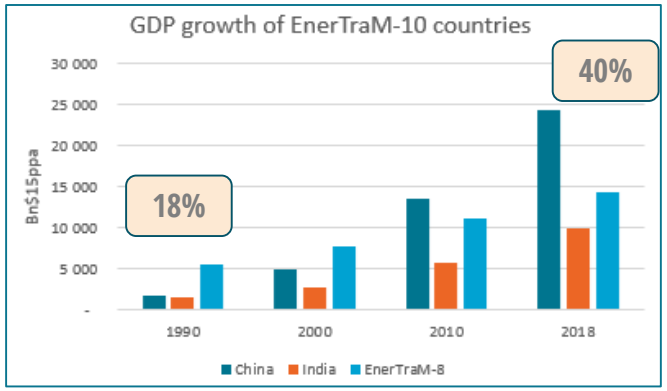
Where do we stand ?

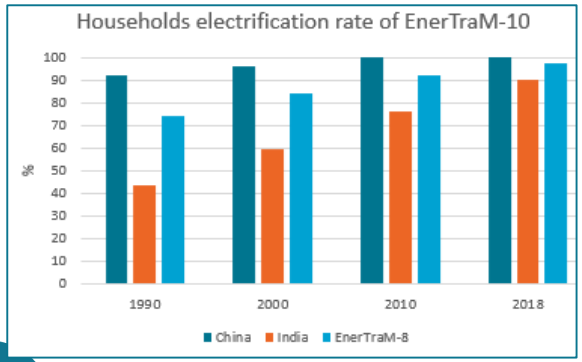
EnerTraM-10 countries: a huge stake in the global energy transition

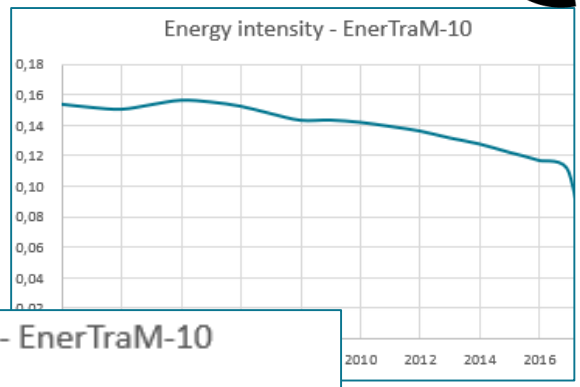
- Population & GDP growth
- Energy consumption, production, and CO_2 emissions
- Key short-term decisions to mitigate global CO_2 emissions growth, especially in the electricity sector

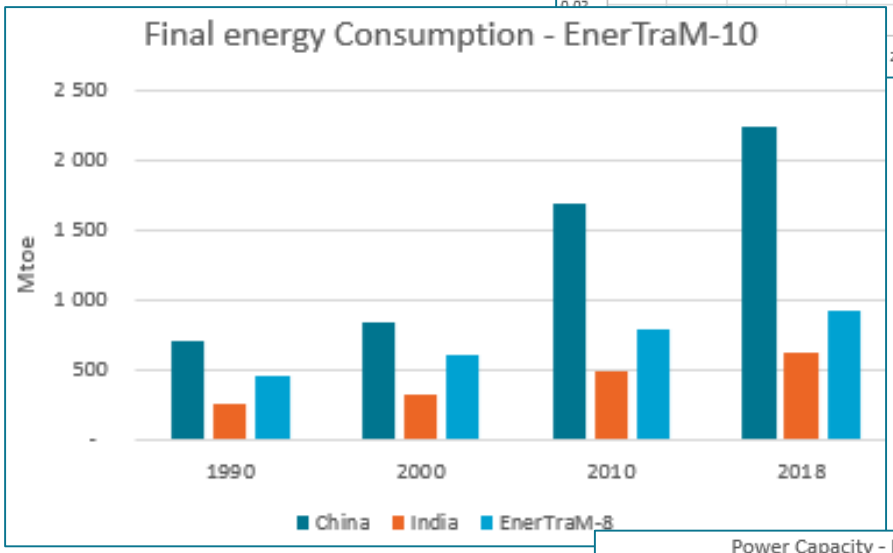
EnerTraM-10 – energy demand trends 1/3

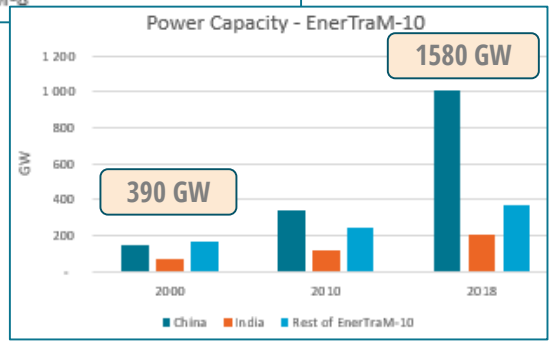










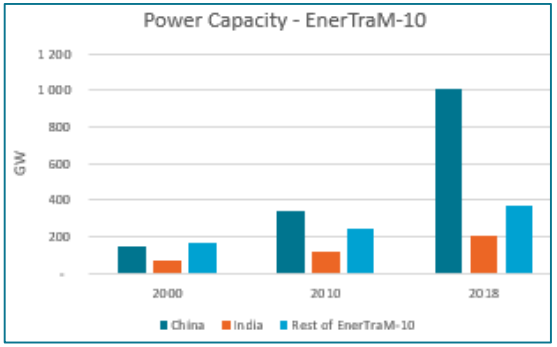


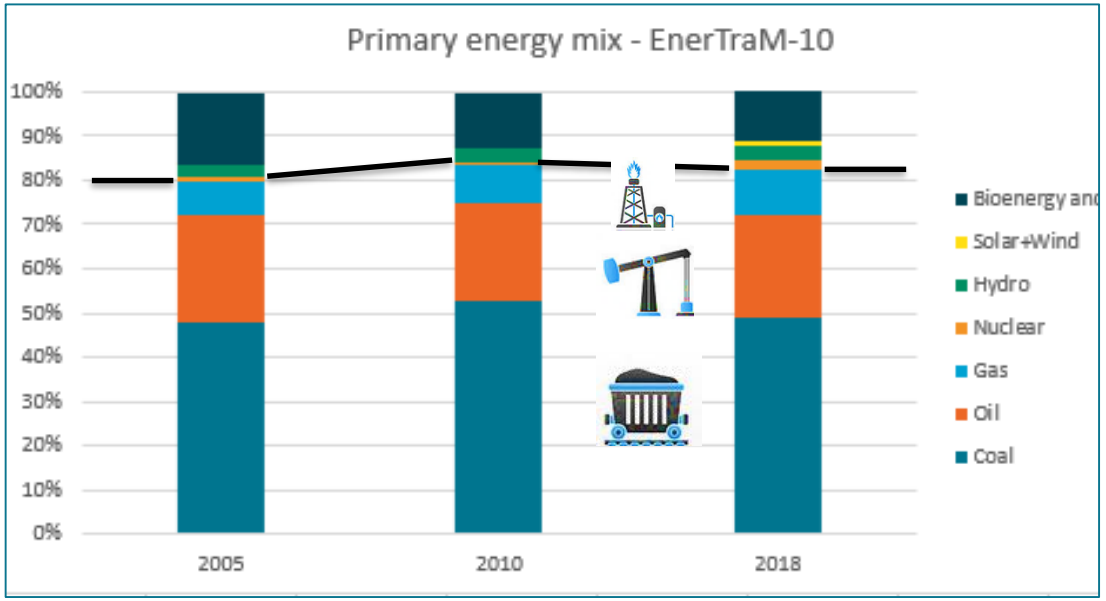
Enerdata

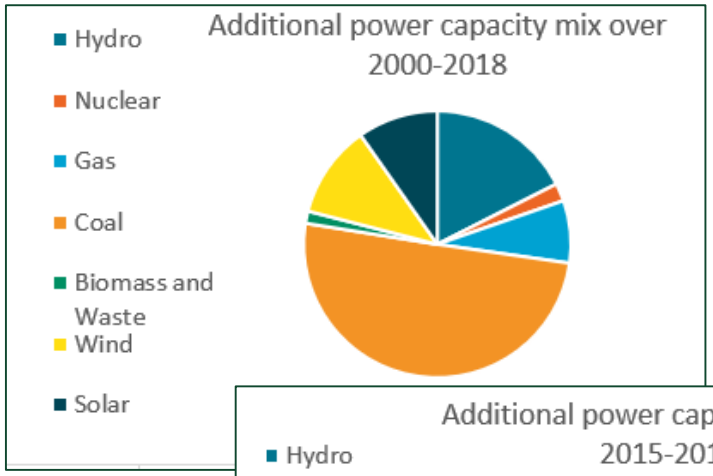
52%: part of ww

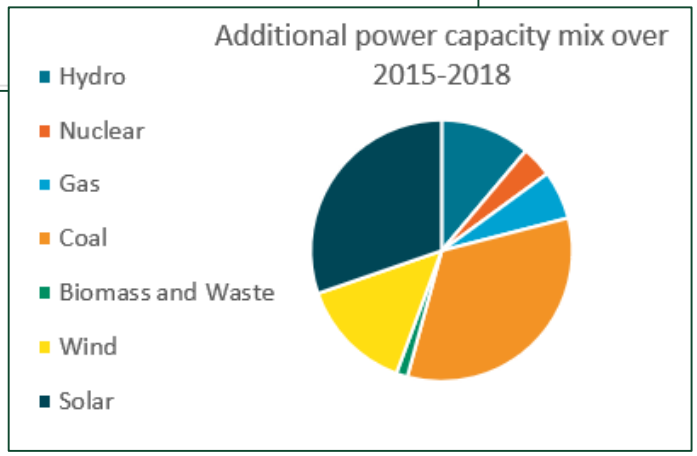
EnerTraM- Dec 2019

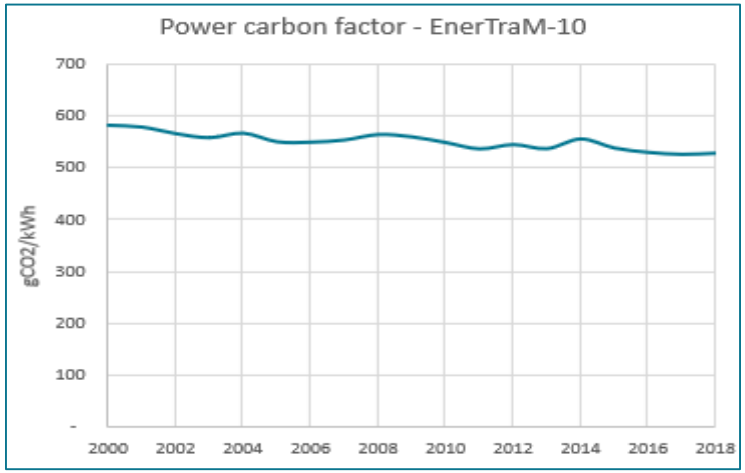
EnerTraM-10 – energy mix trends 2/3





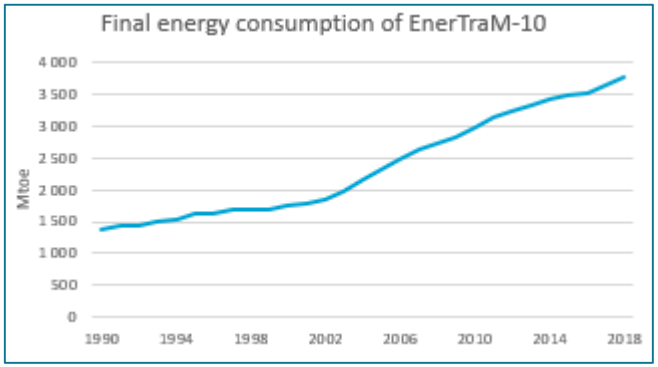


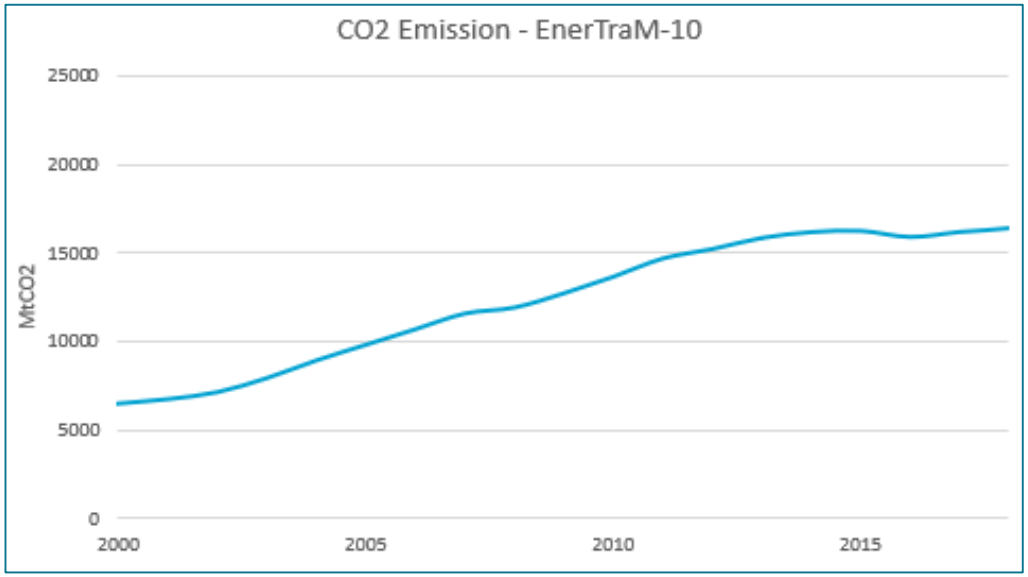


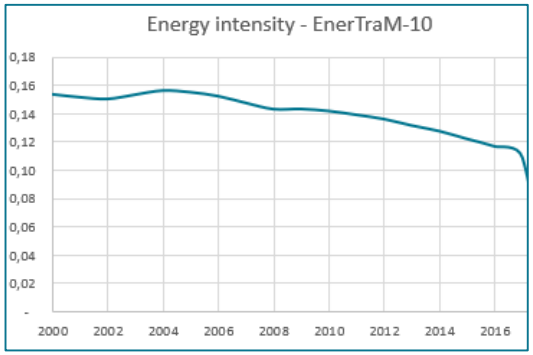


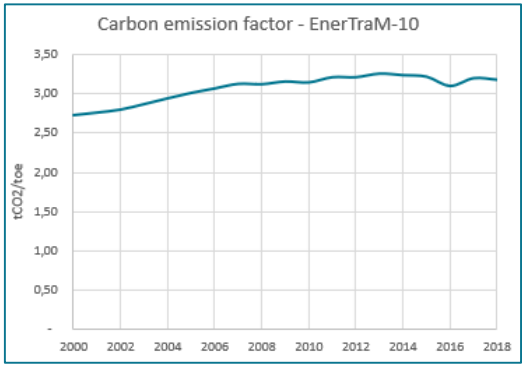
Enerdata

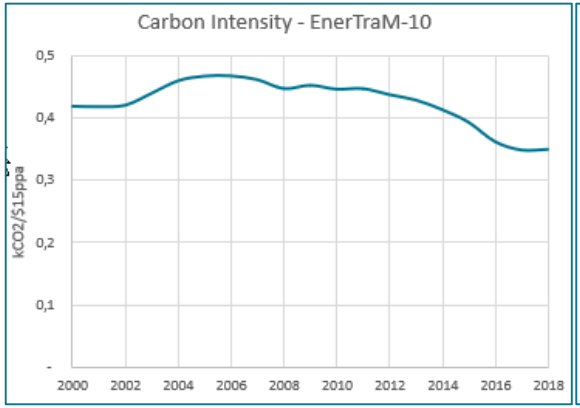
EnerTraM-10 – CO_2 emissions trends 3/3

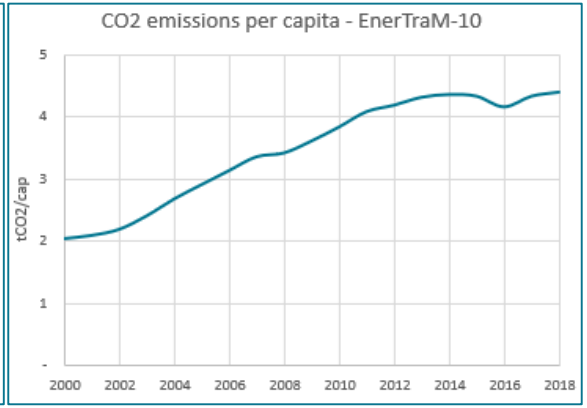




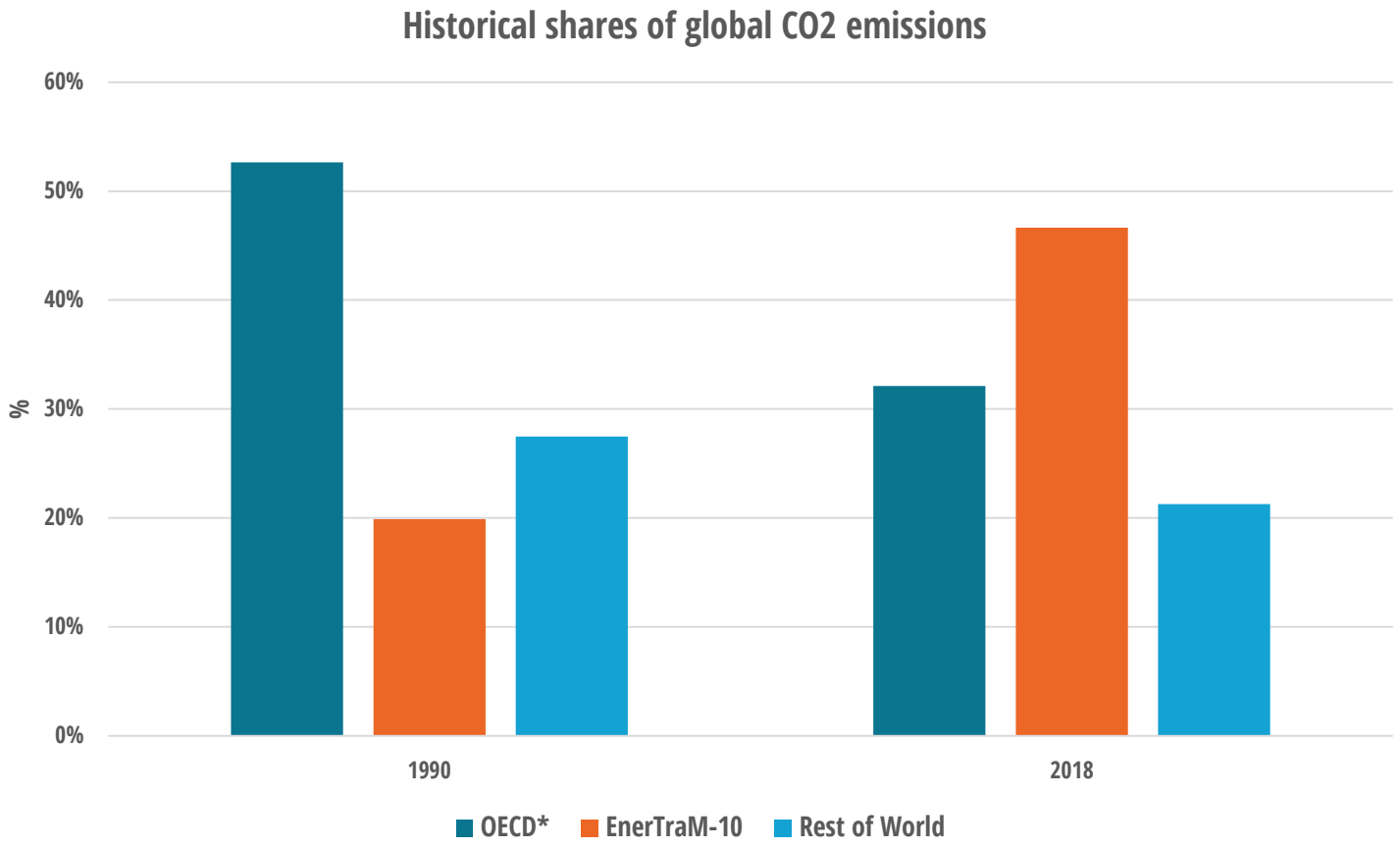








The EnerTraM-10 countries already represent the largest share of global carbon emissions



The same evolution is true for GHG emissions

Note: OECD*=OECD minus Mexico & Turkey

Content Table

EnerTraM-10 Key Takeaways

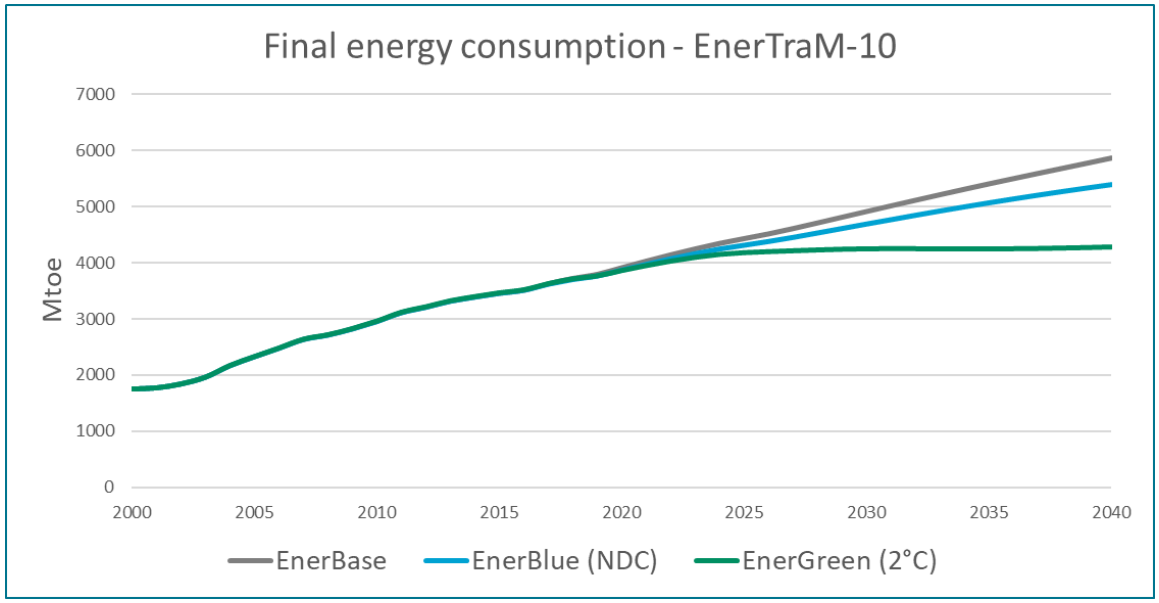
Where do we go ?

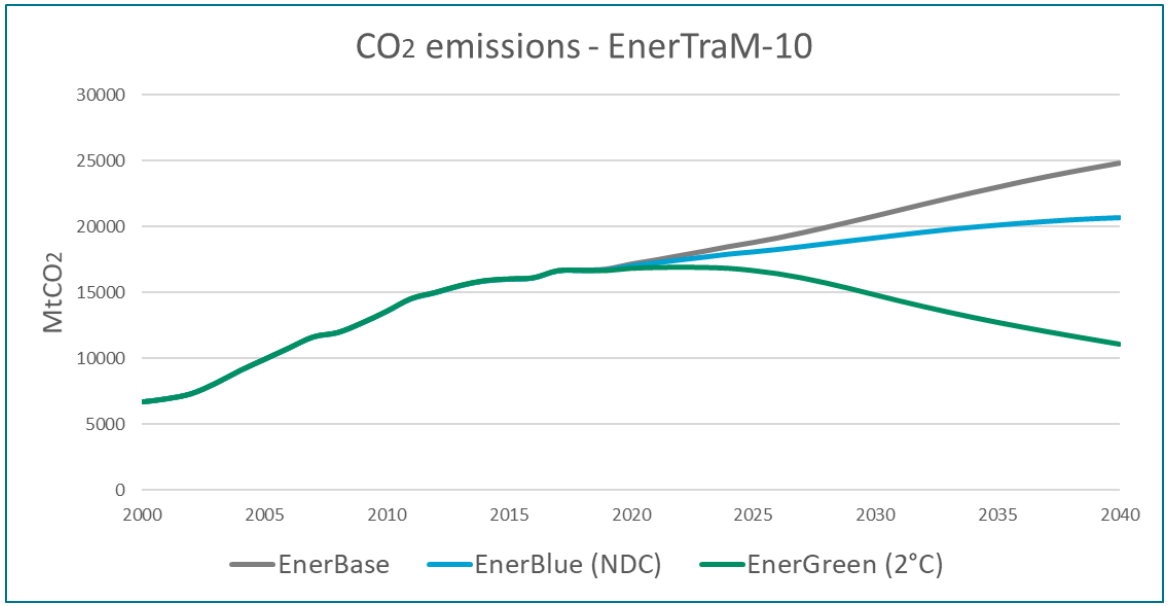
What are the possible futures ?

Current NDCs are generally within reach but are not ambitious enough for a less-than-2° scenario

- Existing NDCs were set via bottom-up approach before COP-21 in 2015
- They are defined differently in each country, with varying levels of ambition, including "unconditional" and "conditional" commitments
- Overall, the EnerTraM-10 NDCs are an improvement to "Business-as-Usual", but they are only a limited part of the effort necessary in a less-than-2°C scenario
  - This is also true for OECD countries
- As of 2019, EnerTraM-10 NDCs are achievable in most countries

Current NDCs are generally within reach but are not ambitious enough for a 1.5-2°C scenario





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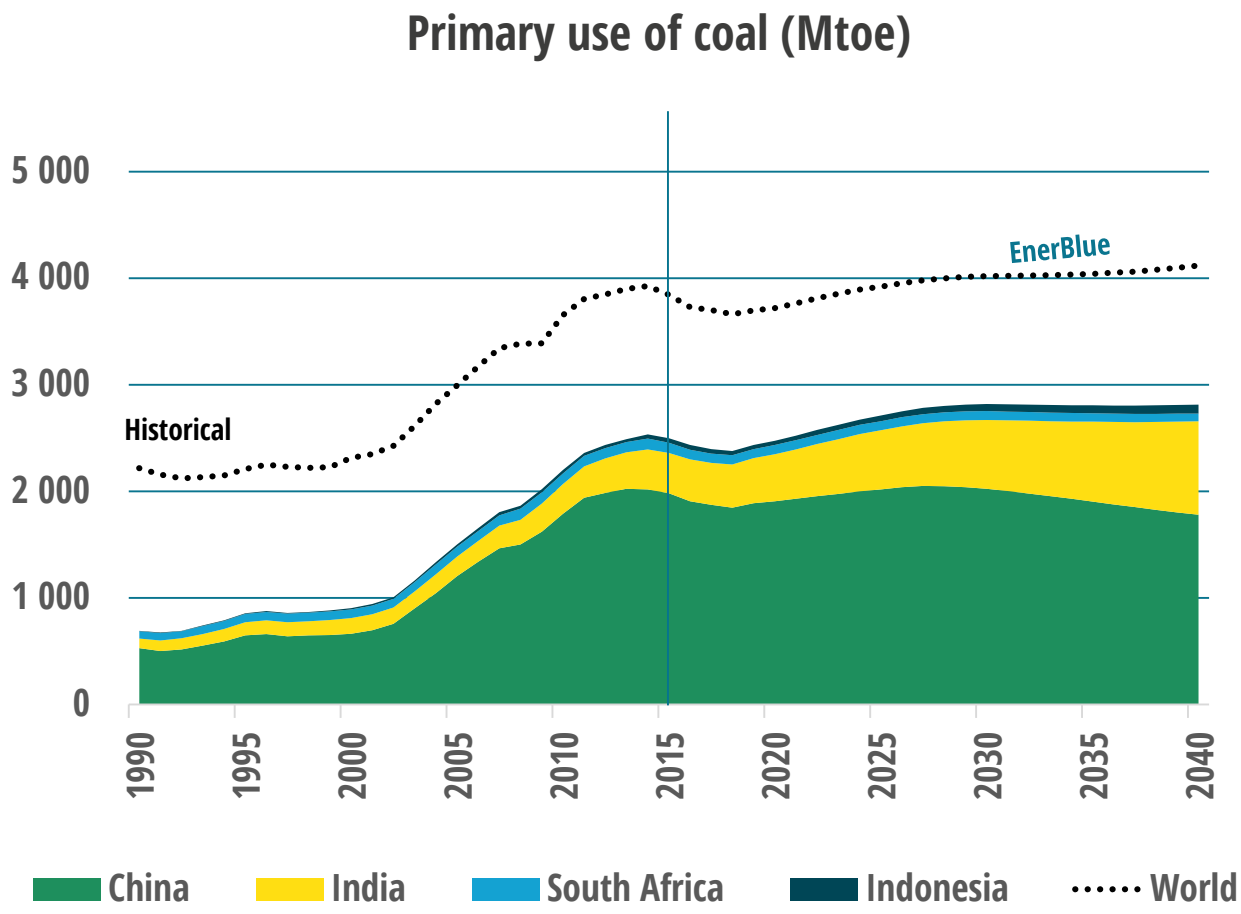
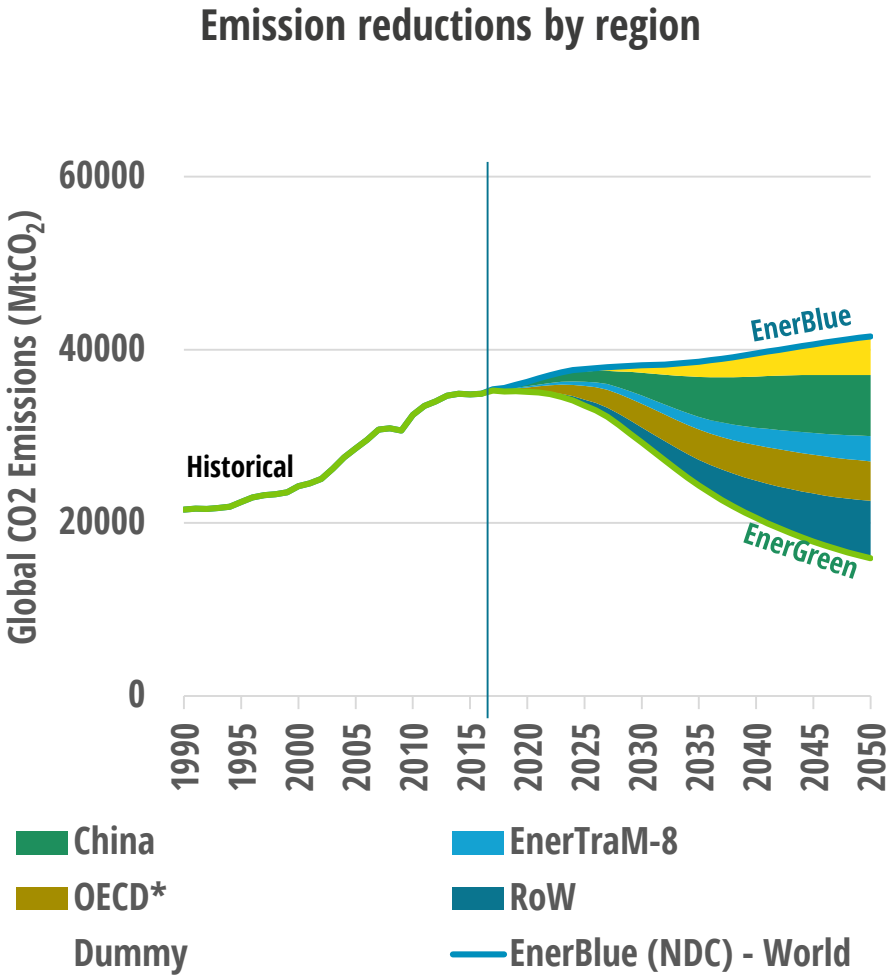
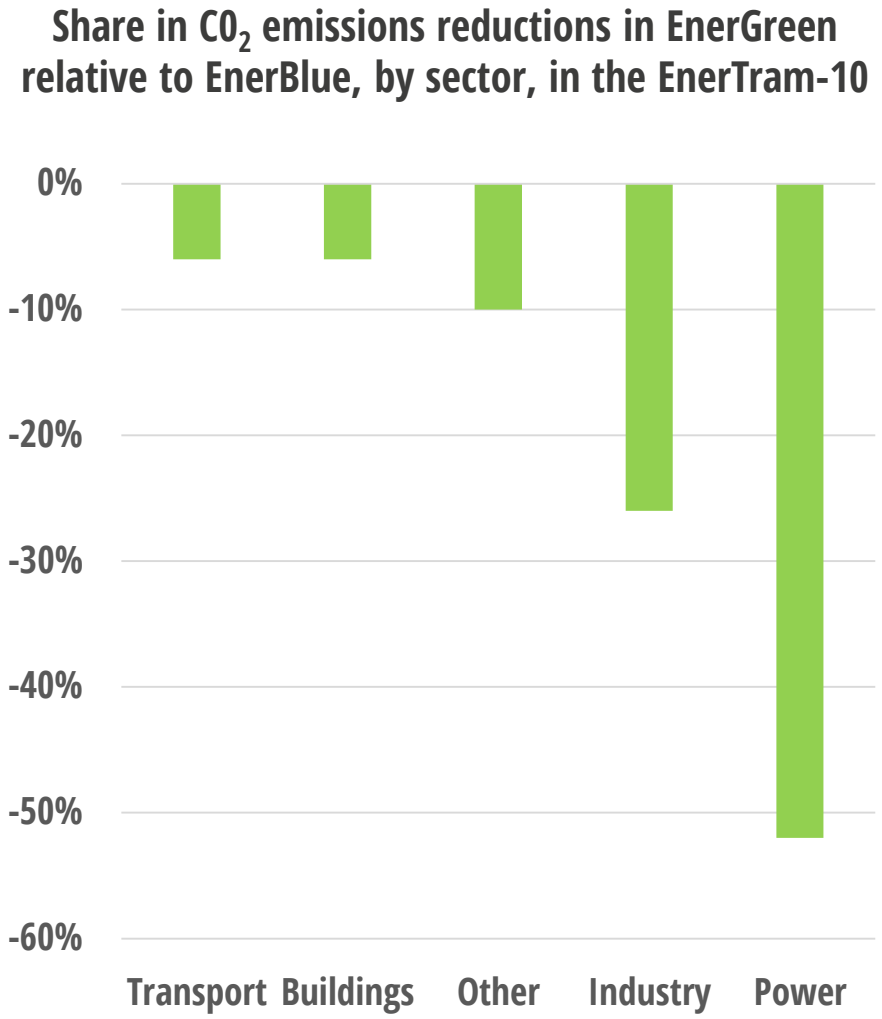
Coal has driven emission increases...
... and will continue to – under current NDCs



The EnerTraM-10 account for more than half of potential global CO_2 reductions in EnerGreen, relative to EnerBlue





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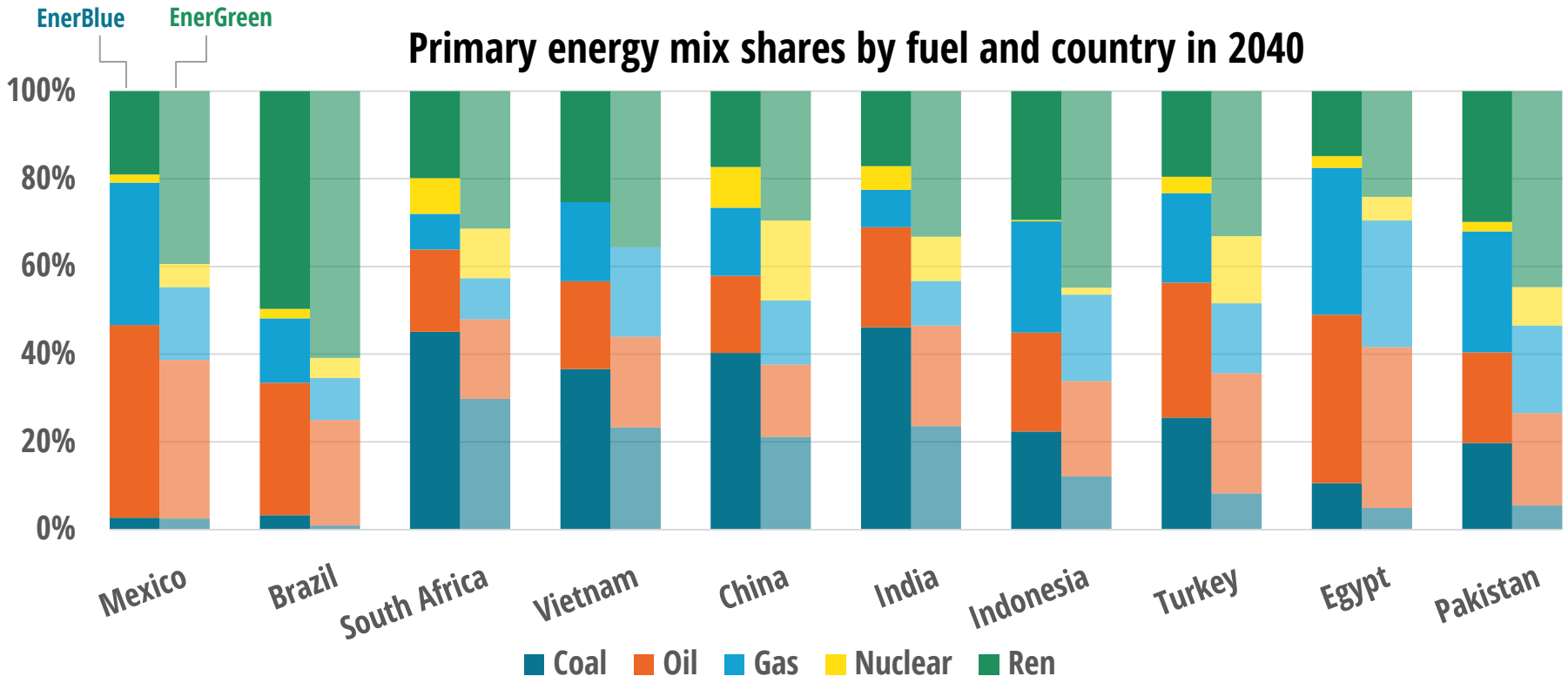
EnerTraM- Dec 2019

2 key questions for the energy mix of EnerTraM-10 countries by 2040: % of fossil fuels + mix of fossil ?



To comply with the Paris Agreement, the EnerTraM-10 countries need
1- to replace fossil fuels with non-fossil energy options
2- in some cases, to invest in fuel switching from coal to gas in the medium-term.

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Content Table

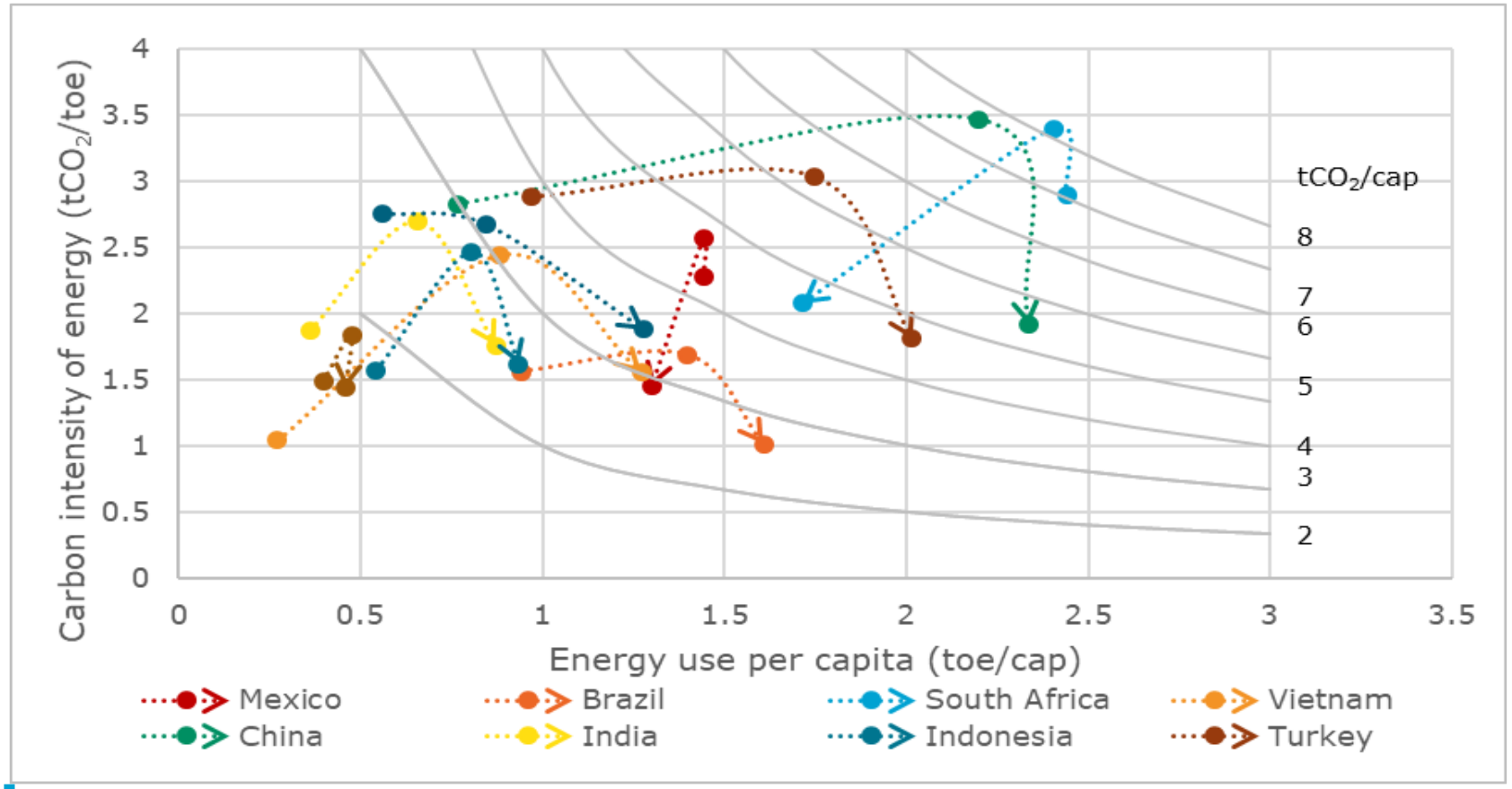
EnerTraM-10 Key Takeaways

Recommendations

What should be addressed in the new NDCs (2020) ?

In a less-than-2° scenario, need for a change of direction !

Energy use per capita vs. carbon intensity of energy
1990 → 2016 (historical) → 2040 (EnerGreen)



In EnerGreen, carbon intensity decouples from energy use.

Energy efficiency strategies in EnerGreen do not hinder improved energy access as energy use per capita continues to grow in EnerTram-10 countries, except for in South Africa and Mexico.

Revised NDCs in 2020 should:

- Improve their content (all sectors, all GHG / LULUCF) + set 2030 and 2040 objectives

- Aim at decoupling development and energy consumption
  - Development is not just GDP
  - Objective: energy intensity improvement growing from 1 to 3-4 pts / year
    Include a mix of Energy *Efficiency* and Energy *Sufficiency* measures
- Dramatically accelerate the energy mix decarbonisation
  - Rapid coal phase-out
  - Electrification of end-uses in all sectors: with electricity rising from 15% of energy consumption in 2018 to 40% in 2050
  - Strong development of RES + transitional role of natural gas in some countries
- Clarify means & measures
  - Carbon tax & markets implementation + revenue use
  - Fossil fuel subsidies
  - Costs & investments balances
  - Access to international support

Content Table

Questions & Answers

Next steps

- Presentation will be sent to webinar participants
- Sample of complete EnerTraM country report available on demand
- EnerTraM-10 report available early Jan 2020
- Inputs on your needs and recommendations are welcomed to further develop the methodology
- New countries to be analysed in 2020
- + Update of EnerTraM-10 countries based on 2018 / 2019 data

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About Enerdata:

Enerdata is an energy intelligence and consulting company established in 1991.
Our experts will help you tackle key energy and climate issues and make sound strategic and business decisions.
We provide research, solutions, consulting and training to key energy players worldwide.

https://www.enerdata.net/

Thank you for your attention!