



# ***Impact of the Paris climate agreement on energy markets***

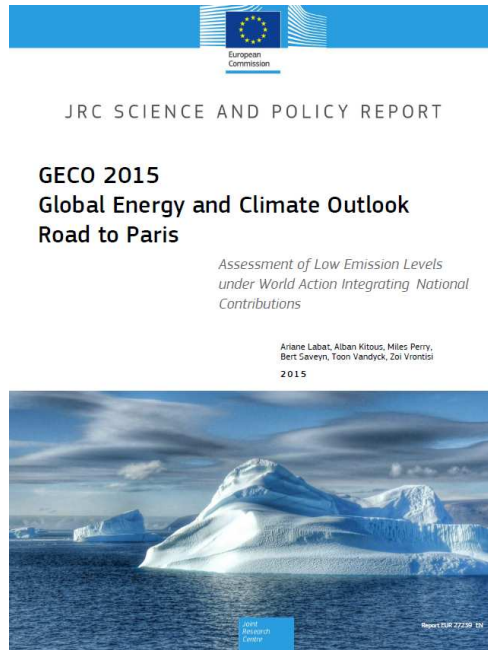
## ***GECO & analysis of INDC***



**Joint Research Centre**  
the European Commission's  
in-house science service

Joint  
Research  
Centre

# Global Energy and Climate Outlook (GECO) & analysis of the INDCs



*GECO 2015: Road to Paris*

<https://ec.europa.eu/jrc/geco>

- Work conducted by JRC, with support by DG CLIMA
- Energy and emissions system forecasting (POLES modelling)
- Study of macro-economic impacts (GEM-E3 modelling)
- Used as a basis for [Communication COM\(2015\) 81 final/2](#)
- Used as a basis for the [Policy Brief on INDCs analysis](#)
- *To be updated by June 2016, will include INDCs*

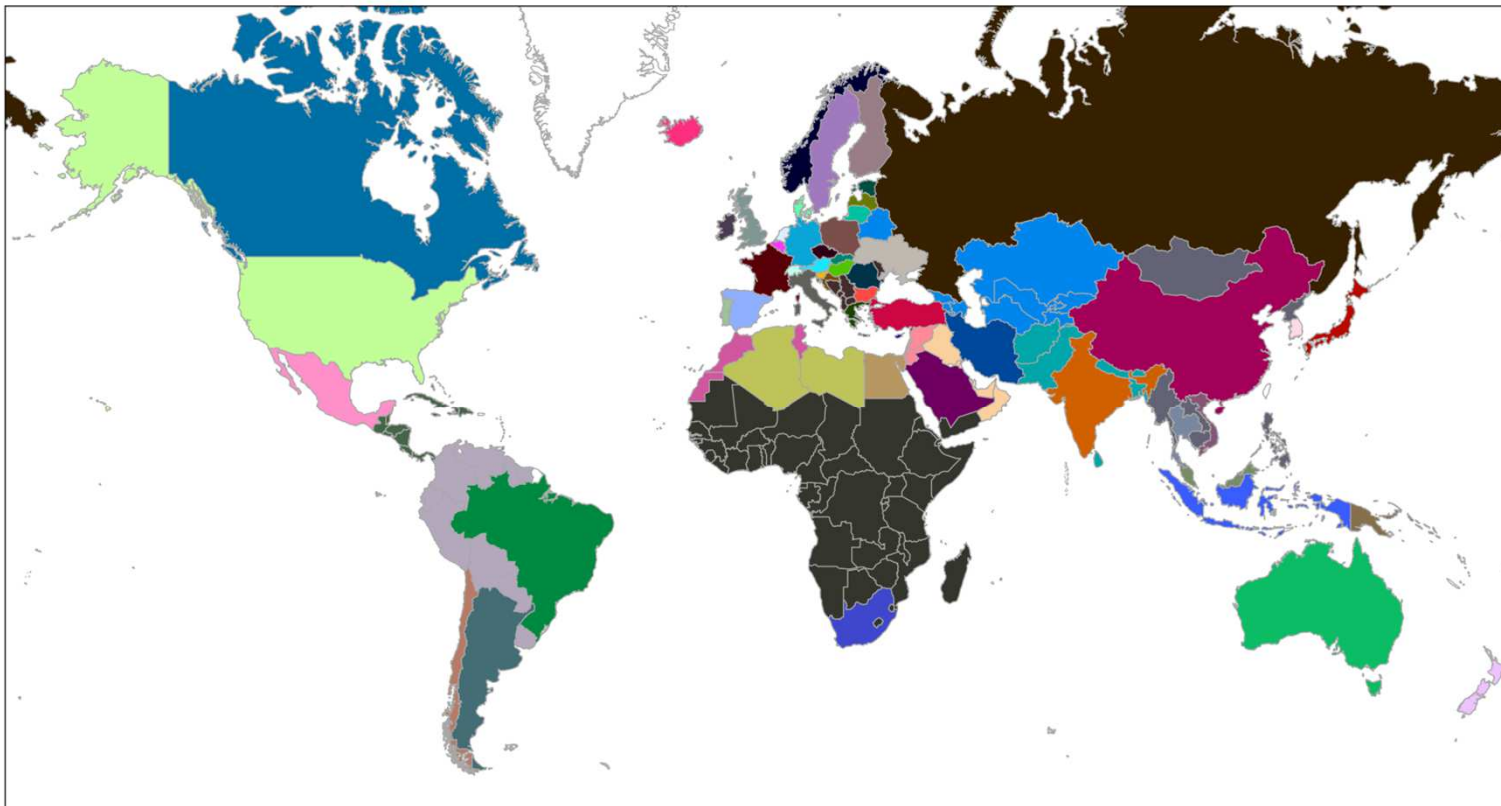
# Regional detail of the analysis

39 regional entities covering the world:

EU28

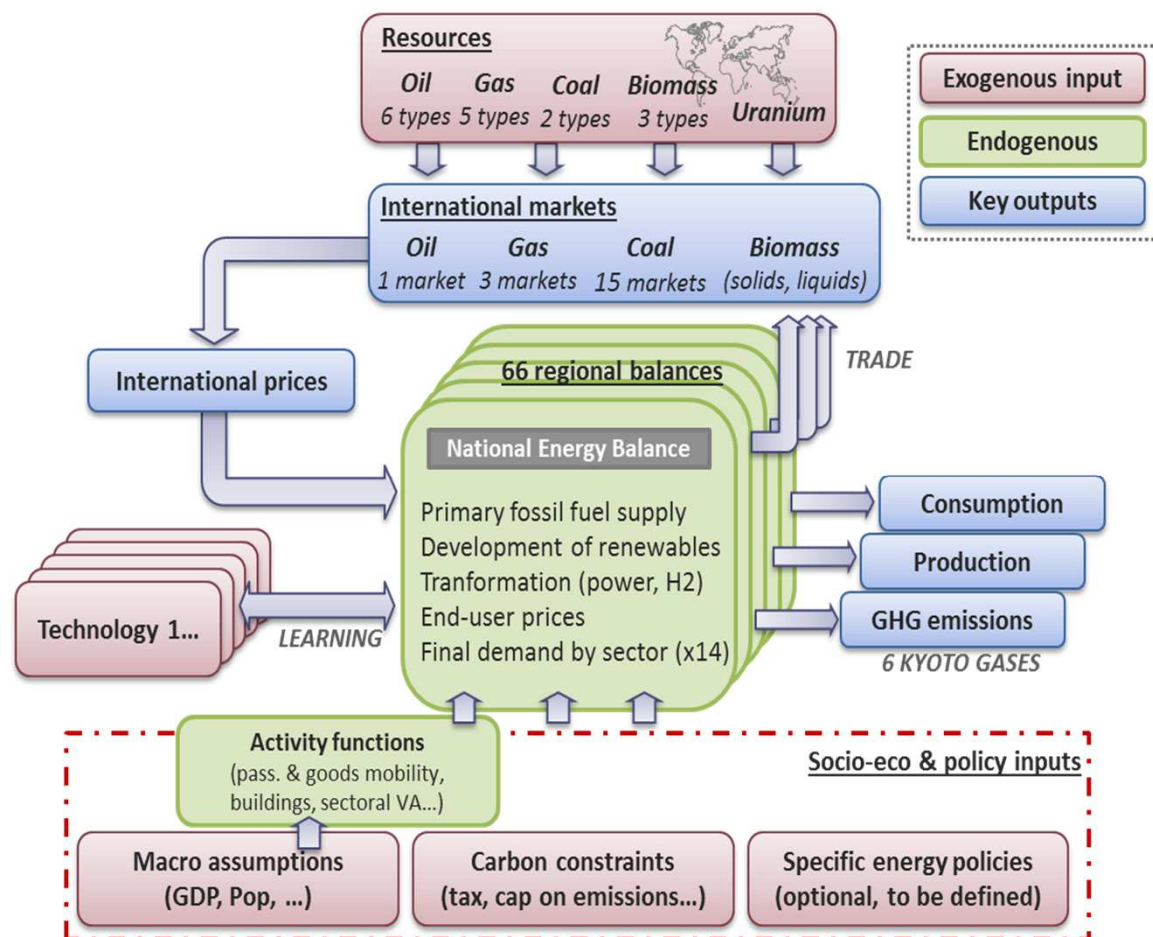
26 non-EU countries: detailed OECD, G20, emerging Asia

12 non-EU regions



# International energy & climate policy

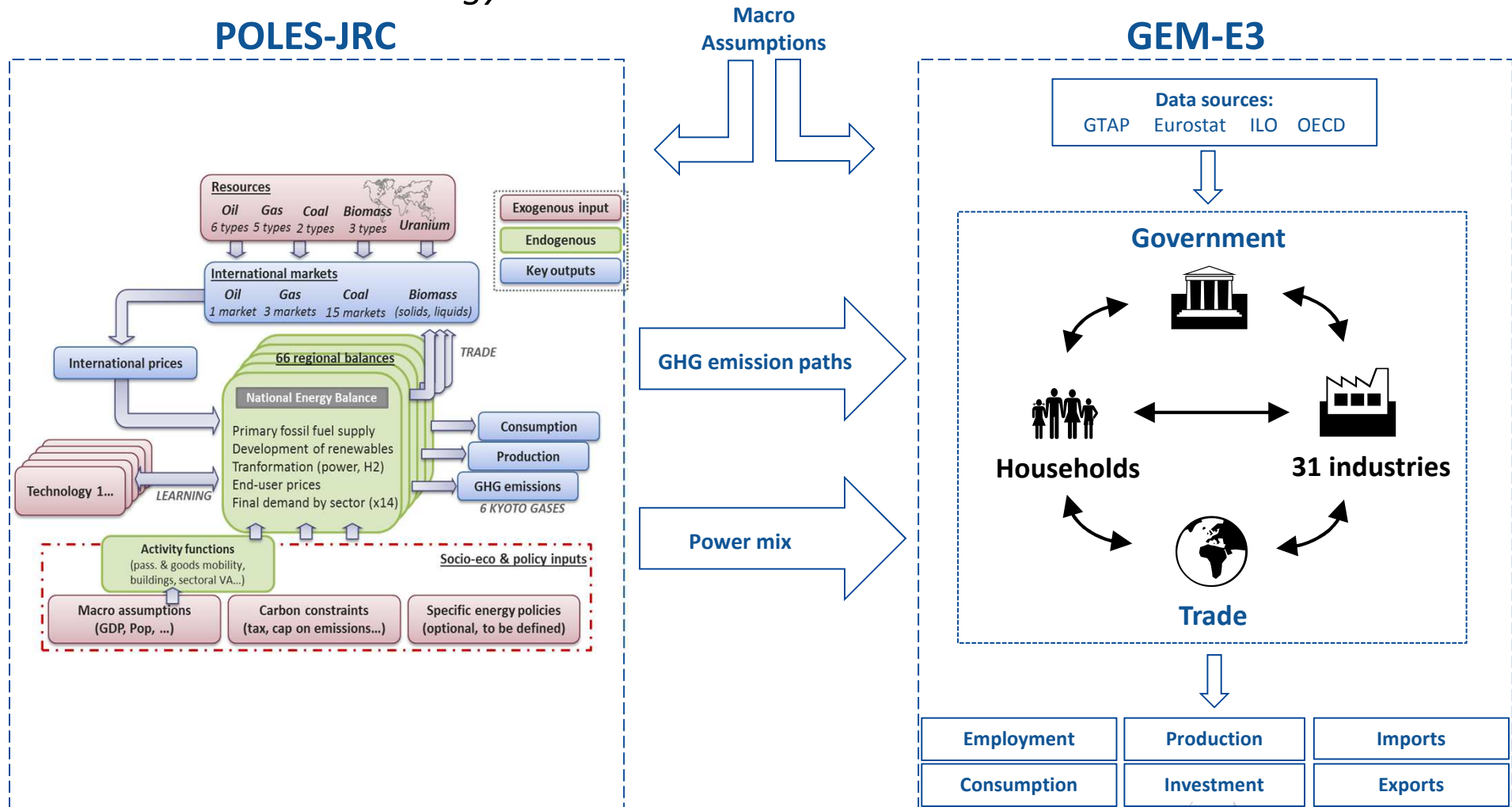
## POLES-JRC model



- Yearly simulation, recursive dynamics
- Core energy system
- Covers all GHGs:
  - Energy & industry
  - Agriculture (*GLOBIOM*)
  - LULUCF (*GLOBIOM*)

# Global Energy & Climate Outlook Modelling framework

*Energy + macroeconomic models interaction*



# Key outputs of GECO

## International energy & climate policy impacts on:

POLES-JRC model

- Energy production, consumption and trade
- Energy and carbon prices
- Greenhouse gases emissions
- Investment in the energy sector

GEM-E3 model

- Economic activity
- Employment

# Scenarios and Policies

## "No Policy"

→ only income & price driven

## "Reference"

List of energy & GHG policies by 2020

## "INDCs" (low: unconditional / high: conditional)

2020: at least Reference policies

2025/2030: List of GHG policies

2030+: extended effort to maintain global average GHG intensity decrease

## "2°C"

2030: - at least "INDC high" / more ambitious

- convergence of climate effort to EU level, except for LDCs

2050: - cumulated CO<sub>2</sub> 2010-2050 < 1200 GtCO<sub>2</sub>

- GHG 2050 < -50% 1990 level (*excl. sinks*)

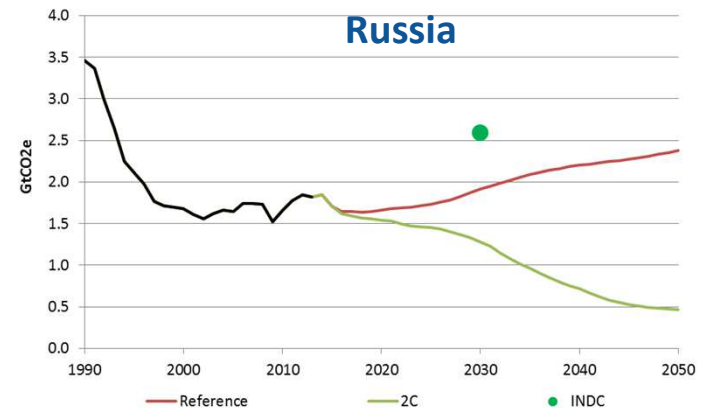
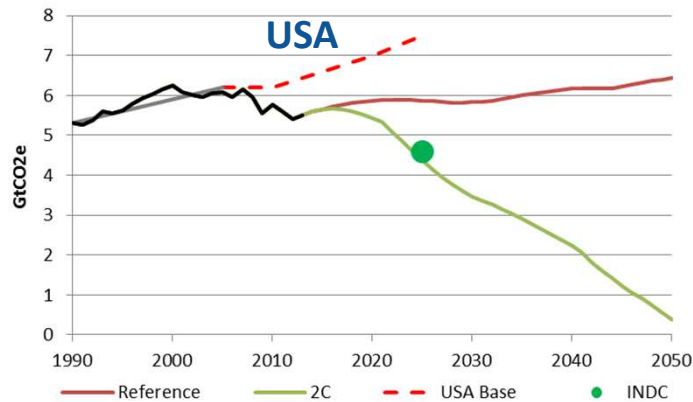
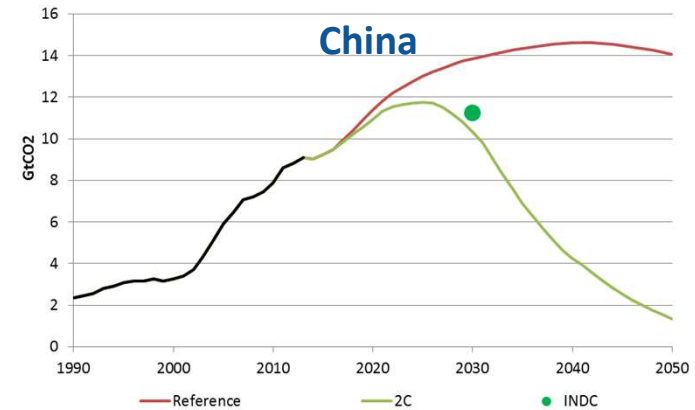
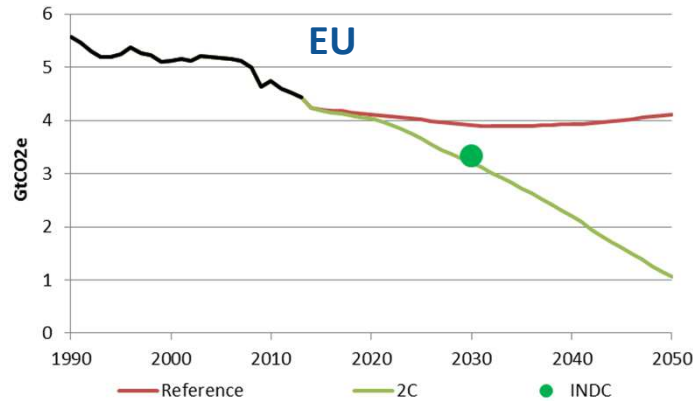
} IPCC recommended levels



# INDCs & GECO

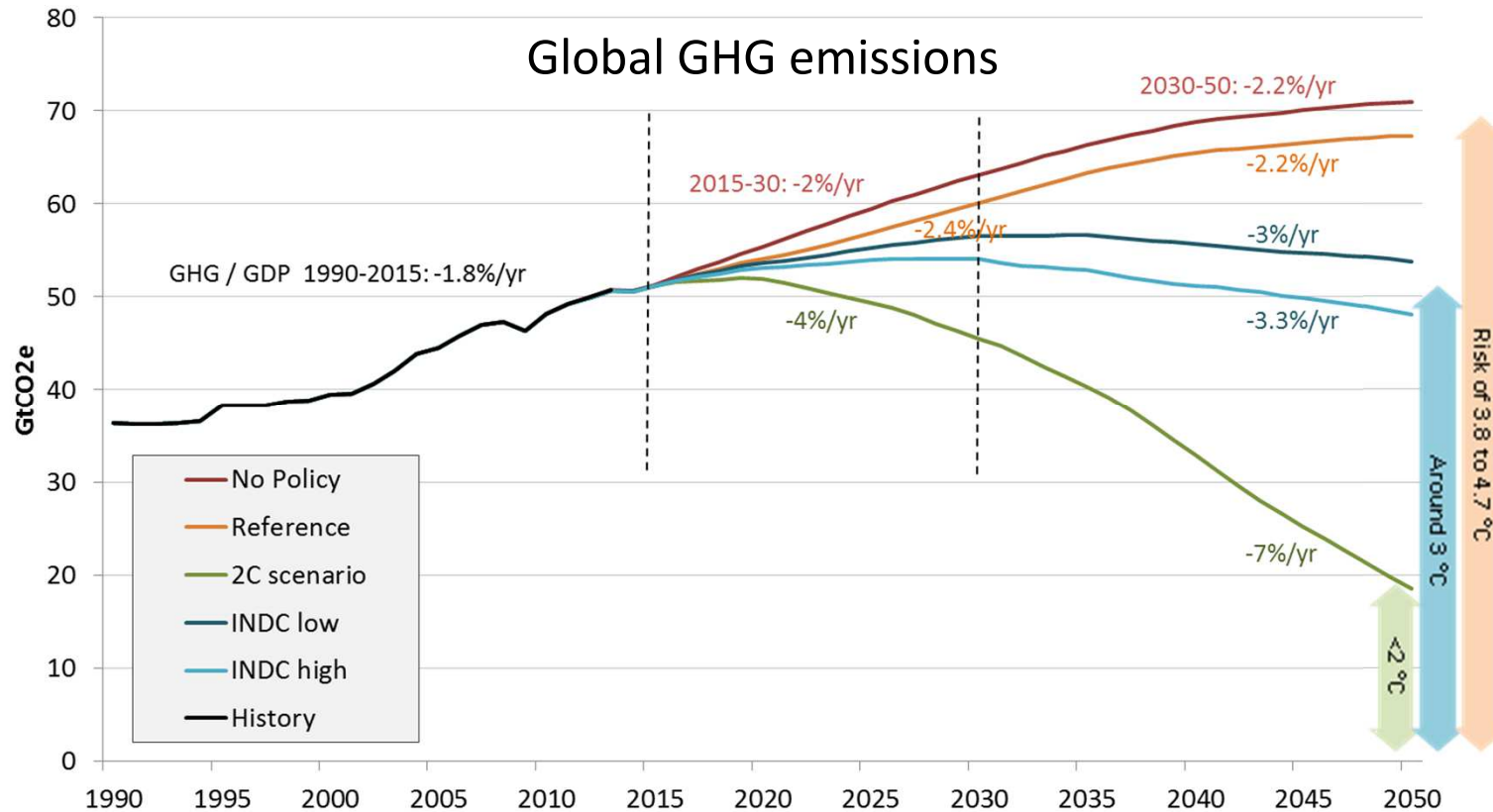
Sample INDCs:

Party	Gases coverage	Sectors	INDC "low"/ unconditional	INDC "high"/ conditional	Metric used	Base year
EU	All GHGs	All sectors	-40%		Emissions	1990
USA	All GHGs	All sectors	-26%	-28%	Emissions	2005
China	CO2	Energy	-60%	-65%	CO2 intensity	2005
Russian Federation	All GHGs	All sectors	-25%	-30%	Emissions	1990
India	All GHGs	All sectors	-33%	-35%	GHG intensity	2005





# Framing scenarios and INDCs



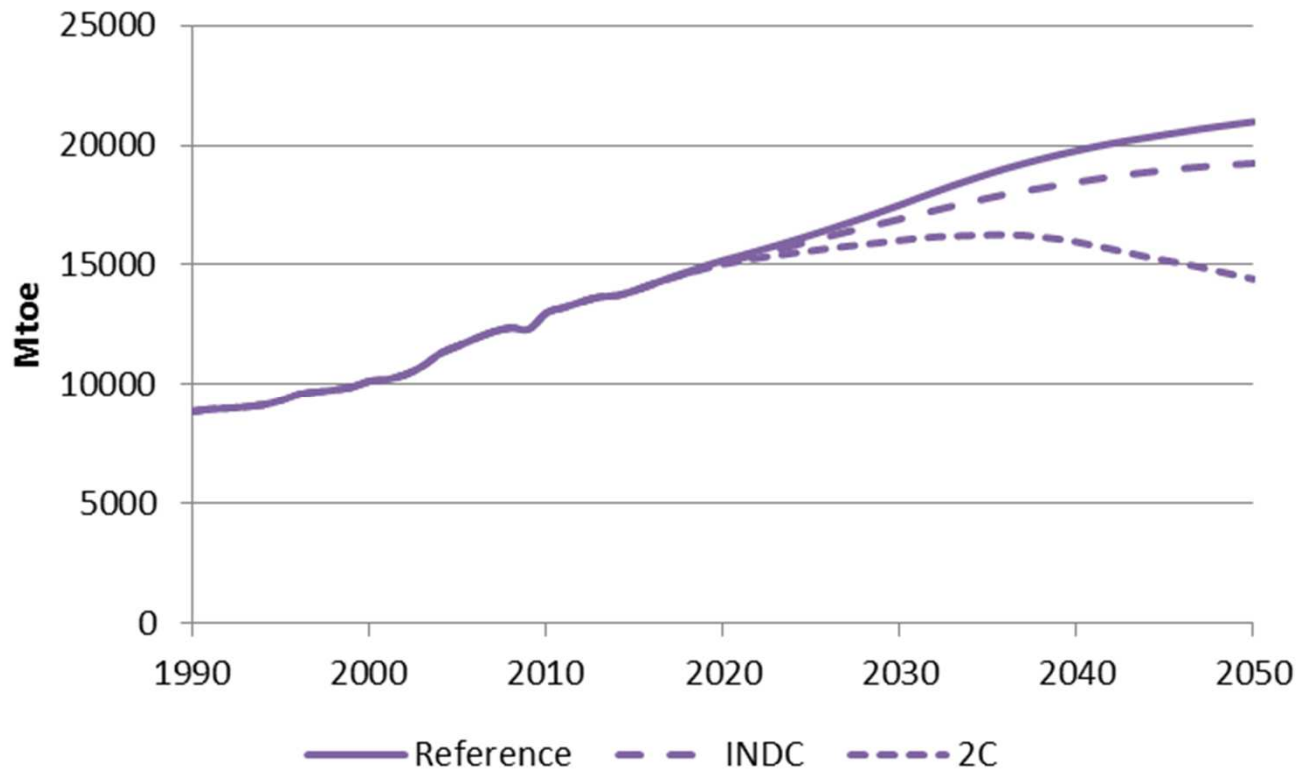
Source: POLES-JRC; [Policy Brief on INDCs analysis](#)

- INDCs effect:
  - limiting emissions to + 12-17% w.r.t 2010 (vs. +25% in Reference)
  - Half the reductions in INDCs come from the power sector
- 2°C scenario:
  - energy efficiency doubled/tripled vs. history
  - Further decarbonization of the power sector

# Impact on the energy system

- Energy demand
- Power sector
- Emissions

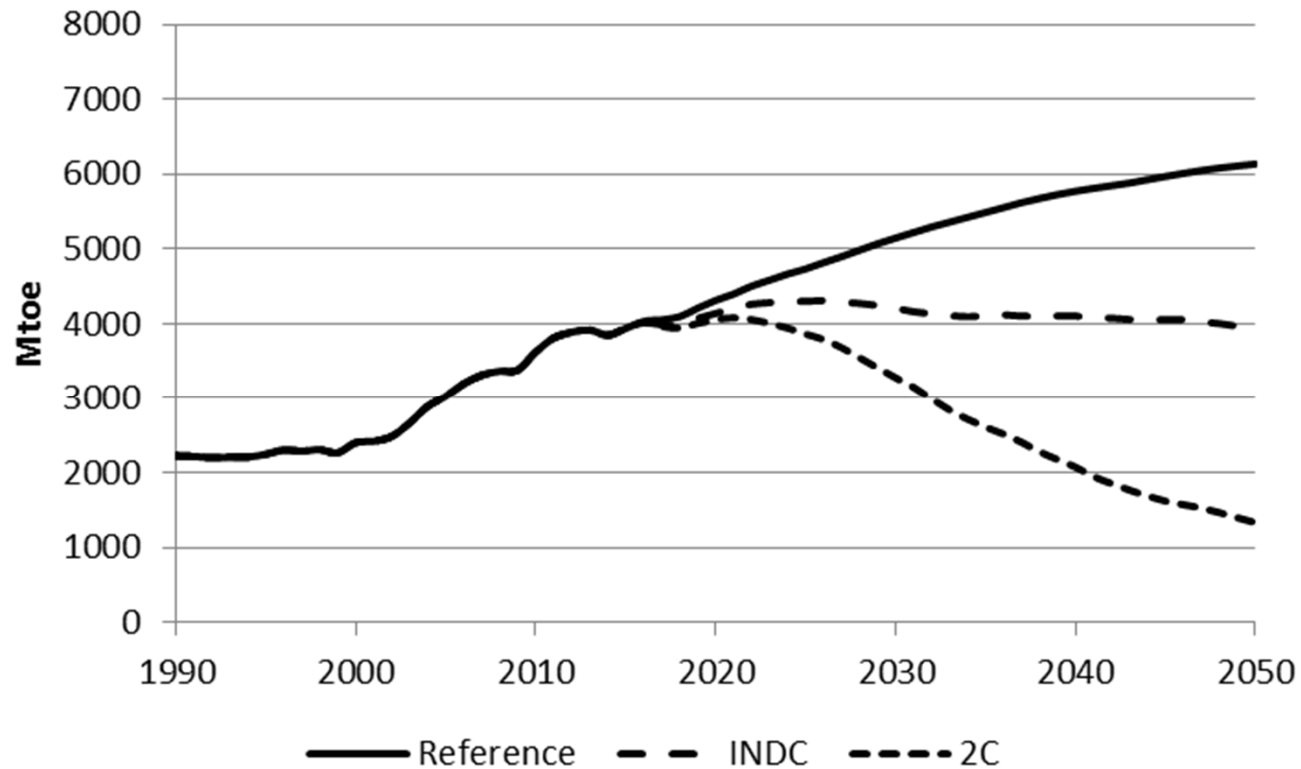
# Primary world energy demand



-> INDC: energy demand somewhat lower

-> 2°C case: change of trend from 2020, demand peaks in 2035

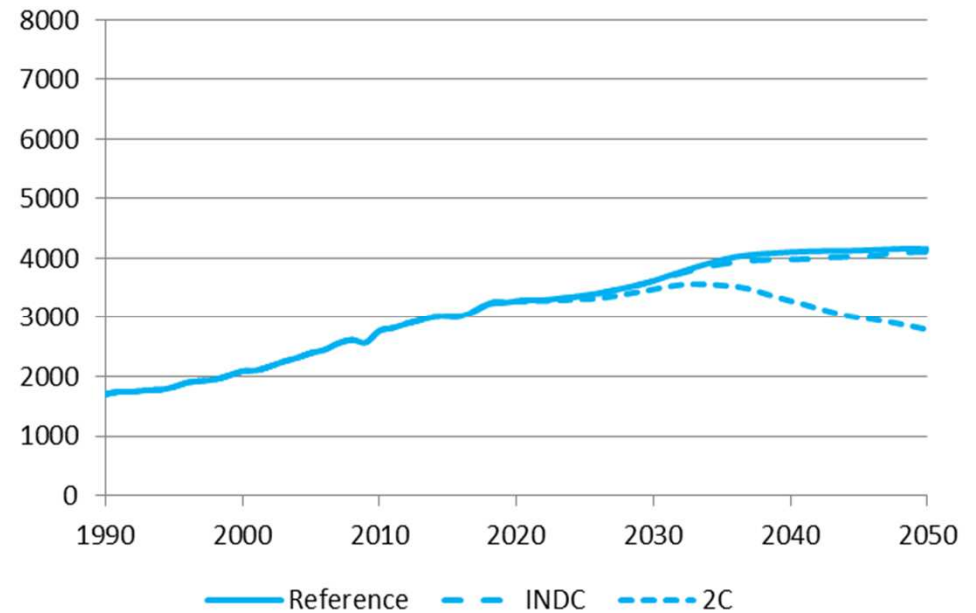
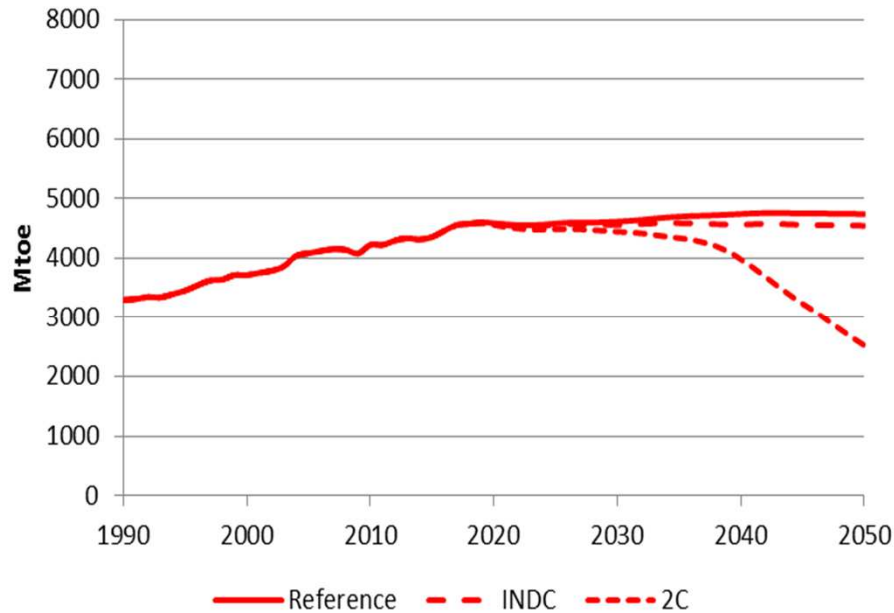
# World coal demand



-> INDC: coal demand plateaus from 2020 onwards (China's INDC)

-> Going to the 2°C case requires a sharp reduction of coal use (even with CCS)

# World oil and gas demand

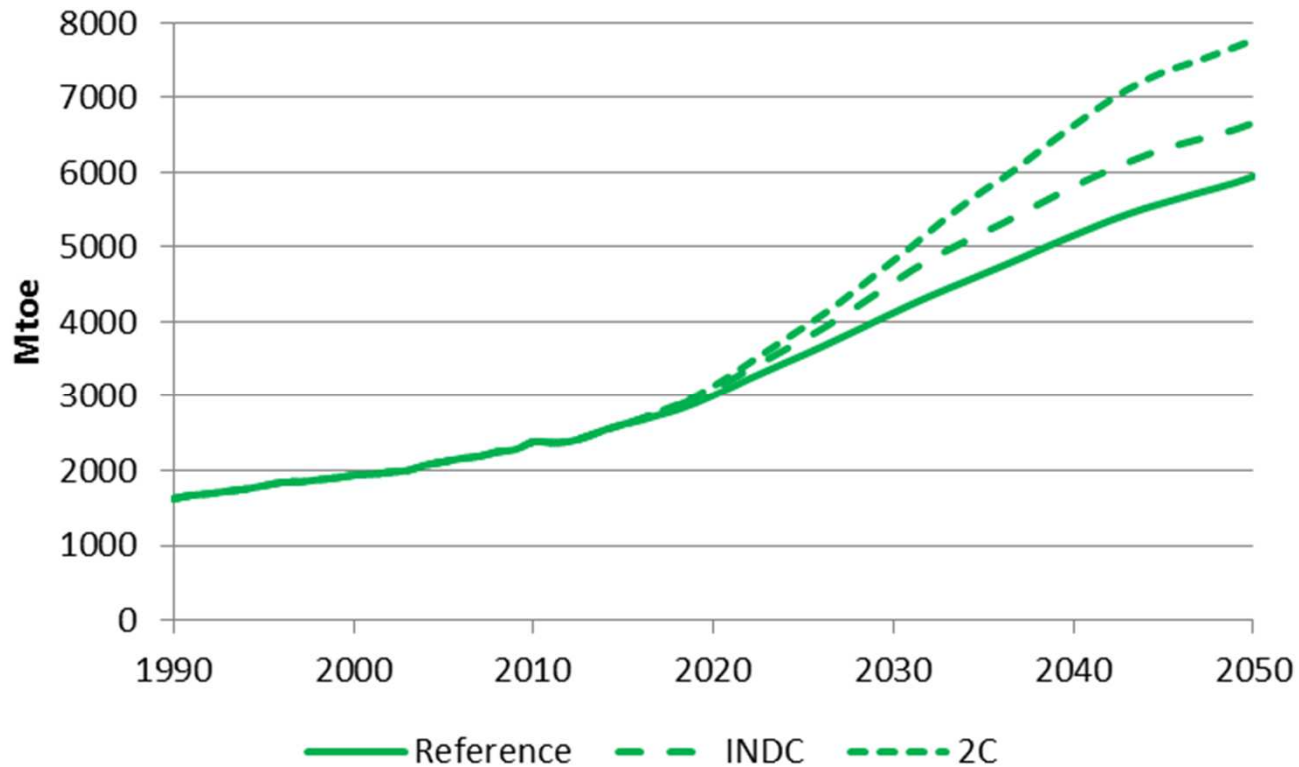


-> Little impact of INDCs on oil demand

-> However, going to the 2°C case will affect significantly the oil market beyond 2030

-> 2°C case will reduce the gas market by 2050 back to current levels (CCS)

# World non-fossil energy

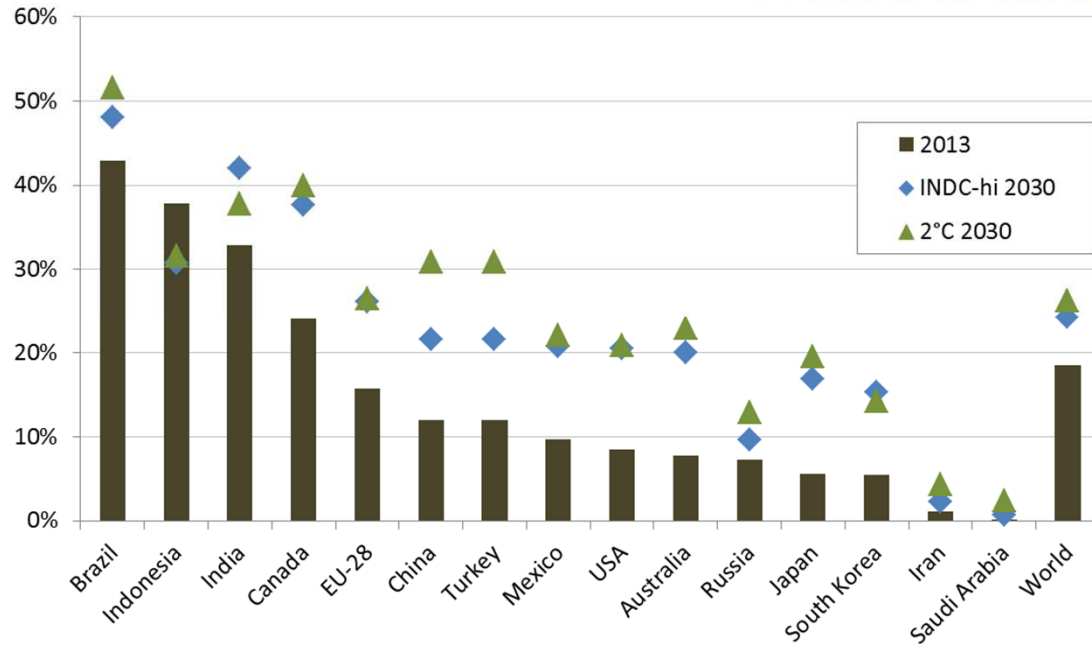


-> Mostly renewables (nuclear: 1- 2 Gtoe), already high in the Reference

-> INDCs positive effect, n°1 “fuel” by 2030

-> more than 50% of demand in 2°C by 2050

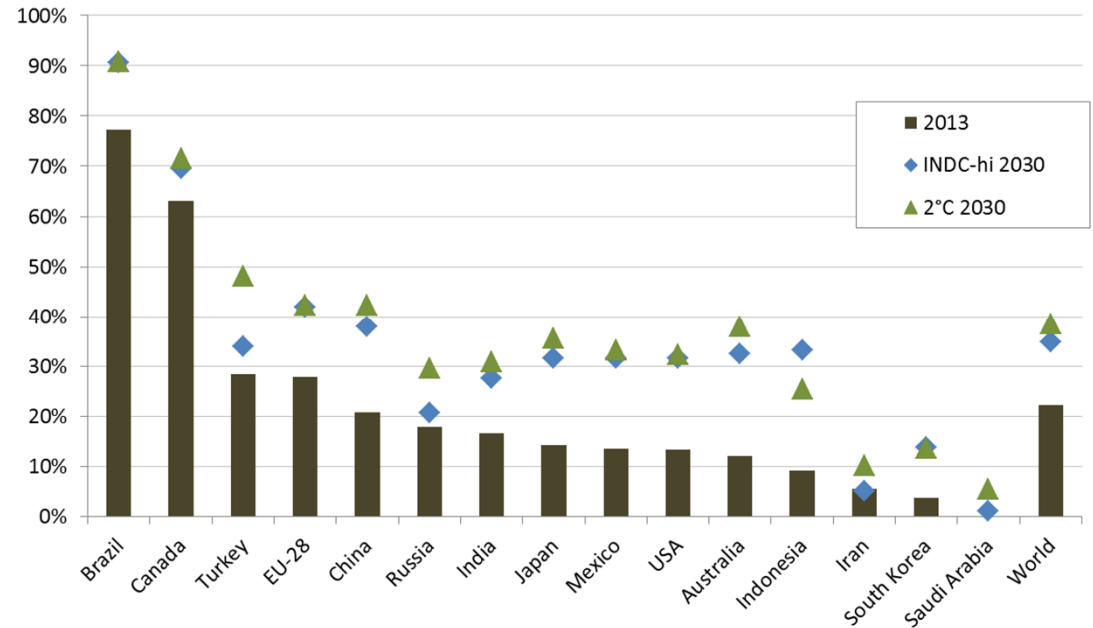
# Renewables



## Share in Final Energy

*Includes large hydro & traditional biomass*

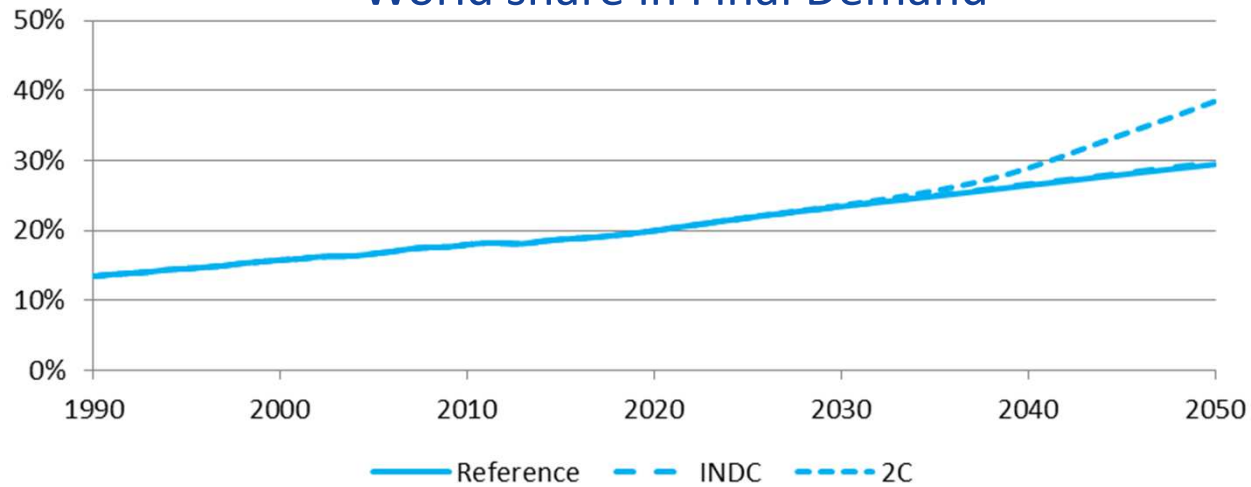
## Share in Power Production



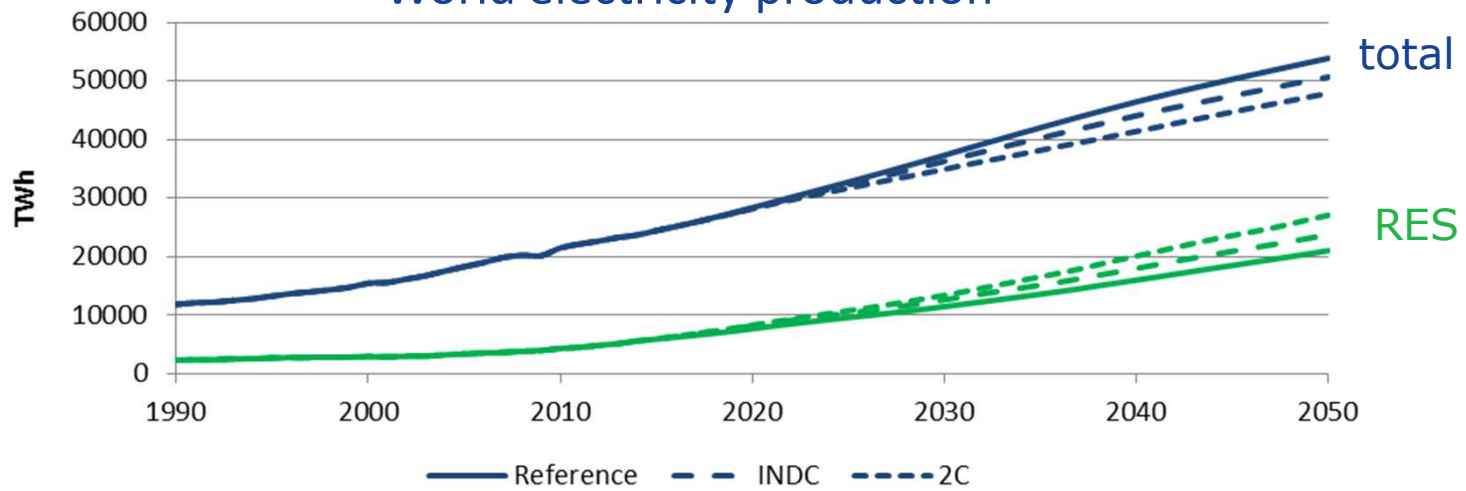


# Electricity

## World share in Final Demand

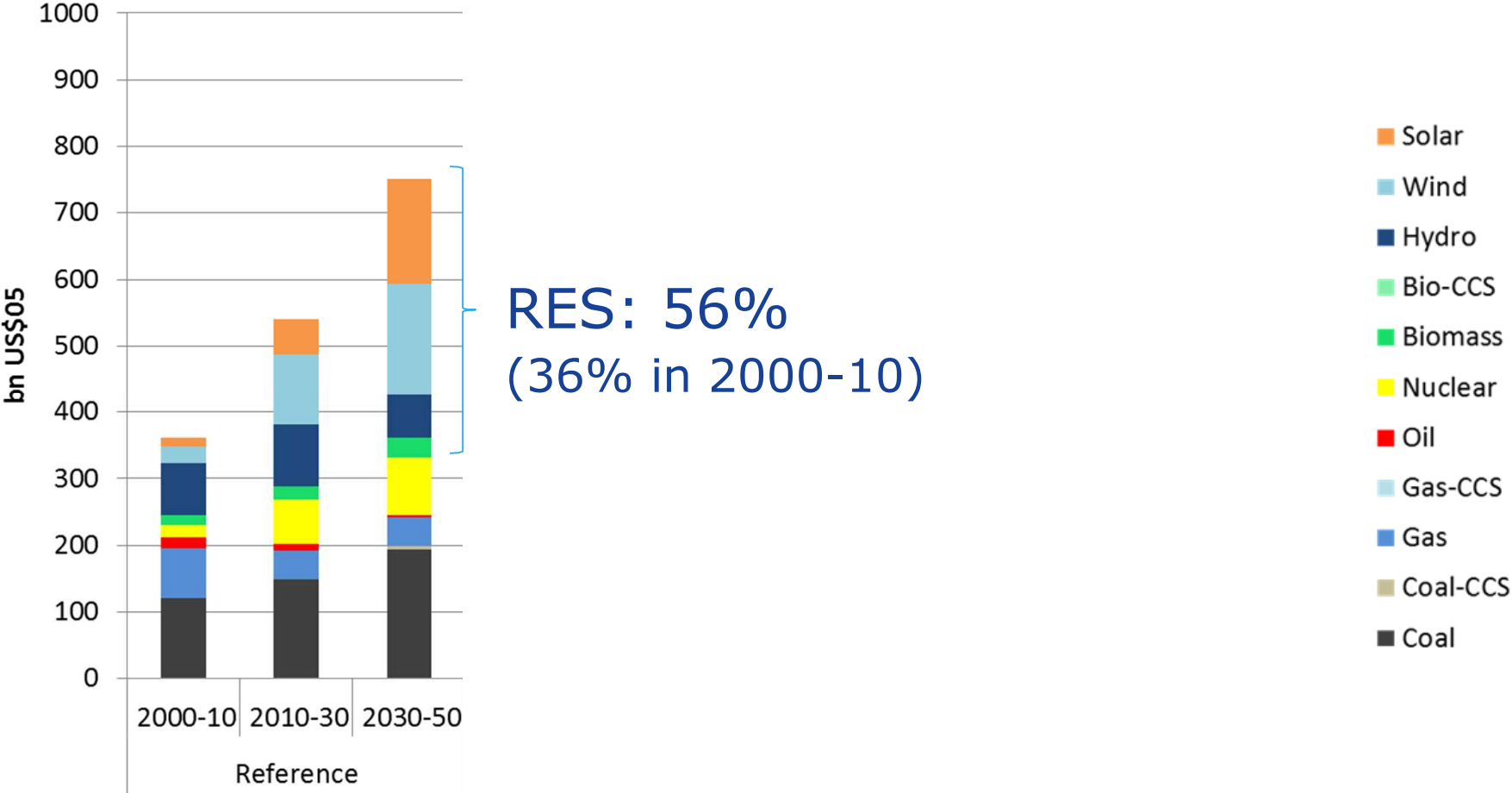


## World electricity production



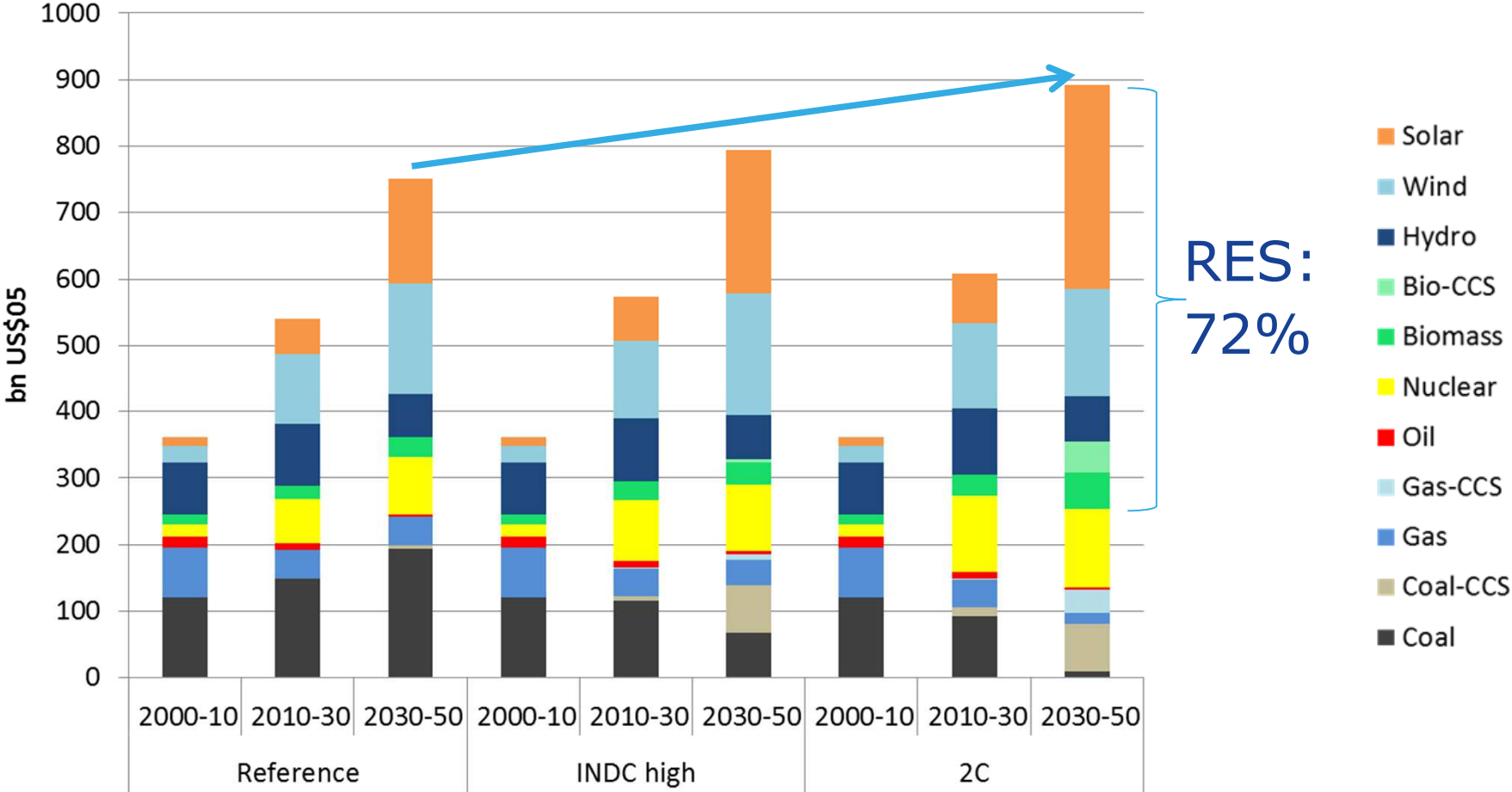
# Investments – power sector

*World, average yearly investment*



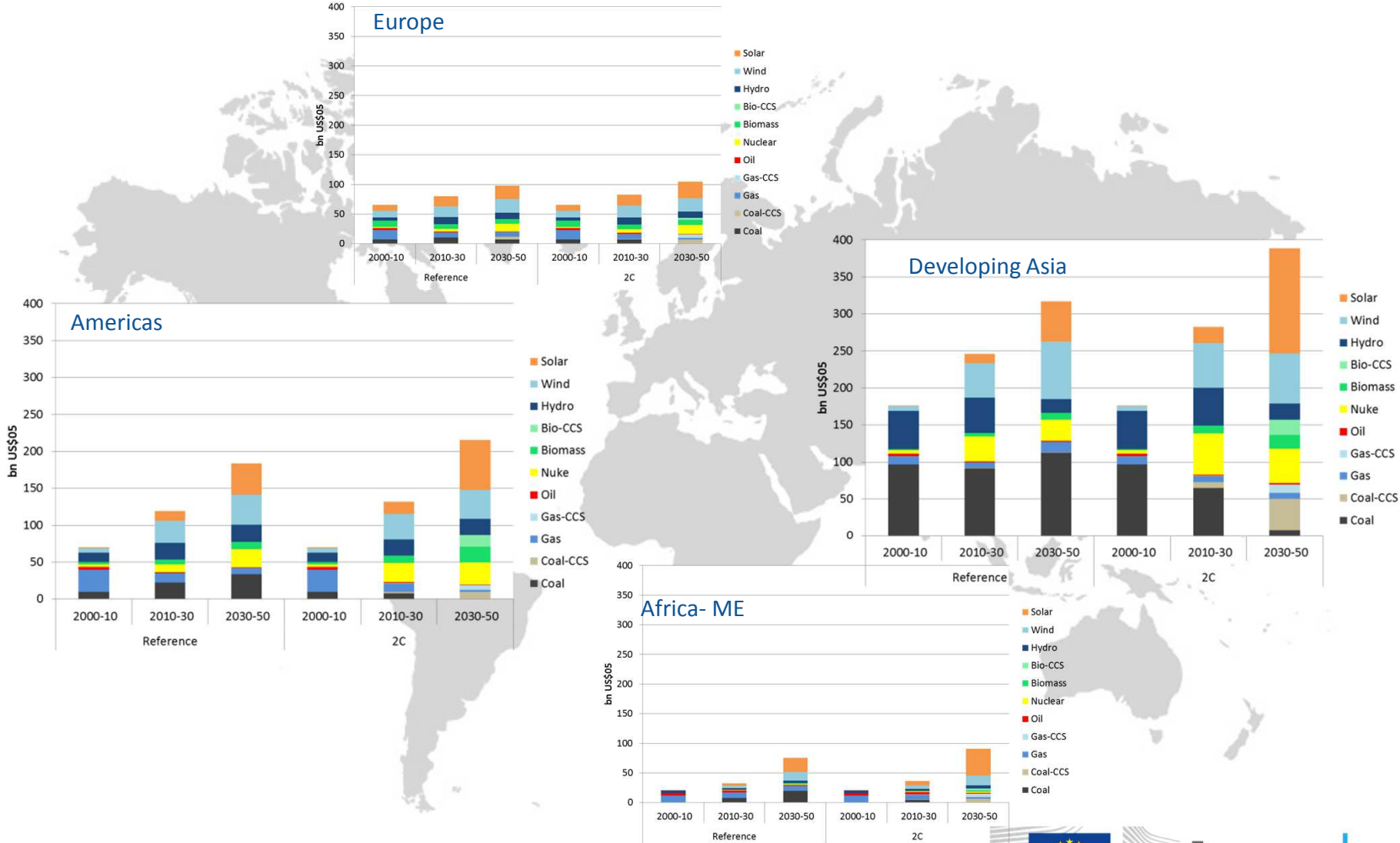
# Investments – power sector

World, average yearly investment

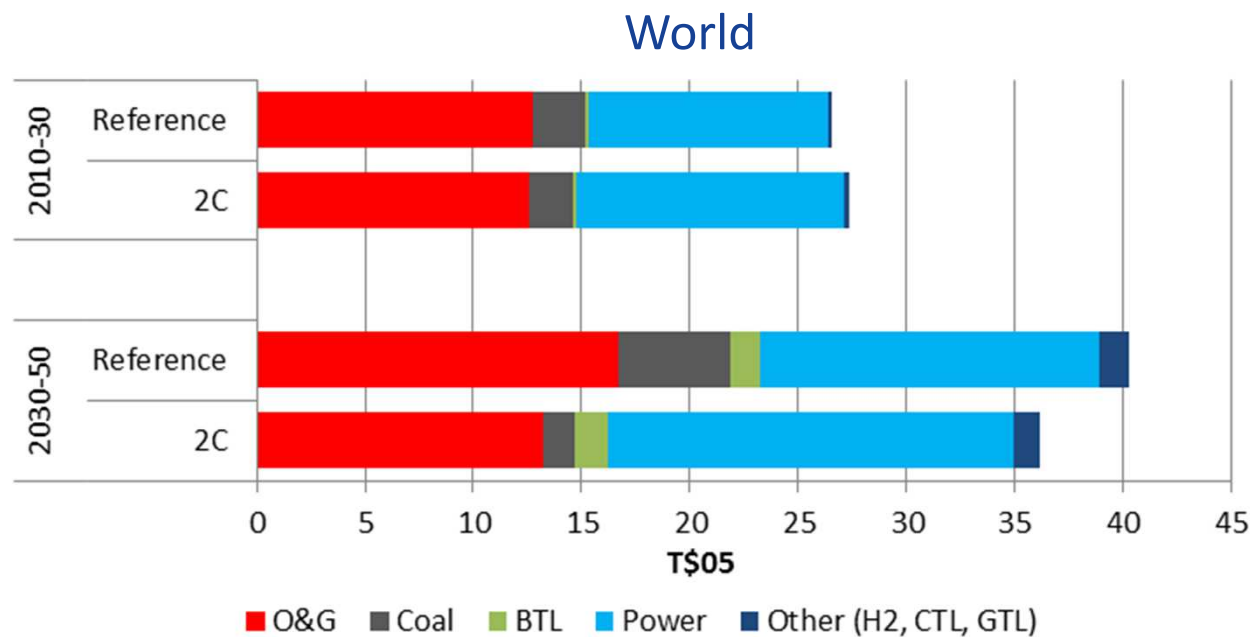


# Investments – power sector

## Yearly investments



# Investments in energy supply

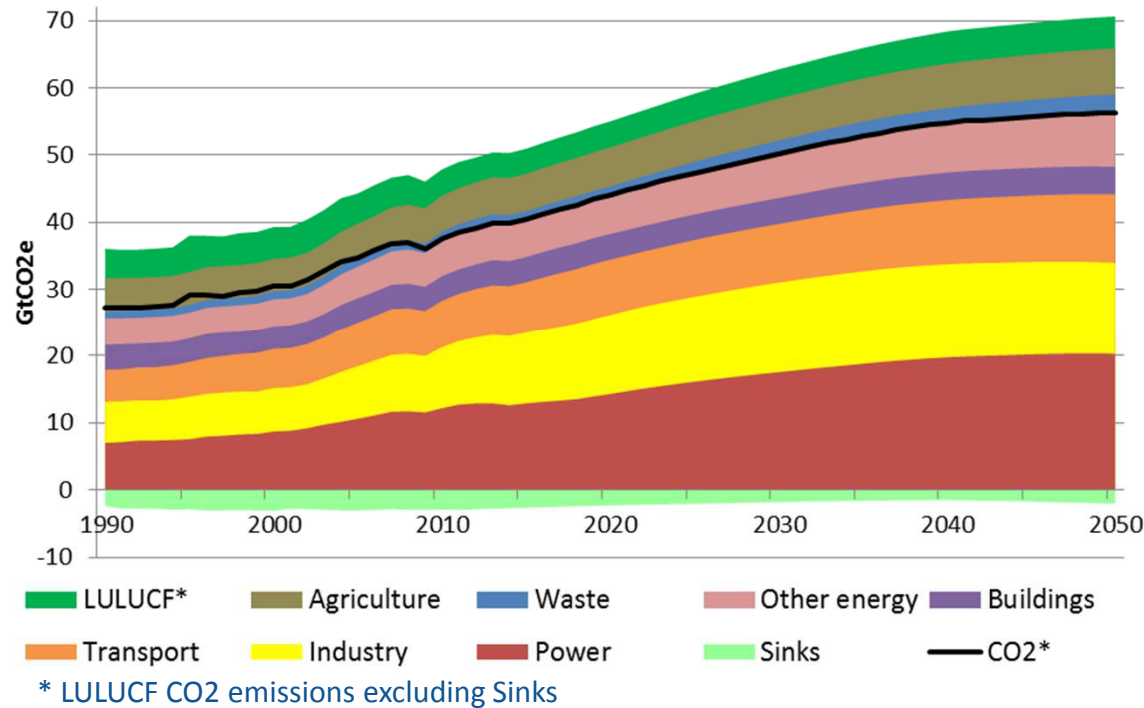


2°C vs. Reference:

- more in electricity, less in O&G, much less in coal
- more total investments by 2030, less by 2050

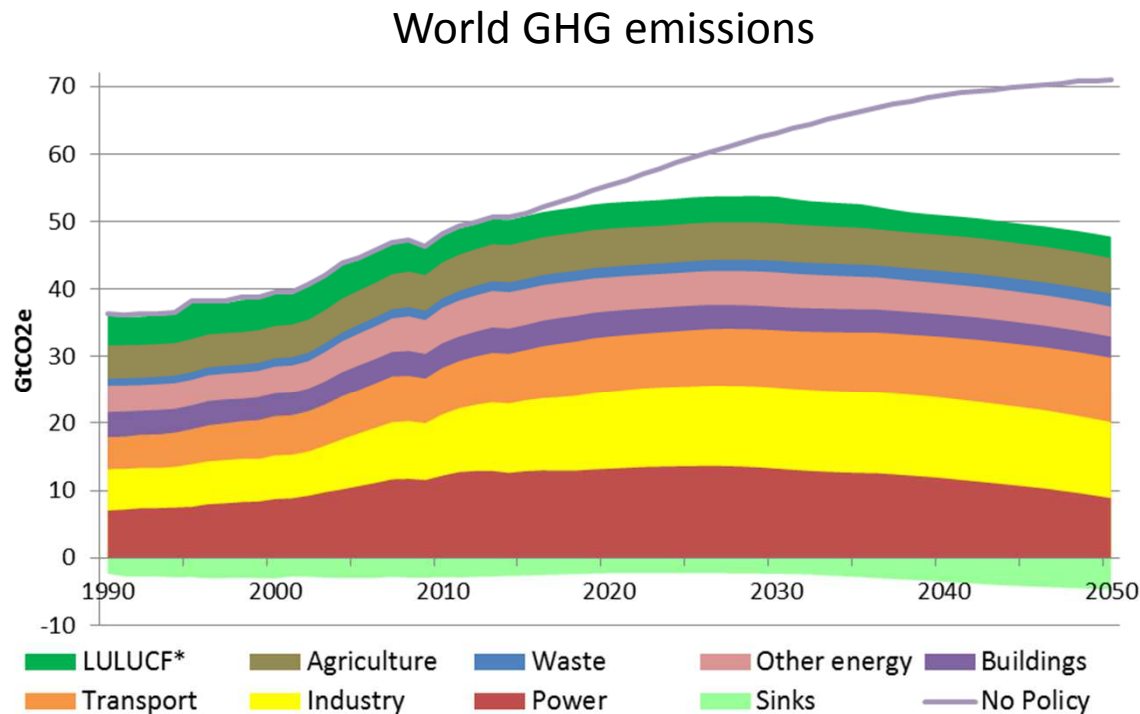
# Emissions – No Policy

World GHG emissions



- Emissions grow +45% in 2050 vs 2010
- Energy efficiency improves (economy x2, energy +37% by 2030)
- Carbon content of energy roughly stable
- No emissions peak yet by 2050
- Towards +4°C

# Emissions – INDC

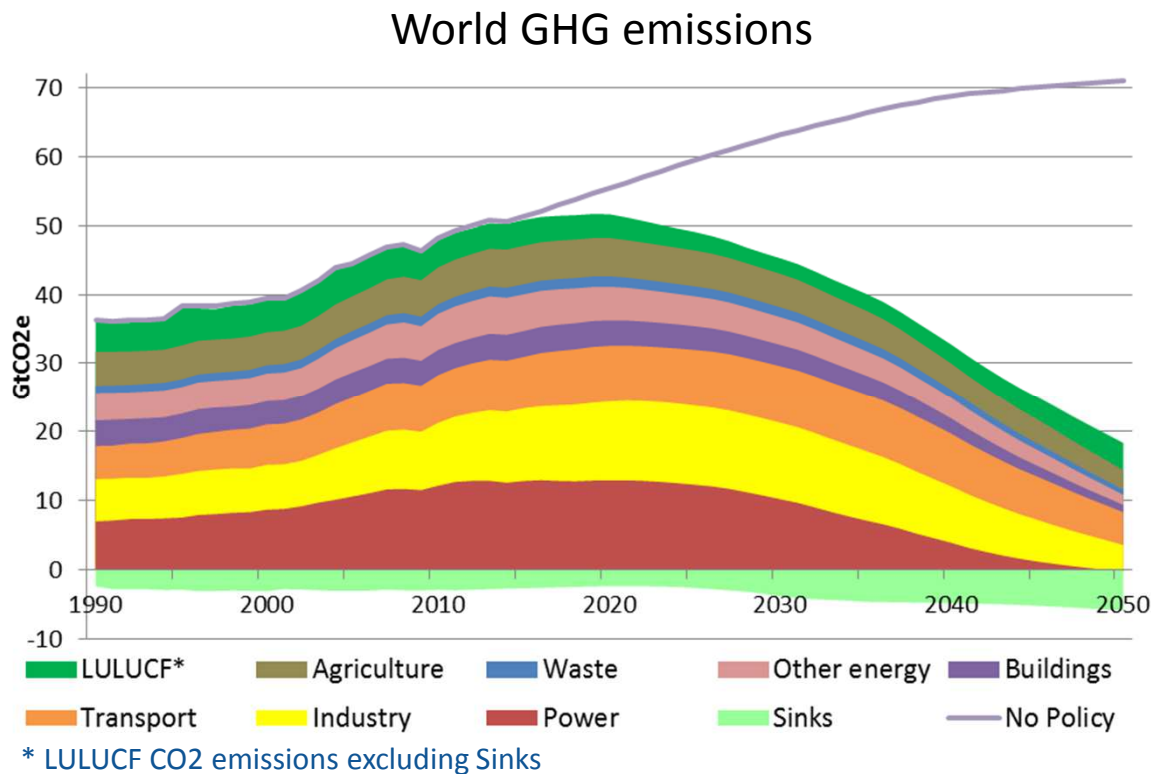


\* LULUCF CO2 emissions excluding Sinks

- Emissions plateau in 2030, recover 2010 levels in 2050
- Energy efficiency accelerated (economy x2, energy +30% by 2030 vs. +37% in No Policy)
- Carbon content decreases by -13% by 2030
- Towards around +3°C

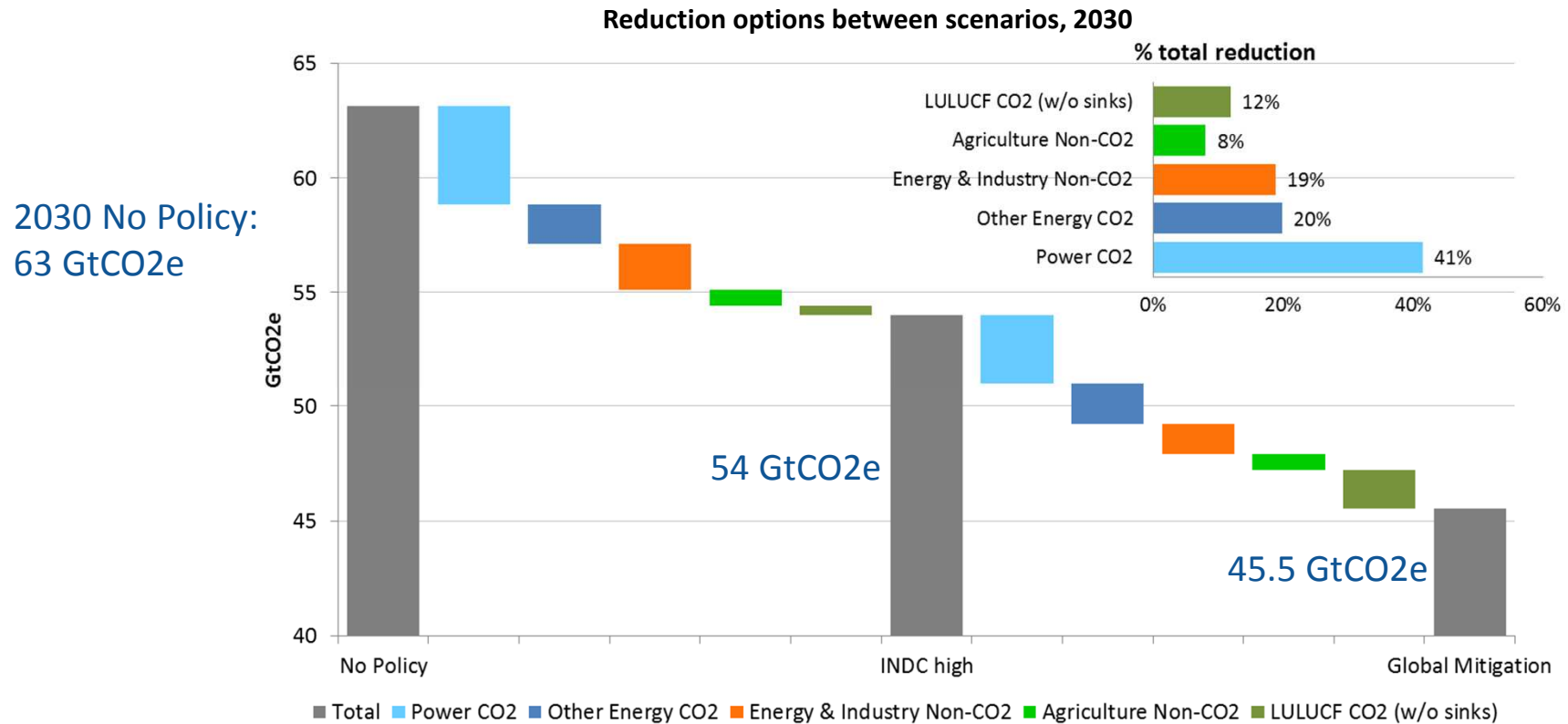


# Emissions - 2°C scenarios



- Emissions peak in 2020, decrease to -60% in 2050 vs 2010
- Increased energy efficiency (economy x2, energy +25% by 2030)
- Carbon content significantly decreases (-24% in 2030 vs 2010)
- Compatible with a <2°C increase

# Mitigation options



INDCs effect:

- Limiting emissions to + 12-17% w.r.t 2010
- Half the reductions from the power sector (limit coal, REN)

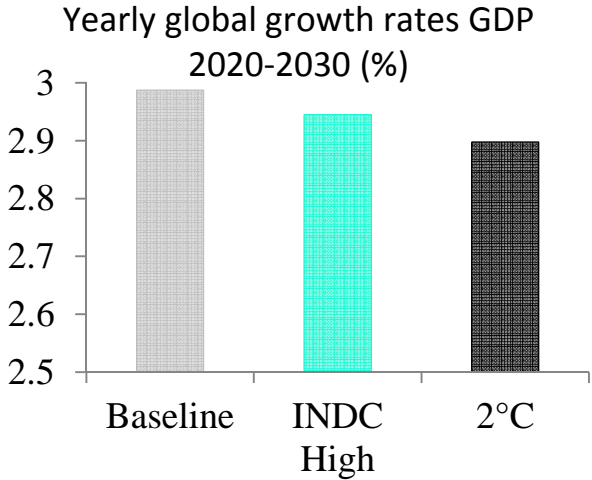
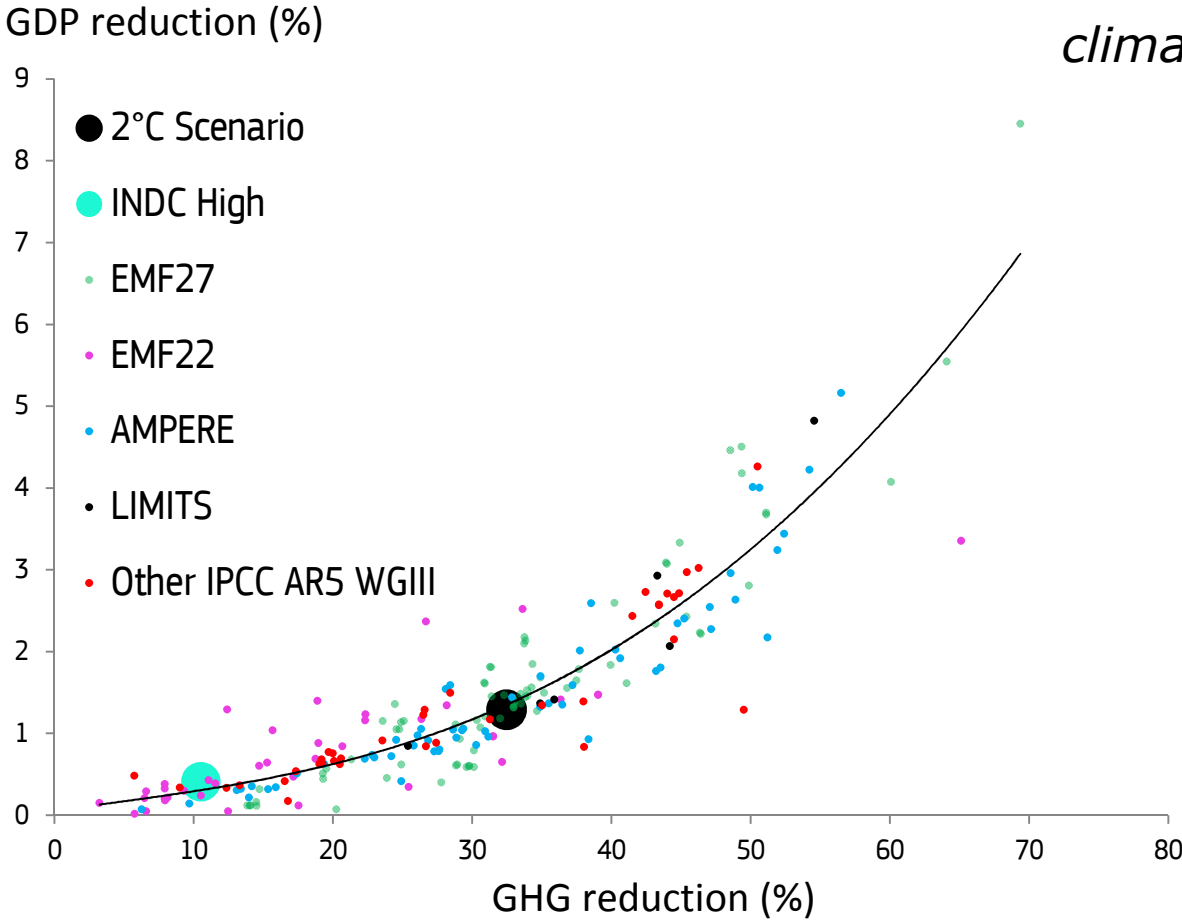
2°C scenario:

- E&I CO<sub>2</sub> = 60% total reductions: power + efficiency *all* sectors
- E&I non-CO<sub>2</sub>: 20% total
- AFOLU: 20% total

# GECCO 2°C & INDC analysis: mitigation costs

2030 – Relative to Baseline

*Caveat: does not consider climate impact costs!*



# Q&A

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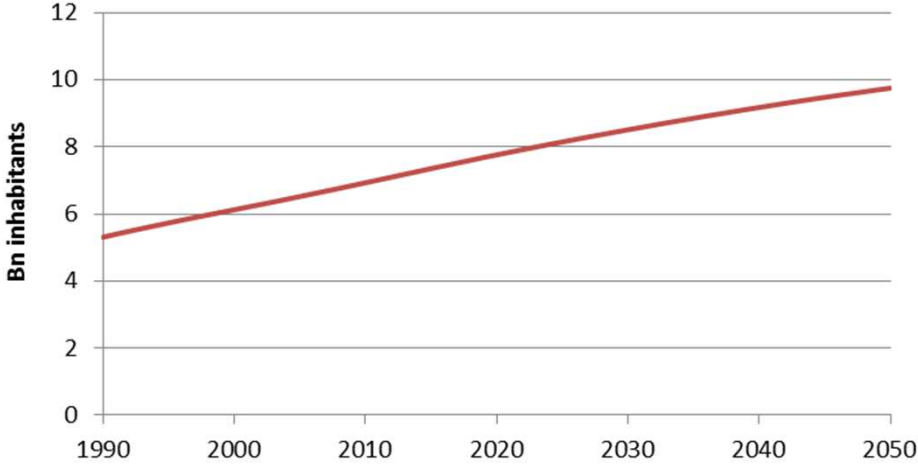


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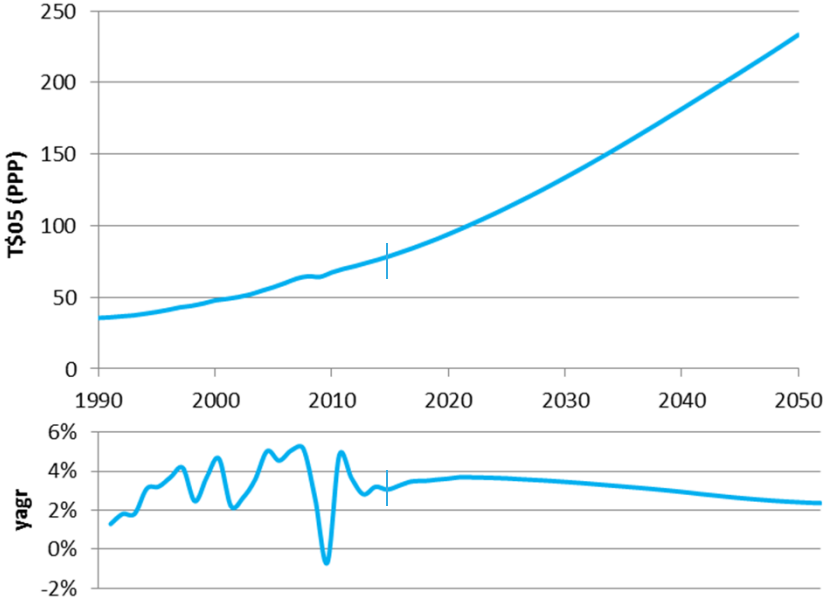
# Supplementary material

# Macro assumptions

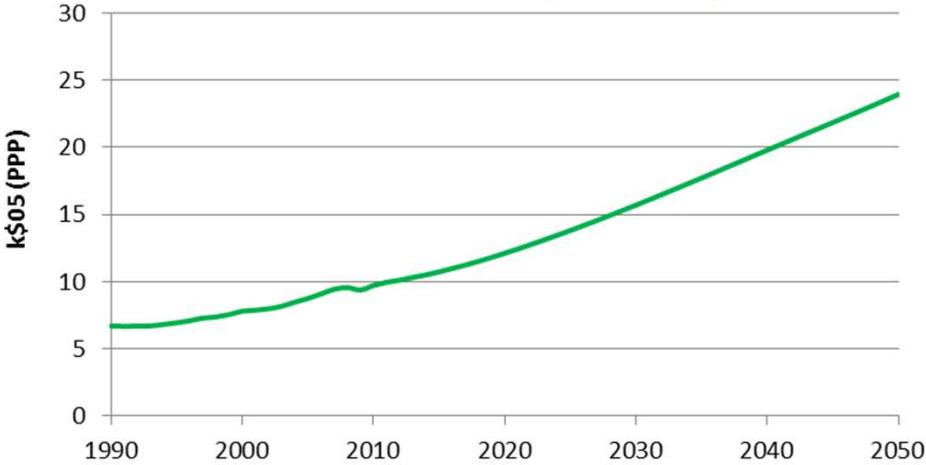
## World population



## World GDP



## World GDP per capita



Sources: most recent from:  
*Population: UN, Ageing Report (EU)*  
*GDP historical: WB*  
*GDP projections: IMF, OECD, Ageing Report (EU)*