

# CLIMATE SCENARIOS FOR DEVELOPING AND DEVELOPED COUNTRIES: A PROSPECTIVE ANALYSIS WITH TIAM-FR

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au service du développement durable



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# Objectives of the study



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Objectives

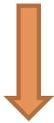
TIAM-FR and Scenarios

Results

Conclusion

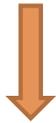
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- **Effectiveness of climate policy**
  - Will promised emissions reductions be sufficient?
  - Will a wider participation be required?

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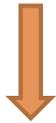
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### **□ Evolution of the energy system**

- What will be the future energy mix?
- What technological choices?

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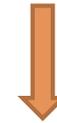
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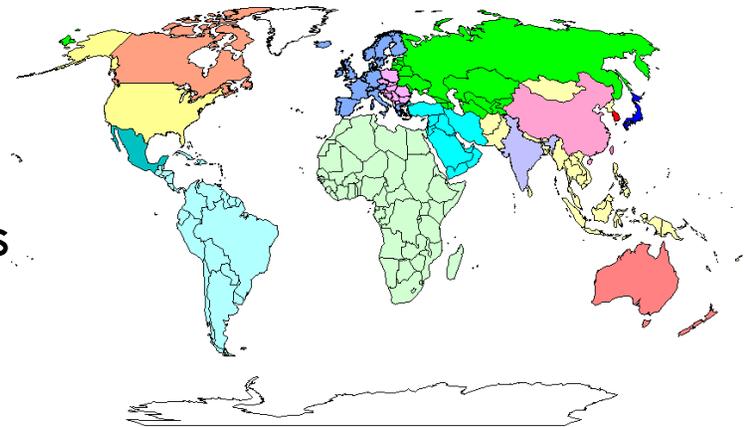


### **□ Developed and developing countries perspectives**

- What shares of contribution?

# Model: TIAM-FR

- TIMES Integrated Assessment Model developed by ETSAP (Energy Technology Systems Analysis Program) under the aegis of IEA
  - A linear programming model
- A technological detailed bottom-up energy system model
- A time horizon from 2005 to 2100
- A geographically integrated model  
in 15 world regions
- GHG emissions:
  - CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O
  - Carbon capture and sequestration and mitigation options for CH<sub>4</sub> and N<sub>2</sub>O
- An integrated climate module
  - Atmospheric GHG concentrations and temperature changes



# Specification of scenarios



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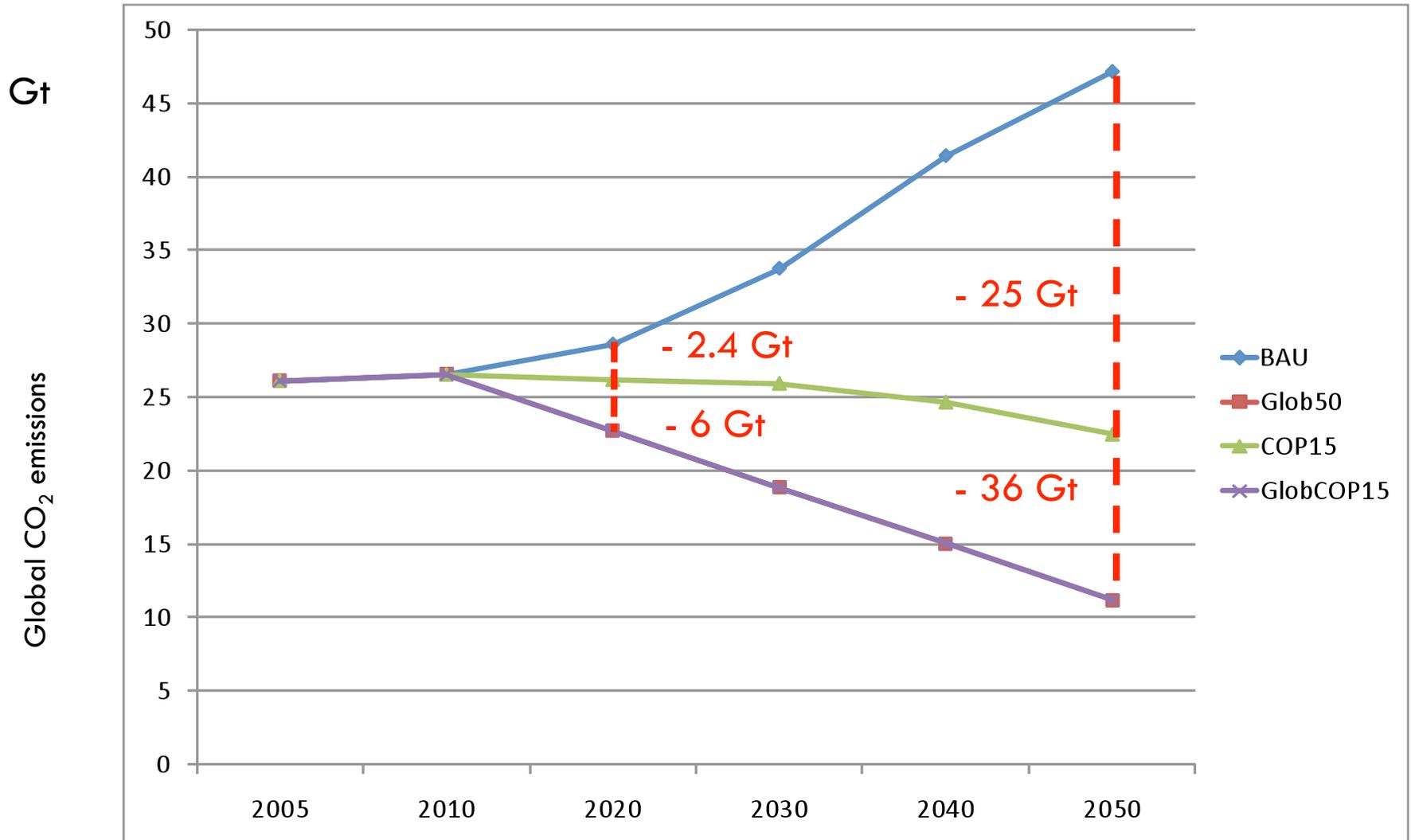
Conclusion

- A global 2050 target scenario in line with the consensual 2°C objective
  - **Glob50** – Limiting the world CO<sub>2</sub> emissions to 50% in 2050 by comparison with 2000
  
- A regional scenario considering post COP15 pledges in 2020 and assuming new targets for 2050
  - **COP15** – The lower CO<sub>2</sub> mitigation targets by 2020 expressed by Europe, the USA, Australia, Canada, Japan, China and India and assumptions in 2050 representing the international convergence in terms of mitigation
  
- A coupled regional and global scenario
  - **GlobCOP15** – COP15 coupled with Glob50



# Results

# Global CO<sub>2</sub> emissions (Gt CO<sub>2</sub>)



# CO<sub>2</sub> emissions (Gt CO<sub>2</sub>) and avoided CO<sub>2</sub> (by comparison with BAU)

Period	Scenario	World	
		CO2 level	Avoided CO2
2020	BAU	28,6	
	COP15	26,2	2,4
	Glob50	22,7	5,9
	GlobCOP15	22,7	5,9
2050	BAU	47,1	
	COP15	22,5	24,6
	Glob50	11,2	35,9
	GlobCOP15	11,2	35,9

- COP 15 pledges expressed here are not sufficient to reach the global UNFCCC objective
- Glob50 and GlobCOP15 follow the same trend at the world level

# Regional distribution of CO<sub>2</sub> emissions (Gt CO<sub>2</sub>) and avoided CO<sub>2</sub> (by comparison with BAU)



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Period	Scenario	Industrialized countries (AUS, CAN, EEU, JPN, USA, WEU)		Fast developing countries (CHI, IND)		Developing countries (AFR, CSA, FSU, MEA, MEX, ODA, SKO)	
		CO2 level	Avoided CO2	CO2 level	Avoided CO2	CO2 level	Avoided CO2
		2020	BAU	11,6		7,9	
COP15	9,5		2,1	7,5	0,4	9,2	-0,1
Glob50	10,1		1,6	6,5	1,4	6,2	2,9
GlobCOP15	9,4		2,2	6,9	1,0	6,3	2,8
2050	BAU	14,5		17,9		14,7	
	COP15	2,2	12,3	5,3	12,6	14,9	-0,2
	Glob50	3,2	11,3	4,7	13,2	3,3	11,4
	GlobCOP15	2,0	12,5	4,8	13,1	4,4	10,3

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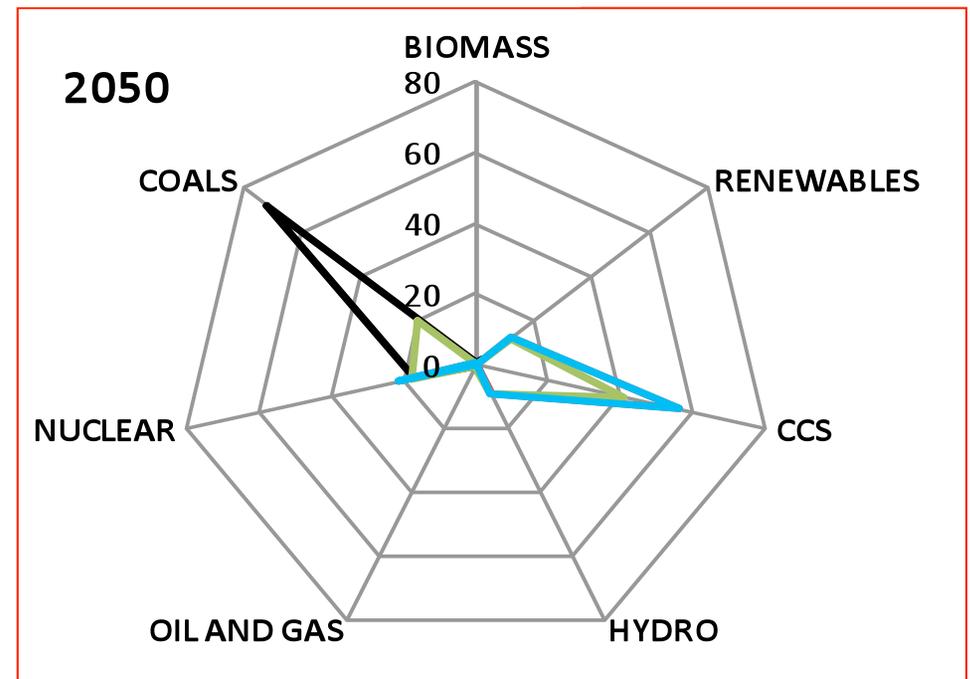
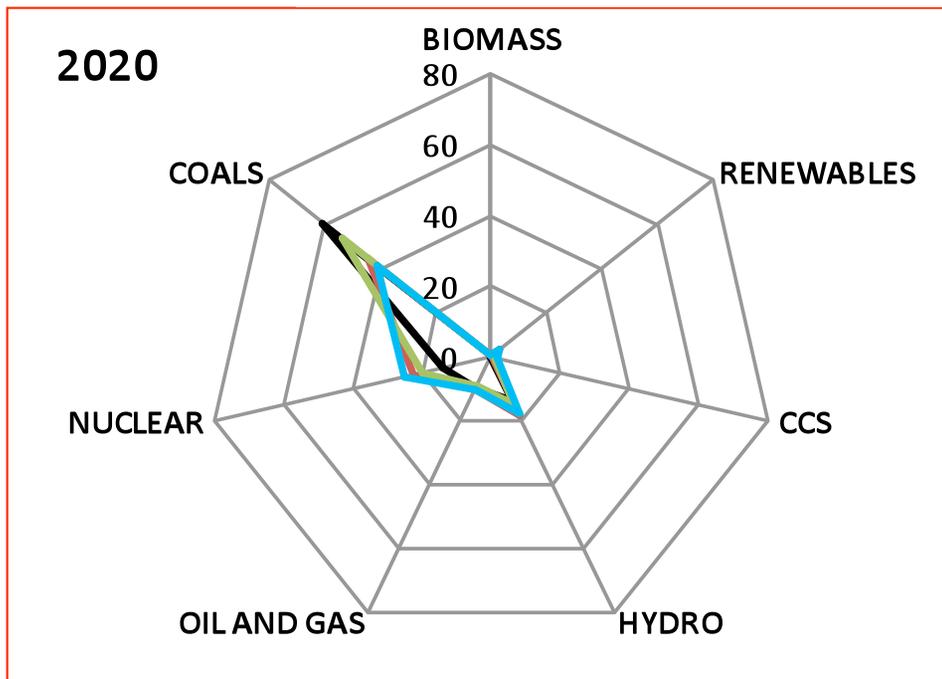
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- Fast developing countries: Insufficient COP15 commitments for 2020
- Industrialized countries: Higher pledges than CO<sub>2</sub> emissions mitigation required by Global climate policy
- Developing countries: -58% of CO<sub>2</sub> emissions reduction in 2050 by comparison with BAU 2005 for Glob50 and -45% for GlobCOP15

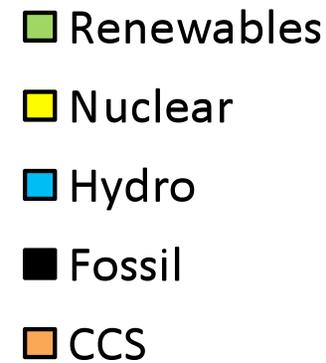
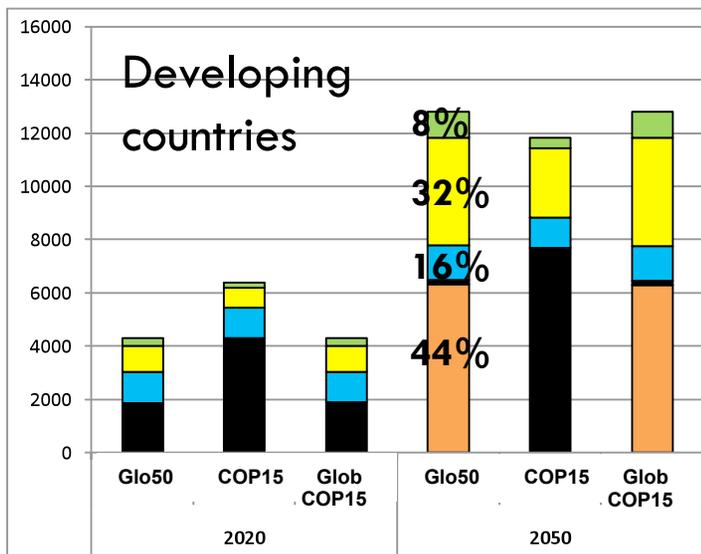
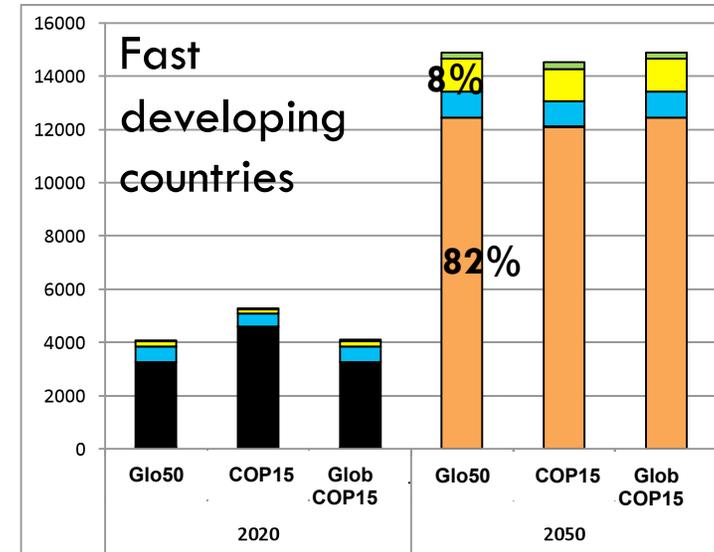
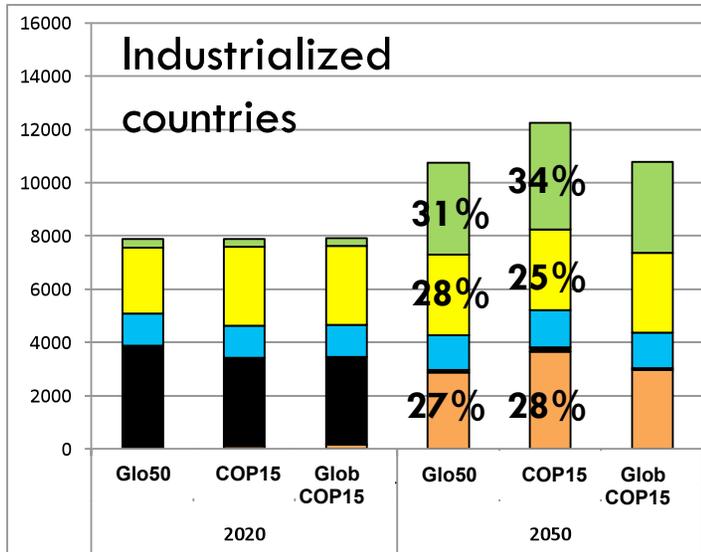
# Fuel shares in the world electric mix (%)

—BAU —Glob50 —COP15 —GlobCOP15



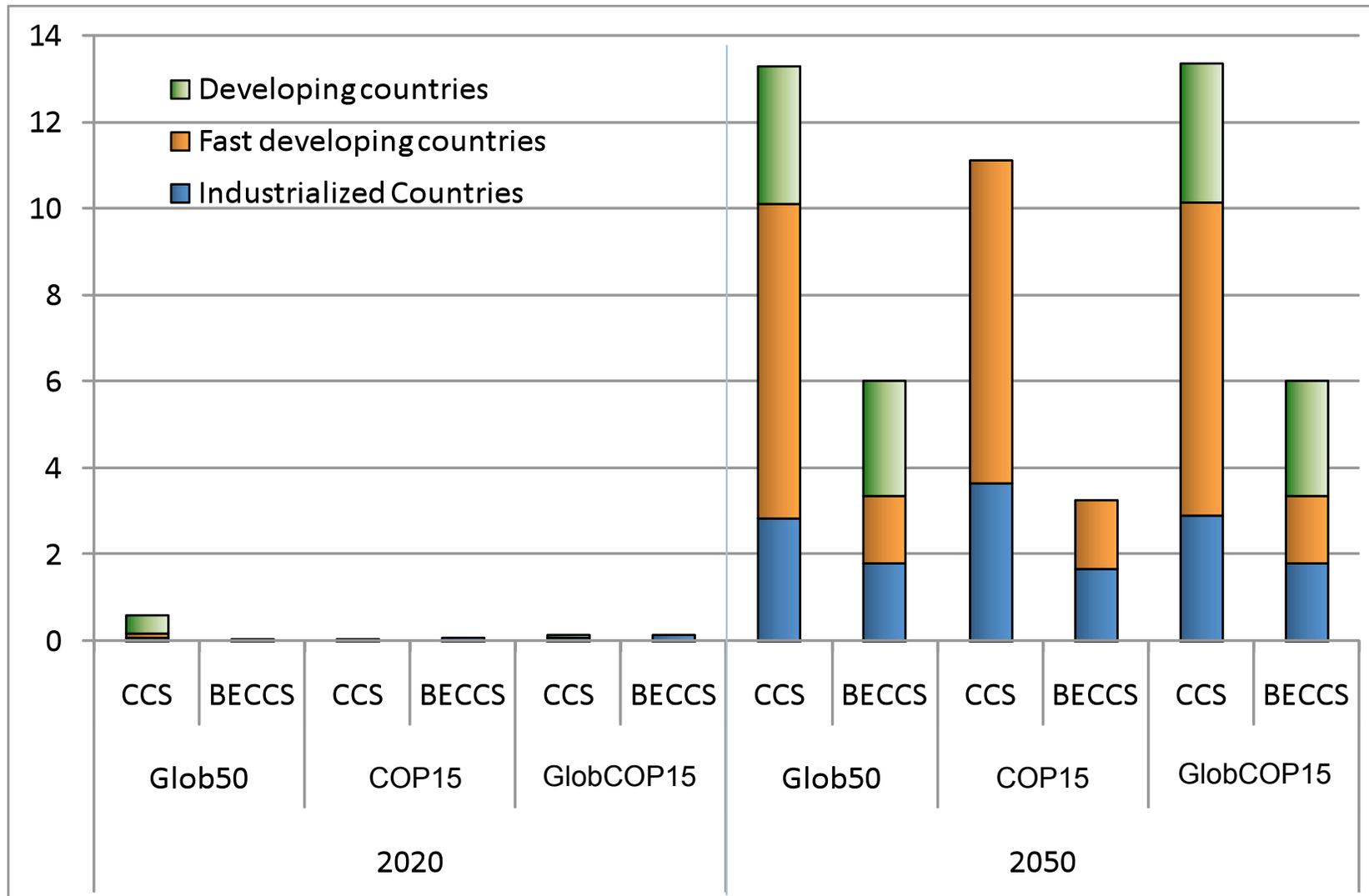
- 2020: Energy switch from coal to nuclear and hydro
- 2050: Deployment of CCS technologies

# Power generation by group of countries (TWh)



# Carbon sequestrated by group of countries

Gt





# Conclusion

# Highlights of the presentation (1/2)



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- ❑ International cooperation is required to reach the global climate target
  - ❑ With a higher contribution of fast developing countries
  - ❑ With the necessary participation of developing countries to reach the global climate objective
    - ❑ Fair level of CO<sub>2</sub> mitigation for developing regions
    - ❑ Possible level according to growth and development perspectives
    - ❑ Technological options?

# Highlights of the presentation (2/2)



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- ❑ The technological progress is also a significant issue
  - ❑ The deployment of CCS as a response of carbon constraints: feasibility of this development
    - ❑ Safety problem: Social acceptability and carbon leak back into the atmosphere
    - ❑ Commercialization limits: high costs, scale of production, time of deployment
    - ❑ The place of BECCS
  - ❑ Nuclear
    - ❑ Impact of Fukushima to debate
  - ❑ Renewable investments
    - ❑ Structural costs of the power network



# Annexes

# COP15 pledges

A/A

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Regions	Year ref.	Year target	Targets	Reduc. type	Level CO2 (Gt)
WEU-EEU	1990	2020	20%	Emi. Reduc.	3,54
		2050	80%		0,89
USA	2005	2020	17%	Emi. Reduc.	4,74
		2050	83%		0,97
AUS	2000	2020	5%	Emi. Reduc.	0,37
		2050	80%		0,08
CAN	2005	2020	17%	Emi. Reduc.	0,47
		2050	83%		0,1
JPN	1990	2020	25%	Emi. Reduc.	0,79
		2050	80%		0,21
CHI	2005	2020	40%	CO2 intensity	6,45
		2050	10%	Emi. Reduc.	4,12
IND	2005	2020	20%	CO2 intensity	2,16
		2050	10%	Emi. Reduc.	0,98