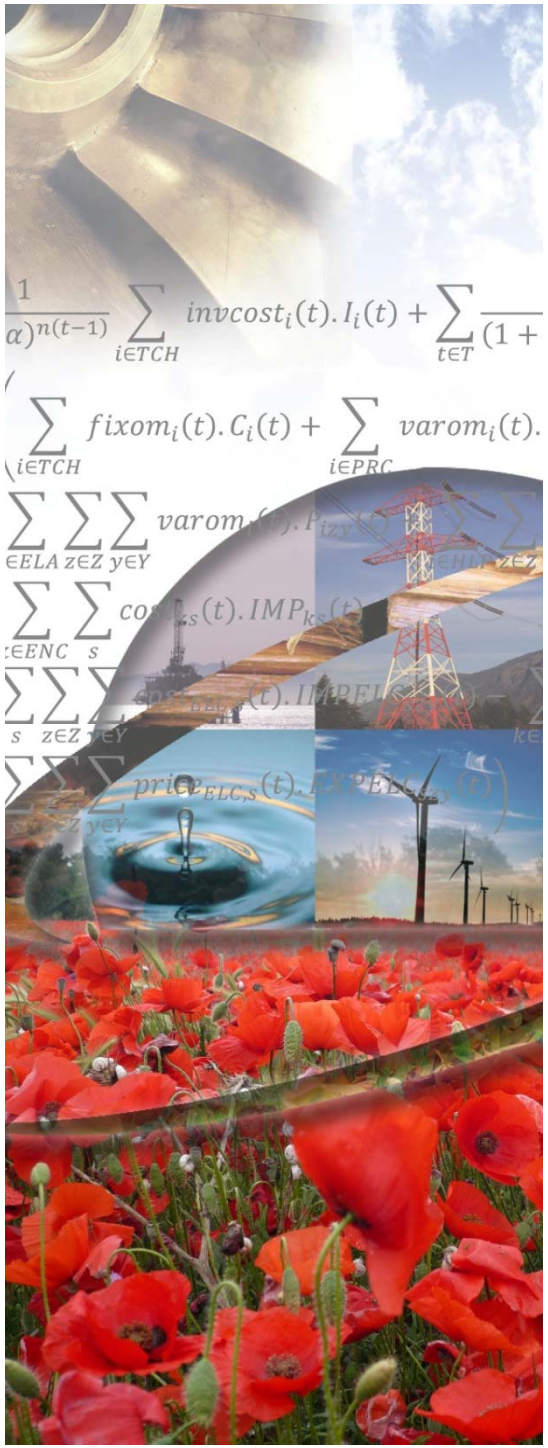


MINES ParisTech
Centre for Applied Mathematics

Technology transfer challenges

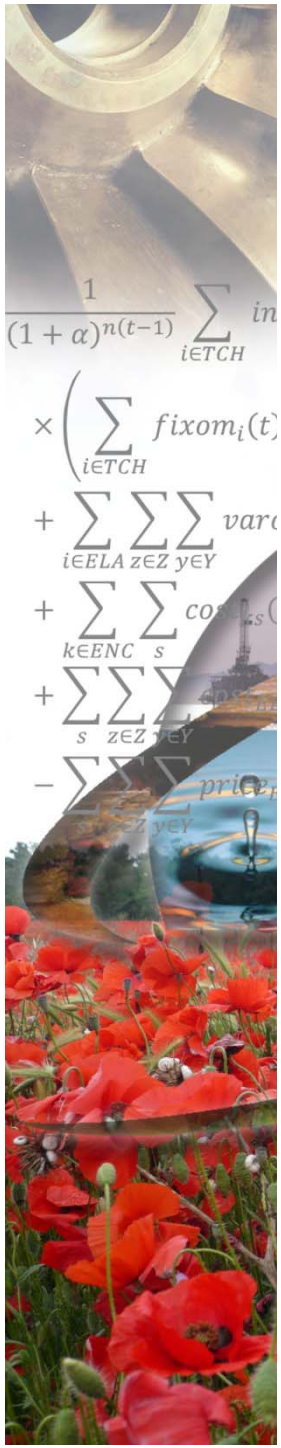
Edi Assoumou
Sandrine Selosse

Mines ParisTech-PSL- Center for Applied Mathematics
Chaire Modélisation Prospective au Service du Développement Durable

November 07 2016

MARRAKECH COP22|CMP12
UN CLIMATE CHANGE CONFERENCE 2016

Combating climate change in Mediterranean and African countries and in the Middle East

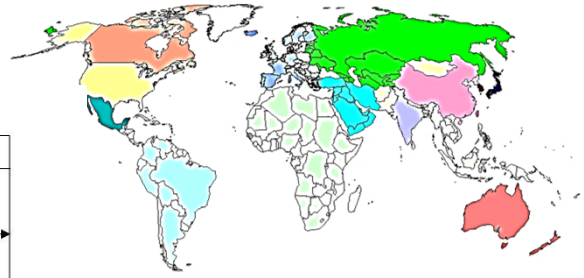


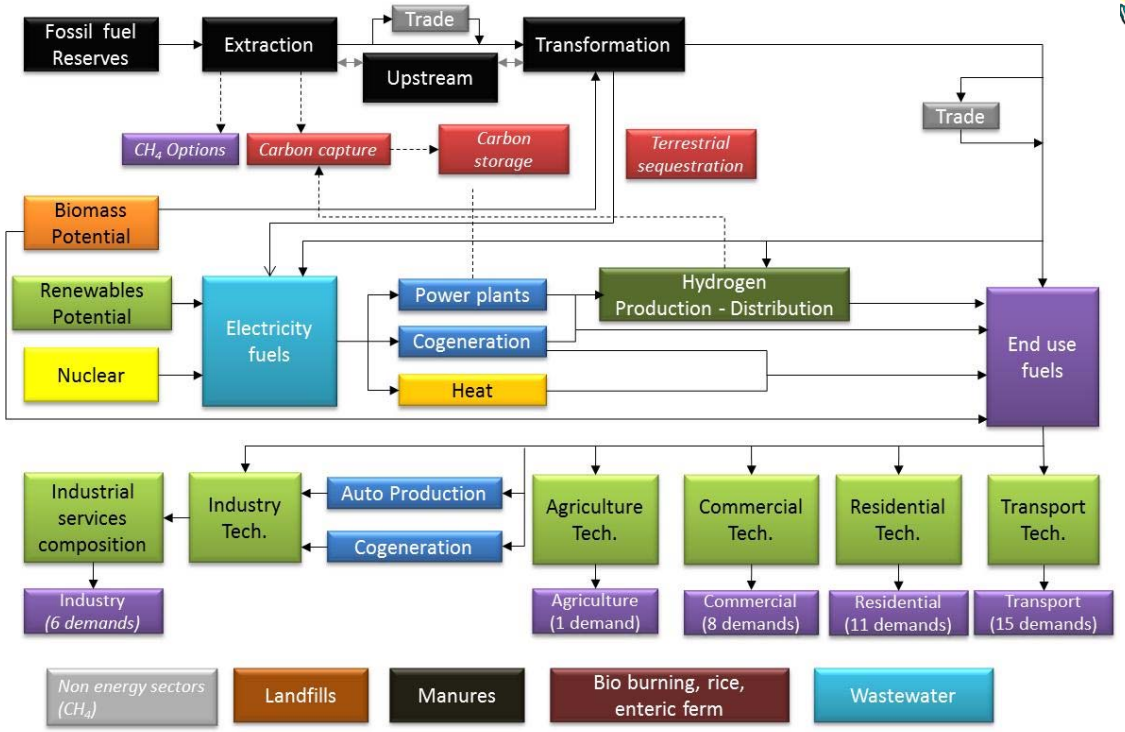
Technology transfer from a modeling perspective

- The role of effective technology transfer is clearly stated in the COP21 Agreement
  - *ART 10, 1. Parties share a long-term vision on the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emissions.*
  - *ART 10, 2. Parties, noting the importance of technology for the implementation of mitigation and adaptation actions under this Agreement and recognizing existing technology deployment and dissemination efforts, shall strengthen cooperative action on technology development and transfer.*
- Here we will consider technology availability for Africa
  - For alternative scenarios: targets & technologies
  - Using a model for virtual experiments
  - To confront expected contribution and current status

The TIAM-FR modelling approach

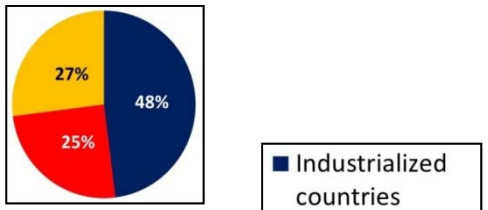
- French version of the **TIMES Integrated Assessment Model** (ETSAP/IEA)
- Optimization, linear programming, bottom-up, multiregional
- Long-term possible futures of the energy system



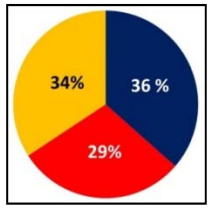


Climate regime/ mitigation target/ constraint

- **Coordinated action**
  - 40%, 50% and 70% GHG emissions reduction by 2050 compared to 2010
- **Paris Agreement with INDCs**
  - Low and Up commitments by (2025) 2030 compared to reference year
  - Regional assumptions by 2050

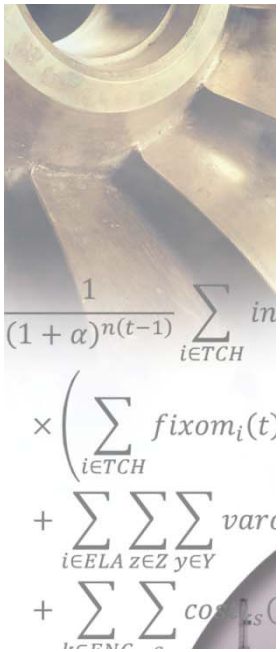


World GHG 2005

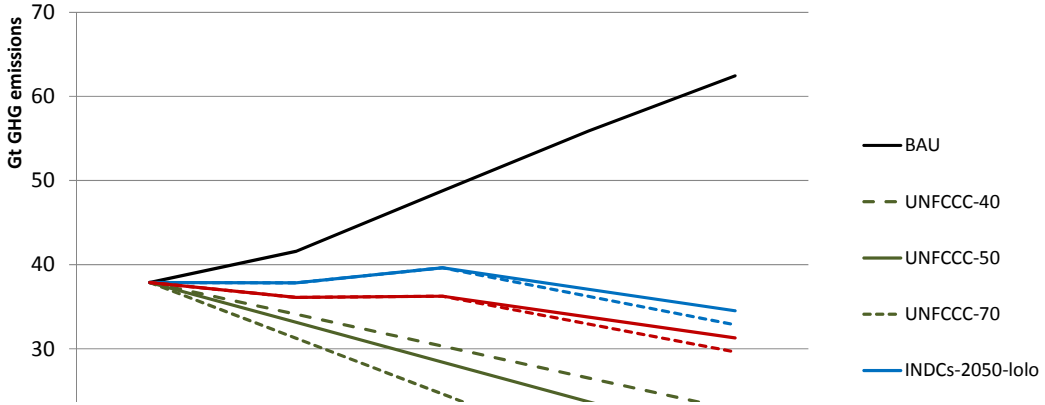


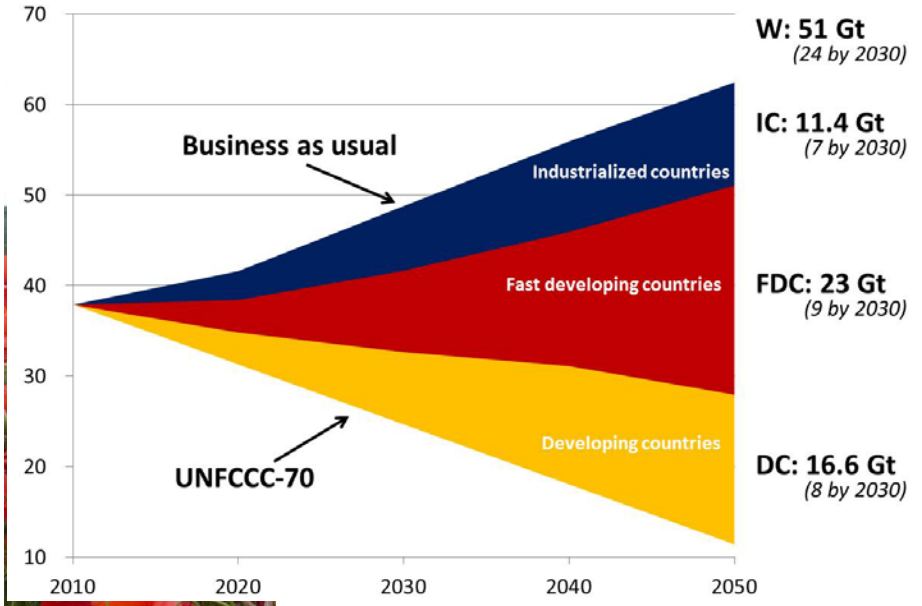
World GHG 2010

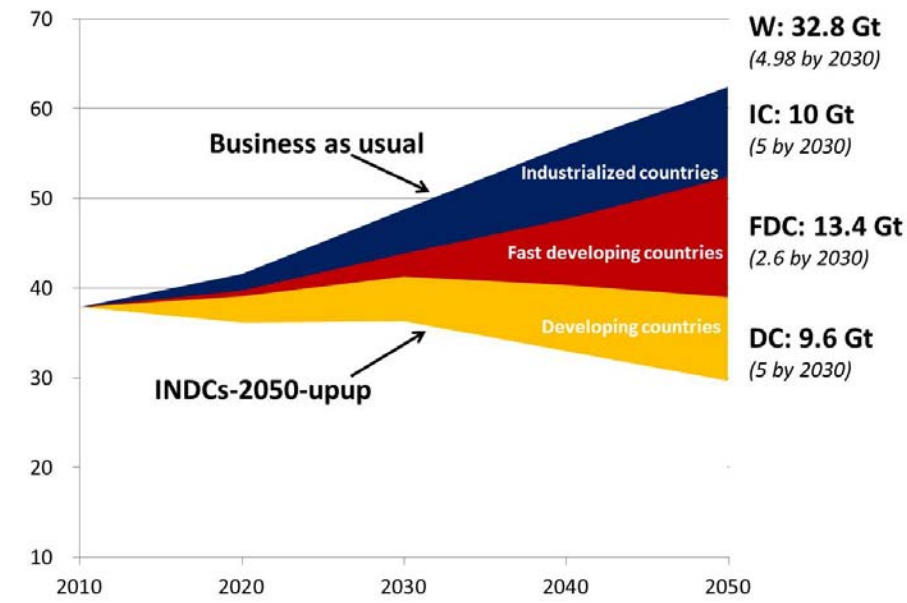
Regions	Reference year	Target year	Reduction level		Reduction type
USA	2005	2050	COP 15	83%	Emission reduction
WEU-EEU	1990	2050	LOW	60%	
			UP	80%	
AUS	2005	2050	LOW	60%	
			UP	80%	
CAN	2005	2050	LOW	60%	
			UP	80%	
JPN	2013	2050	LOW	60%	
			UP	80%	
CHI	2030	2050	LOW	Peak emission 2030	
IND					
MEX					
FSU					
SKO					
AFR					
MEA					
ODA					
CSA					

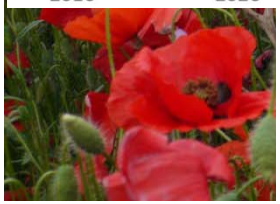


Emissions: the big picture



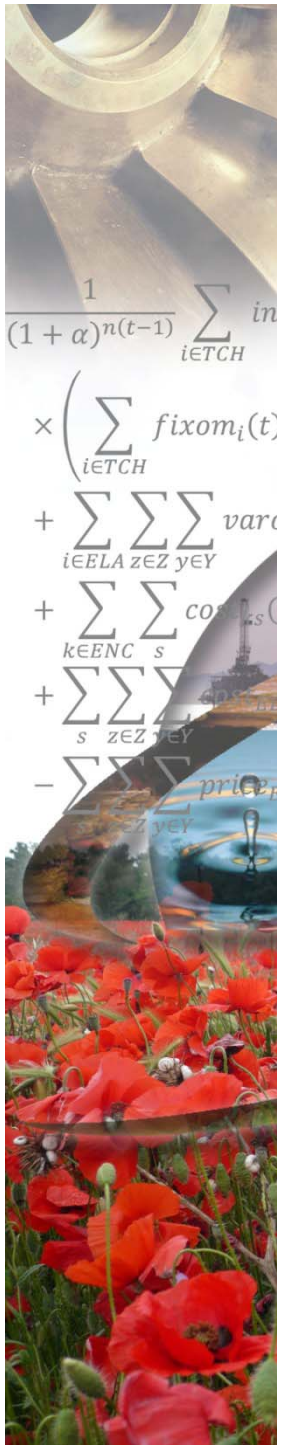






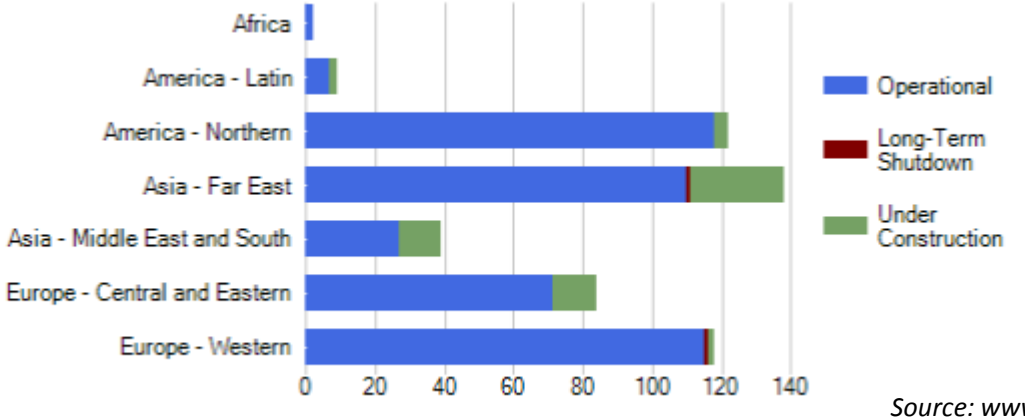
ambitious mitigation levels outside industrialized countries = technology transfer

"The place of BECCS in the future Energy-Climate regime A long-term analysis with TIAM-FR", Selosse 2016



2050 power mix for Africa: nuclear yes or no?

- IAEA data on regional nuclear development



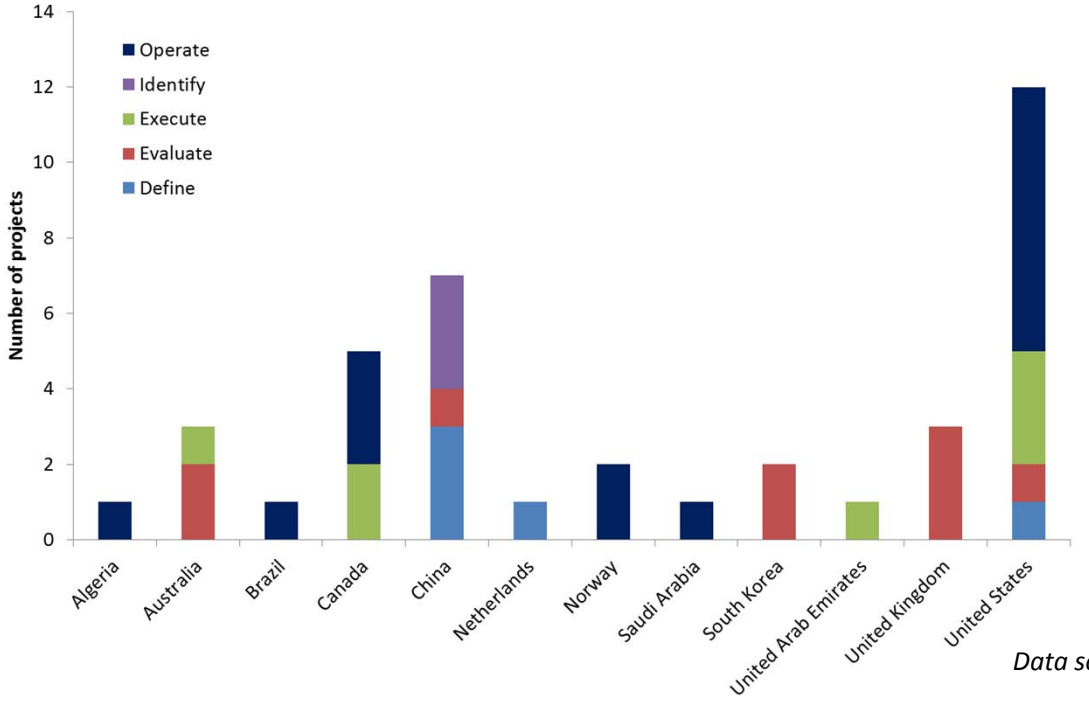
Source: www.iaea.org

- South Africa and potential new nuclear players in Africa
  - Nigeria, Kenya, 2015 Integrated West African regional nuclear power programme …

- Still 4-10 years before construction & 7-10 years for construction

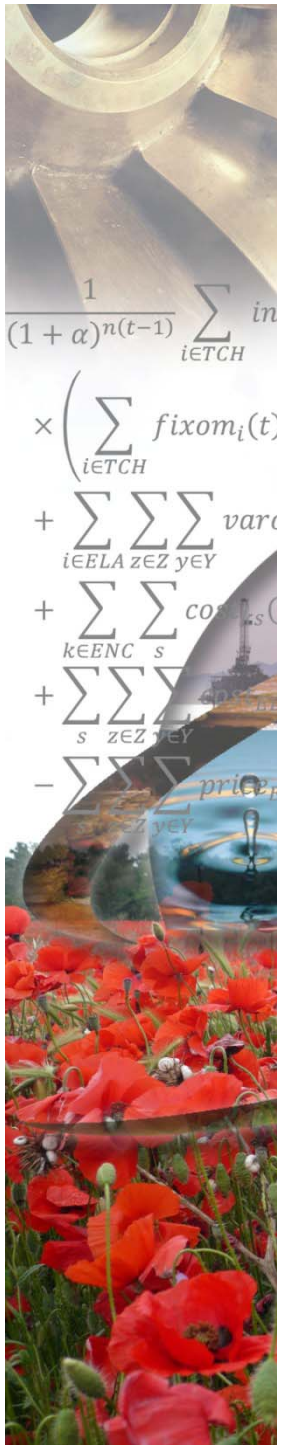
2050 power mix for Africa : CCS yes or no?

- Recalling CCS development today



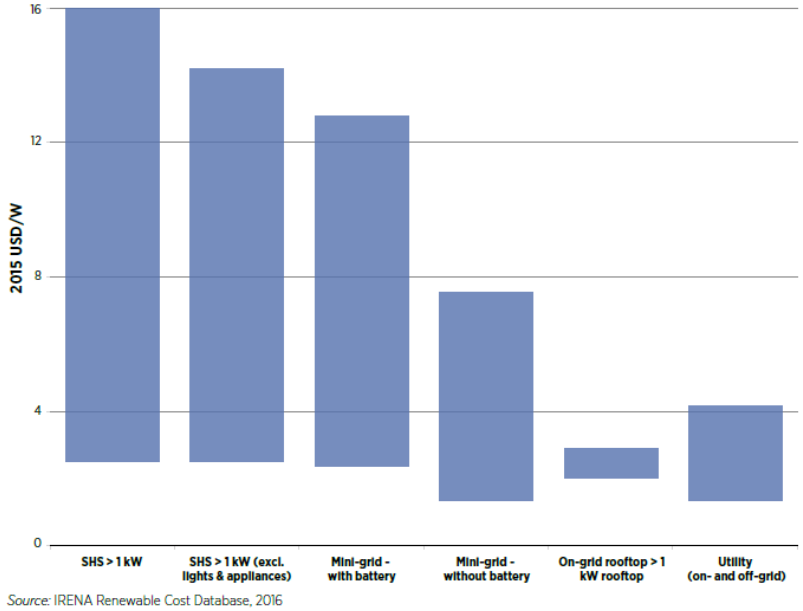
Data source: global ccs institute

- 10 -20 years from early definition to operation
- Active R&D in South Africa



2050 power mix for Africa: challenges for decentralized renewables

- Surveyed investment costs for solar PV in Africa (by IRENA) remain high for most households *(with battery cost for off grid)*

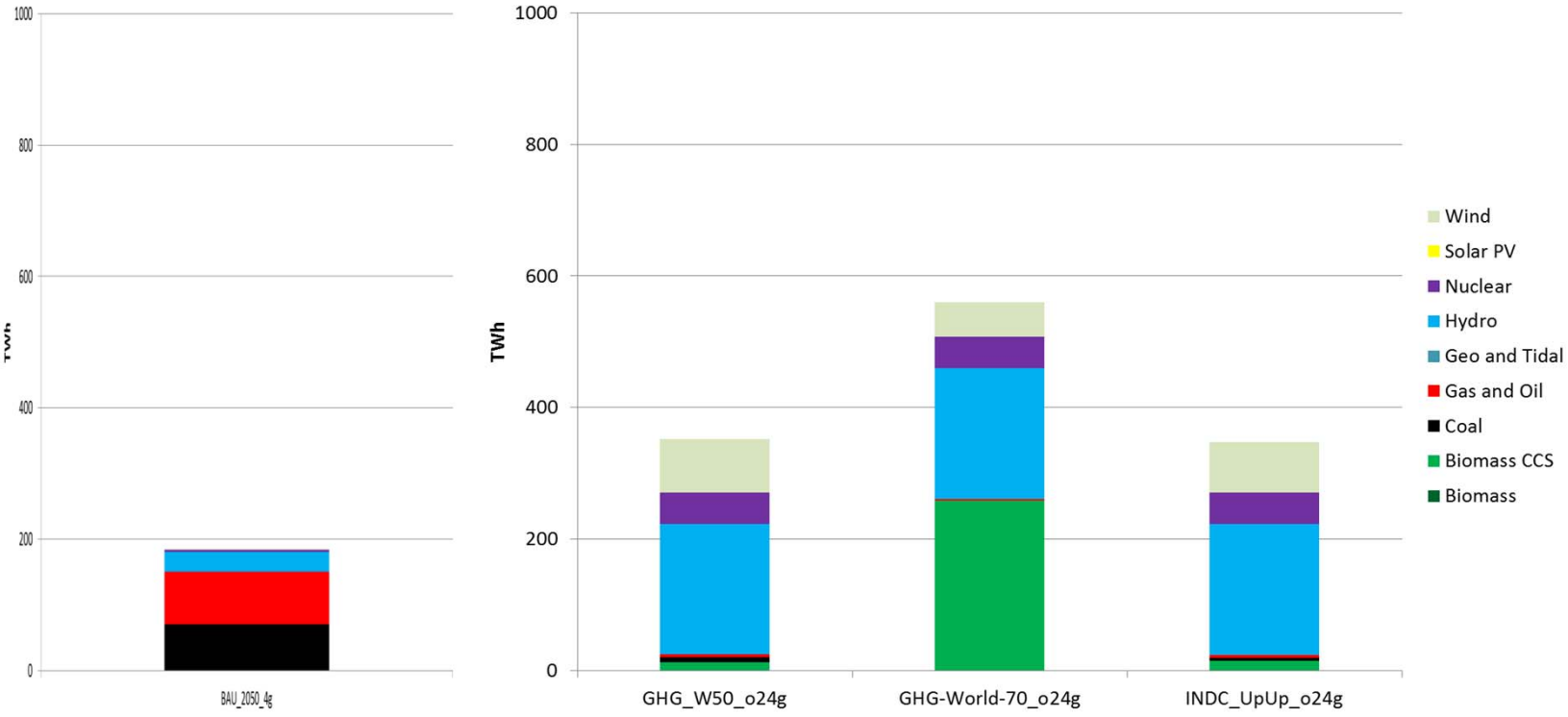


Source: IRENA Renewable Cost Database, 2016

- *Comparatively the cheapest new houses built by a developer in most countries are below 30 000$ according to the Centre for Affordable Housing Finance in Africa*

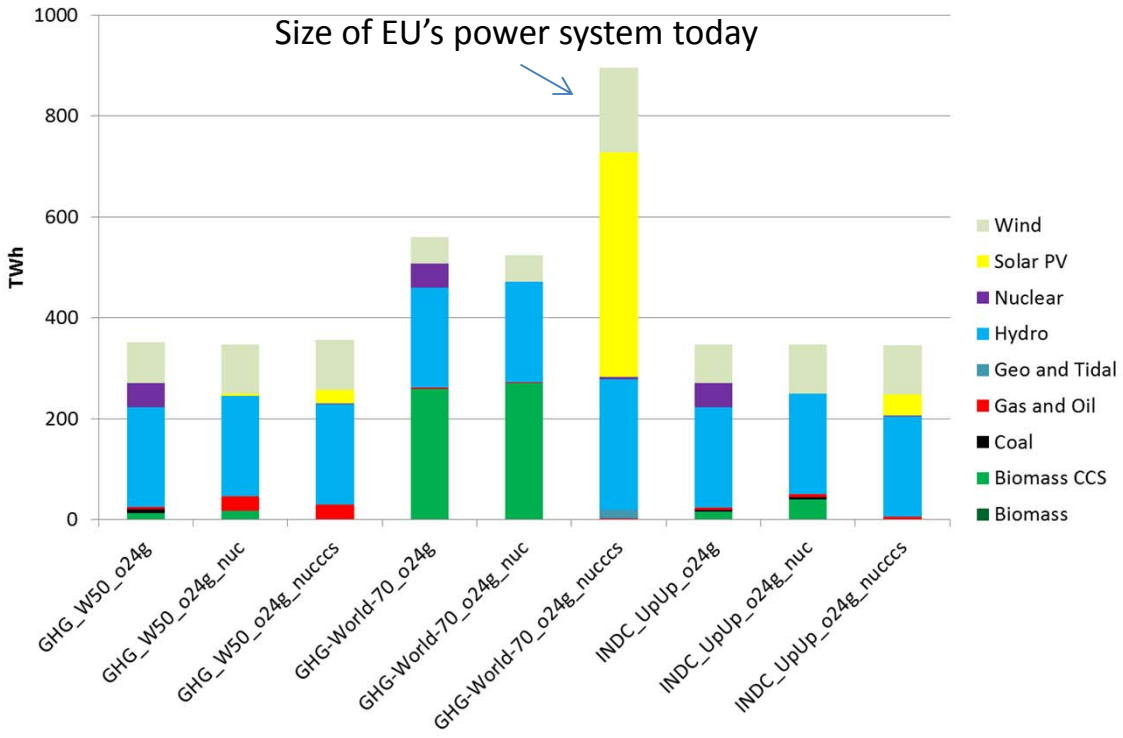
2050 power mix for Africa: generation for various scenarios

- Full technology potential for different mitigation levels

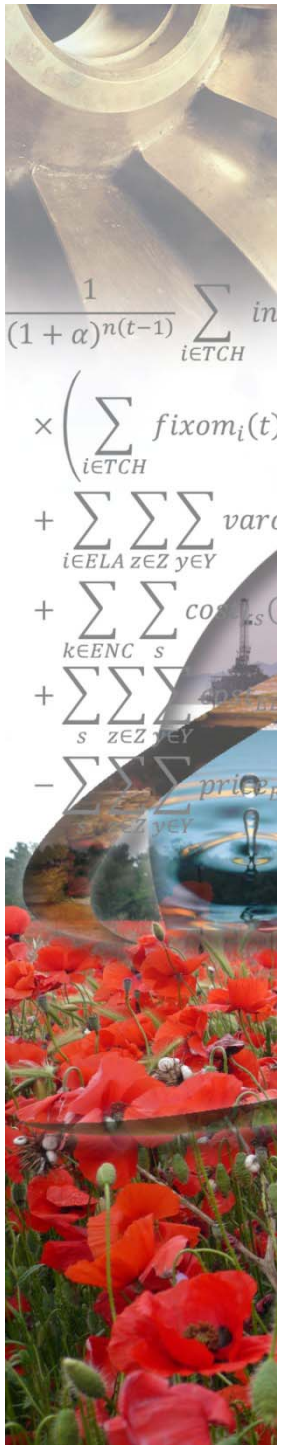


2050 power mix for Africa: generation for various scenarios

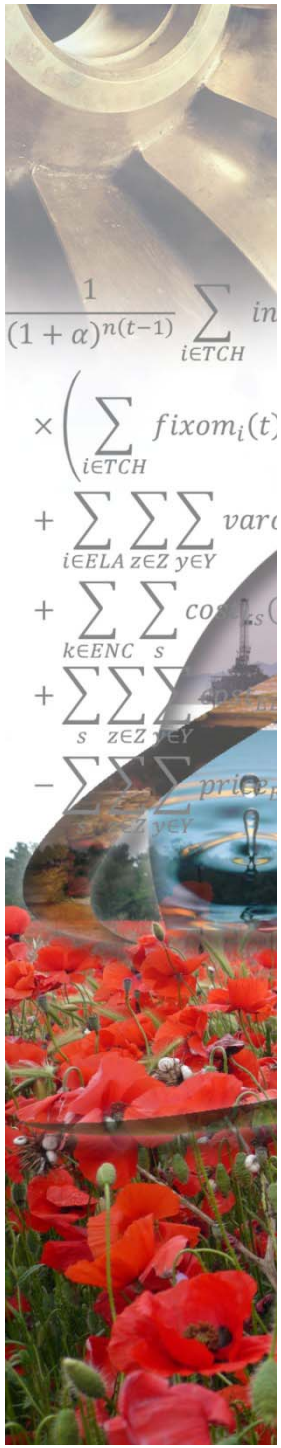
- With full REN potential but constrained CCS and nuclear availability



Maximizing electricity for all end-uses = Solving the electricity access issue!

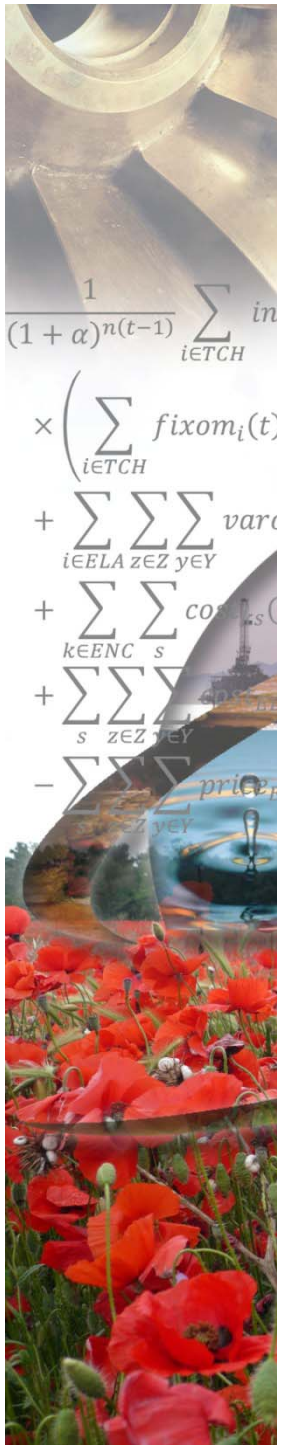


Thank you for your attention!



Climate scenarios – Pathways 2030

Regions	Reference year	Target year	Reduction type	Reduction level
Industrialized countries				
Europe (WEU-EEU)	1990	2030	Emission reduction	40%
The USA (USA)	2005	2025		26% - 28%
Australia and New Zeland (AUS)		2030		26% - 28%
Canada (CAN)				30%
Japan (JPN)	2013			26%
Fast developing countries				
China (CHI)	2005	2030	Carbon intensity	60% - 65%
India (IND)				33% - 35%
Developing countries				
Russia (FSU)	1990	2030	Emission reduction	25% - 30%
Mexico (MEX)	BAU			25% - 40%
South Korea (SKO)				37%
Africa (AFR)				15% - 30%
Middle East (MEA)				15% - 30%
Asian countries (ODA)				15% - 30%
Latin America (CSA)	*INDCs from TIMES-ALyC*			



Climate scenarios – Pathways 2050

Regions	Reference year	Target year	Reduction level		Reduction type
USA	2005	2050	COP 15	83%	Emission reduction
WEU-EEU	1990	2050	LOW	60%	
			UP	80%	
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MEA					
ODA					
CSA					