DDPP DEEP DECARBONIZATION PATHWAYS PROJECT

IDDRI

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

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Pathways to sustainable energy

Insights from the Deep Decarbonization Patwhays Project (DDPP)

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IDDRI

Operationalizing the DD concept
Deep Decarbonization Pathways (DDPs)

DDP = internally coherent national low-carbon transformations

- National specificities
  - Technical potentials (eg, resource endowment), interests (eg, competitiveness), needs (eg, development priorities), preferences (eg, nuclear) …
- Long-term vision (2050) in a backcasting approach
  - To inform short-term decisions on the route towards 2°C
- Explicit content in a problem-solving approach
  - Transparent representation of the transformation (“dashboard” and “strategy matrix”)

(Current) Organisation of DDPP

- A joint initiative IDDRI / SDSN
- 16 countries (74% of 2010 energy-related CO2 emissions)
  - 16 country teams, independent of their governments
    - Expert judgment
    - National models
    - Policy relevance
- Transparent, Iterative, Collaborative, Not prescriptive

www.deepdecarbonization.org

The DDPP modelling approach

- A detailed bottom-up calculator to support the design of DDPs
- Expert-based blueprints for change, sector by sector and over time, for each country's physical infrastructure

Sector	Sub-sectors
End-use Sector	
Buildings	Residential, Commercial
Passenger Transport	Car, Motorcycle, Bus, Urban Rail, Inter-urban Rail, Air
Freight Transport & Pipelines	Freight Trucks, Freight Rail, Domestic Waterway Shipping, Pipelines
Industry	Mining, Iron and Steel Manufacturing, Non-ferrous Metals Manufacturing, Cement Manufacturing, Other Manufacturing, Other Non-manufacturing
Energy Sector	
Power Sector	Central CHP, Net Generation Mix
Gas & Liquids	Pipeline Gas Blend, Liquid Hydrogen Inputs
Key Overall Parameters	
Key Overall Parameters	Conversion Efficiencies and Plant Characteristics, CO2 Emission Factors, Miscellaneous Power Sector & CHP Inputs, Miscellaneous Other Inputs

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	Buildings		
	Residential		
Activity	Population	Million	
	Household size	persons/household	
	Residential floor space	m2/cap	
	Unit energy consumption	MJ/m2	If traditional biomass is induded in this estimate, it should be on a primary energy basis
Energy Shares	Final electricity	%	
	Central CHP (heat)	%	
	Solar thermal	%	
	Fuels	%	Fuels are the residual energy source
Fuel Shares	Pipeline gas	%	Pipeline gas is the residual fuel
	LPG	%	
	Kerosene	%	
	Coal	%	
	Coal gas	%	
	Biomass (direct)	%	This value should be primary energy; improvements in conversion efficiency are captured
	Biomass sustainability factor	%	Percentage of biomass (direct) use that exceeds growth increment; increasing this value
CO2	Fuel CO2 emission factor	gCO2/MJ	
	Total fuel CO2	MtCO2	
	Total electric CO2	MtCO2	
	Total central CHP CO2 (heat)	MtCO2	
	Total CO2	MtCO2	

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- A structured description of the main variables presenting the main drivers of transformations at the aggregate and sectoral level

		2010	2020	2030	2040	2050	2050/2010	AAG 2010-50
Aggregate Inputs and Indicators								
Aggregate Inputs								
Population	Millions	65	66	69	71	72	11%	0,26%
Number of Households	Millions	28	30	32	34	35	26%	0,57%
GDP (real US$)	B$	$2 102	$2 423	$2 794	$3 221	$3 714	77%	1,43%
Final energy consumption (FEC)	EJ	6,4	5,9	4,8	4,0	3,2	-51%	-1,74%
Total primary energy supply	EJ	10,4	8,0	5,8	4,7	3,5	-67%	-2,70%
Fuel combustion CO2 emissions	MtCO2	345	265	172	114	88	-75%	-3,39%
Fuel combustion, fugitive, and industrial process CO2 e	MtCO2	366	286	190	127	97	-76%	-3,52%
total GHG emissions (all s'ources)	MtCO2e	0	0	0	0	0		
Aggregate Indicators								
Energy intensity of GDP	TJ/M$	3,1	2,4	1,7	1,2	0,9	-72%	-3,13%
CO2 intensity of FEC	tCO2/TJ	53,94	45,19	36,06	28,56	27,48	-49%	-1,67%
Energy transformation efficiency	%	0,62	0,73	0,82	0,84	0,92	45%	0,98%
Per Capita Aggregate Indicators								
Per capita GDP	GDP/cap	$32 293	$36 732	$40 763	$45 535	$51 380	59%	1,17%
Per capita FEC	TJ/cap	0,10	0,09	0,07	0,06	0,04	-60%	-2,00%
Per capita fuel combustion CO2 emissions	tCO2/cap	5,3	4,0	2,5	1,6	1,2	-77%	-3,64%
Per capita fuel combustion, fugitive, and industrial pro	tCO2/cap	5,8	4,2	2,6	1,6	1,2	-79%	-3,77%
Per capita total GHG emissions (all sources)	tCO2/cap	0,0	0,0	0,0	0,0	0,0		

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Residential Sector Inputs								
Floor area, residential units	Msqm	2 539	2 744	2 943	3 095	3 196	26%	0,58%
Residential FEC	EJ	1,897	1,634	1,335	1,151	0,975	-49%	-1,65%
Residential non-electricity FEC	EJ	1,315	1,069	0,835	0,708	0,617	-53%	-1,87%
Residential district heating	EJ	0,000	0,000	0,000	0,000	0,000		
Residential solar thermal	EJ	0,000	0,000	0,000	0,000	0,000		
Residential pipeline gas	EJ	0,741	0,592	0,443	0,351	0,292	-61%	-2,30%
Residential liquid fossil fuels	EJ	0,379	0,262	0,197	**0,115**	**0,045**	-88%	-5,19%
Residential coal and coal gas	EJ	0,000	0,000	0,000	0,000	0,000		
Residential solid biomass	EJ	0,185	0,215	0,195	**0,242**	**0,280**	43%	1,04%
Residential final electricity	TWh	162	157	139	123	99	-39%	-1,21%
Residential non-electricity CO2 emissions	MtCO2	70	51	34	**21**	**13**	-81%	-4,02%
Residential total CO2 emissions	MtCO2	78	56	36	**21**	**15**	-80%	-3,98%
Residential Sector Indicators								
Per capita residential floor area	sqm/cap	39	42	43	44	44	13%	0,31%
Residential energy intensity	kWh/sqm	208	165	126	103	85	-59%	-2,21%
CO2 intensity of residential FEC	tCO2/TJ	41,36	34,13	26,60	18,37	15,88	-62%	-2,36%
Non-electricity CO2 emission factor	tCO2/TJ	52,88	48,05	40,29	29,57	21,79	-59%	-2,19%
Share of final electricity in residential FEC	%	31%	35%	37%	38%	37%	16%	0,45%

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Electric Generation Capacity Additions and Replacements- Fossil						
Coal	**GW**	0,0	0,0	0,0	0,0	0,0
Coal w/ CCS	**GW**	0,0	0,0	0,0	0,0	0,0
Fuel Oil	**GW**	0,0	0,0	0,0	0,0	0,0
Fuel Oil w/CCS	**GW**	0,0	0,0	0,0	0,0	0,0
Natural gas	**GW**	1,9	0,2	0,0	0,0	0,9
Natural gas w/ CCS	**GW**	0,0	0,0	0,0	0,0	0,0
Electric Generation Capacity Additions and Replacements - Non-Fossil						
Nuclear	**GW**	0,0	1,0	2,3	0,8	0,0
Hydropower	**GW**	0,0	0,0	0,0	0,0	0,0
Wind-Onshore	**GW**	0,8	1,3	0,8	0,8	2,0
Wind-Offshore	**GW**	0,0	1,3	0,8	0,8	2,0
Solar PV	**GW**	0,6	1,5	1,5	1,5	2,0
Solar Thermal	**GW**	0,0	0,0	0,0	0,0	0,0
Biomass	**GW**	0,0	0,0	0,0	0,0	0,0
Geothermal	**GW**	0,0	0,0	0,0	0,0	0,0

The DDPP modelling approach

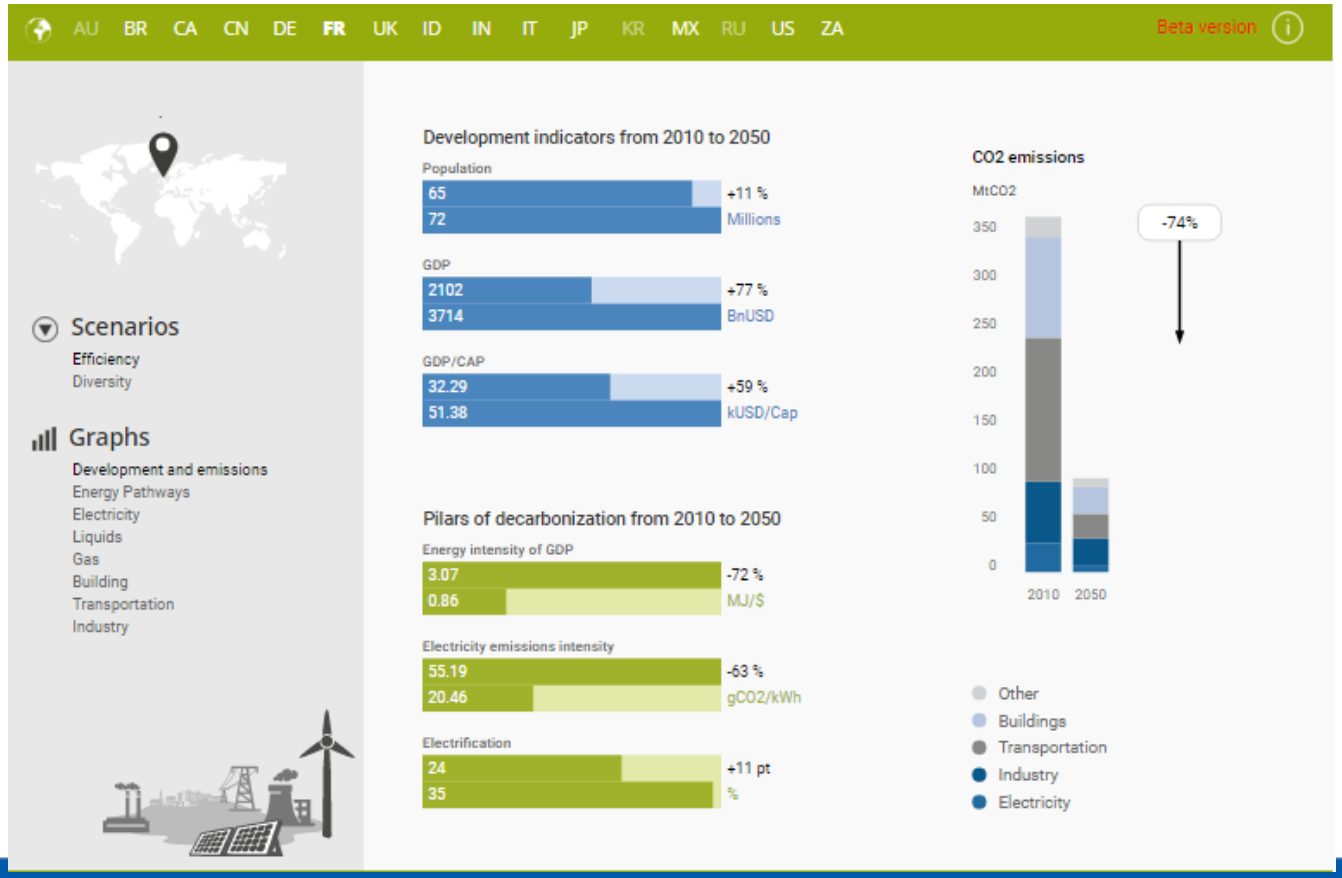
- Agnostic in assessment tools
  - used to inform some aspects of the transformation pathways

Accounting	Bottom Up	BU based hybrid	Mixed linked BU+TD	Top Down based hybrid	National IAM
US	UK	Canada	Australia	France	None
Indonesia	Russia		Japan	Brazil	
South Korea			Italy	Canada	
Mexico			China		
			South Africa		
			India		

Pye and Bataille. "Improving deep decarbonization modelling capacity for developed and developing country contexts", forthcoming in Climate Policy

The DDPP modelling approach

- Vizualisation tool
  - display in a user-friendly manner the content of the pathways



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