

Two Different Approaches to Deep Decarbonisation

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Towards an equitable low carbon development: a science policy dialog for COP21

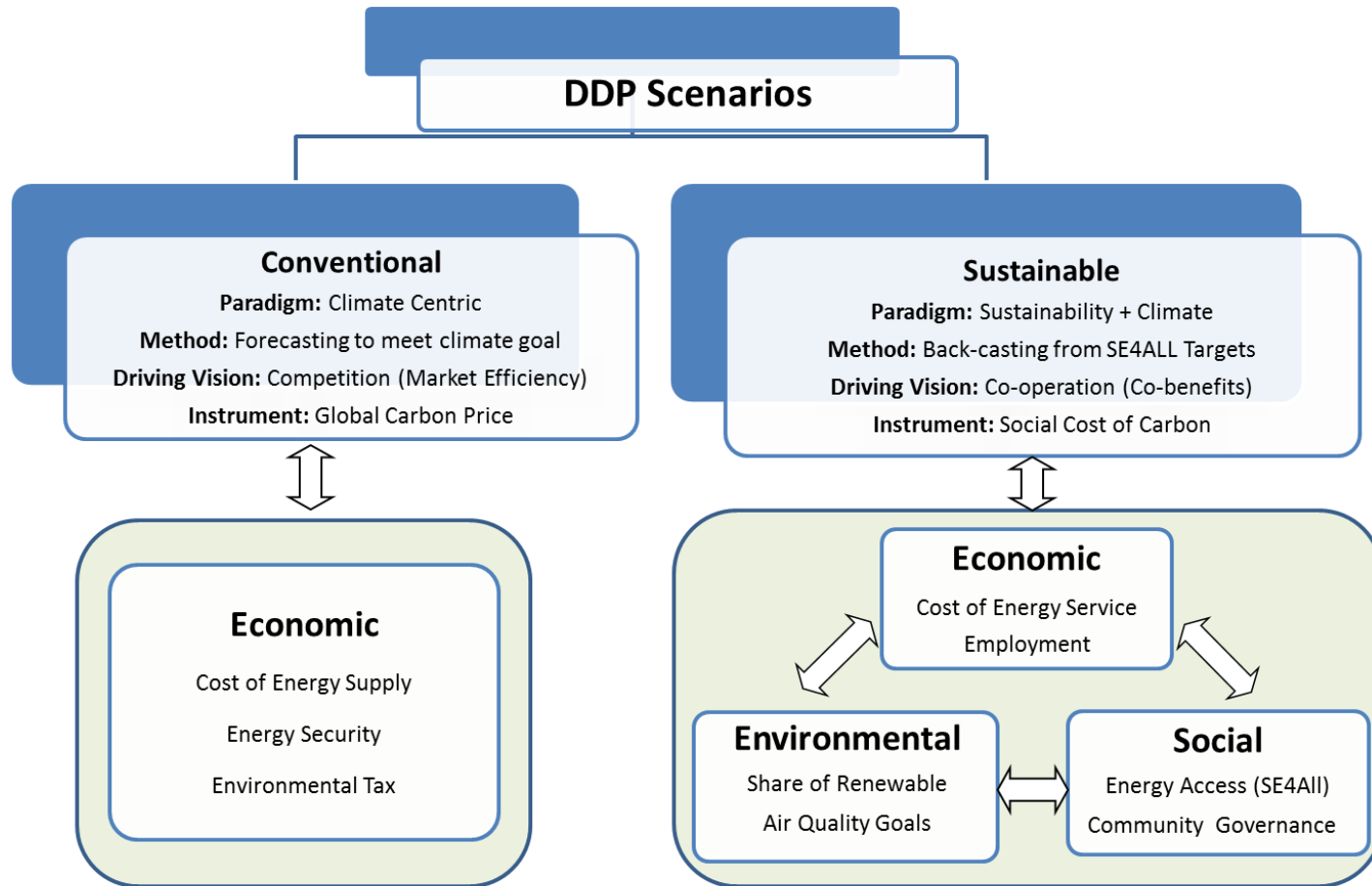
June 15-16, 2015; Paris

Key Challenges for Energy Sector

- Energy Security (Risk)
- Energy Access (SE4ALL)
- Environmental Pollution (SDG)
- High CO₂ Intensity of energy
- Common goal :
 - To achieve SDG targets
 - To achieve a 2 deg C vision

Indicators	Unit	2010	Remark
Aggregate Indicators			
Energy intensity of GDP	toe/M\$	309.5	High
CO2 intensity of FEC	tCO2/toe	3.46	High
Per Capita Indicators			
GDP	GDP/cap	\$1,158	Low
Final Energy Con.	toe/cap	0.36	Low
CO2 emissions	tCO2/ cap	1.24	Low

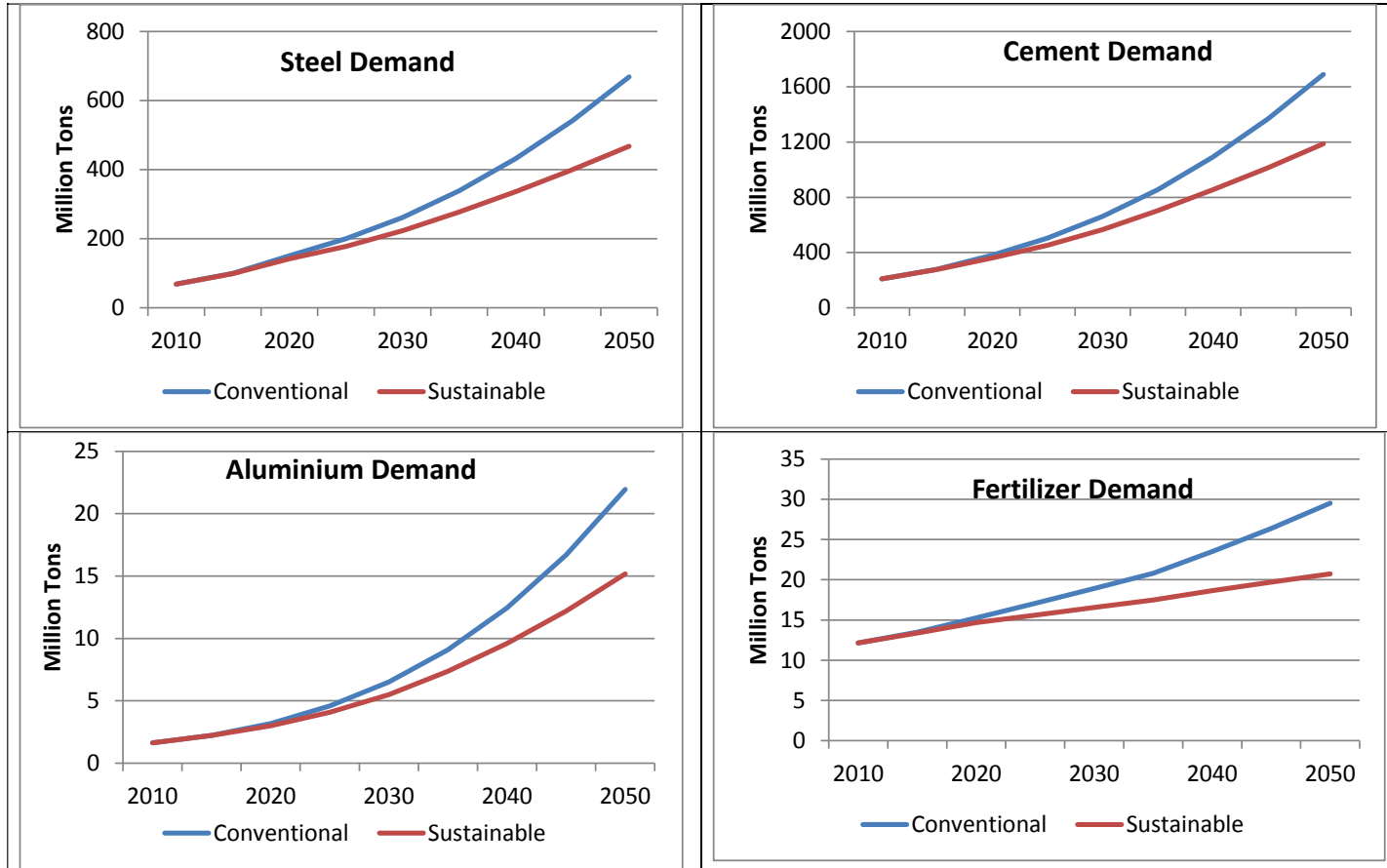
Two Alternative Paradigms



Macroeconomic Drivers

	2010	Conventional 2030	Sustainable 2030	Conventional 2050	Sustainable 2050
Population (million)	1206	1476	1434	1620	1509
Urbansiation	30.9%	39.5%	40.7%	50.3%	54.0%
Households	247	365	356	502	473
GDP (Billion US \$)	1397	6489	6002	25664	23007
GDP per capita (US \$)	1158	4397	4186	15842	15247

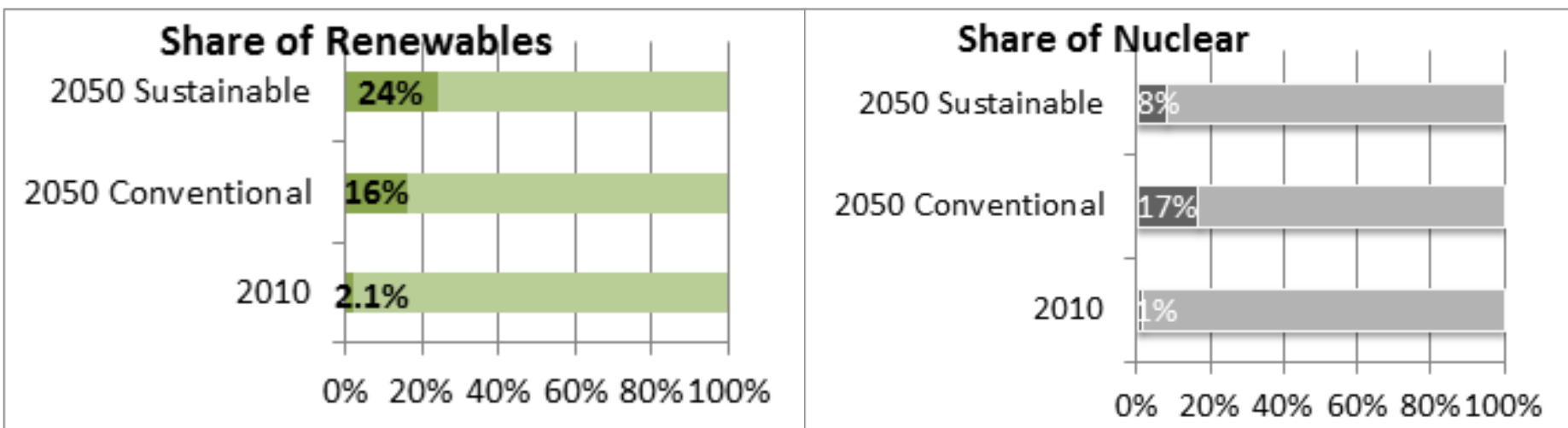
Demand : Industry



Demand: Passenger Transport



Supply Side - Electricity



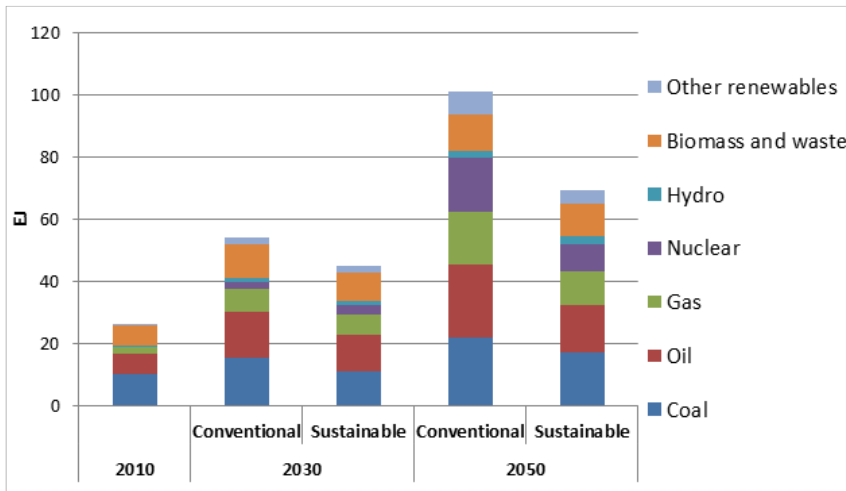
Carbon sequestered by CCS (Million Ton CO₂)

	2030		2050	
	Conventional	Sustainable	Conventional	Sustainable
Power Generation	6.7	7.5	473.6	409.5

CO₂ Intensity of Electricity Generation (Kg CO₂/KWH)

	2010	2020	2030	2040	2050
Conventional	0.77	0.64	0.31	0.12	0.06
Sustainable	0.77	0.55	0.25	0.10	0.05

Primary Energy & CO₂ Emissions



	2010	2030 Con.	2030 Sus.	2050 Con.	2050 Sus.
Total CO₂ (Million Tons)	1497	2810	2138	3157	2108
Primary Energy Supply (EJ)	25.9	54	45	101.1	69.4
Energy Intensity (TJ/M\$)	13	6.5	5.9	3.1	2.5
CO₂ intensity (tCO₂/TJ)	82.7	66.7	60.1	39.9	36.1
CO₂ per capita (tCO₂/capita)	1.24	1.9	1.49	1.95	1.4

Co-Benefits: Air Pollution



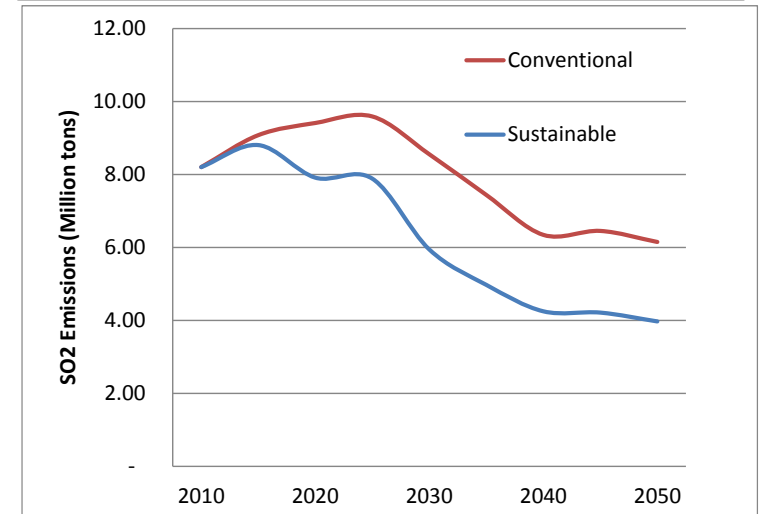
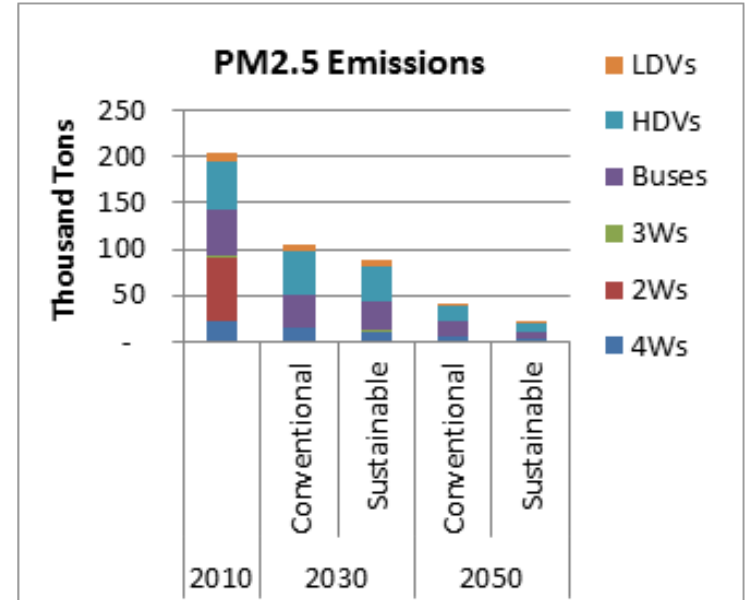
MOST POLLUTED CITIES

Air : Particulate matter pollution for 2012
 ug/m³ is microgram pollutant in cubic meter of air. All figures are average for a year

<p>261 ug/m³ Delhi</p>	<p>219 ug/m³ Amritsar</p>	<p>214 ug/m³ Ludhiana</p>	<p>113 ug/m³ Nashik</p>
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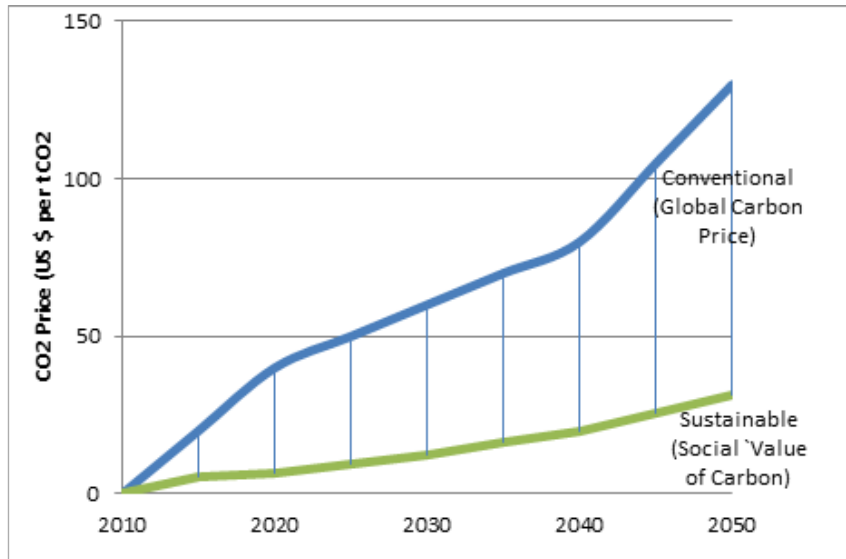
<p>97 ug/m³ Mumbai</p>	<p>60 ug/m³ standard</p>	<p>MAJOR SOURCES OF AIR POLLUTION Vehicles Dust Industries Roadside eateries Biomass Garbage burning Diesel gensets are major sources</p>	<p>HEALTH HAZARD High exposure to air pollution can cause heart attack and long exposure could cause lung dysfunction, asthma, headache and nausea</p>
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Source: <http://www.hindustantimes.com/india-news/india-s-cities-more-polluted-than-china-but-there-is-still-hope/article1-1355013.aspx>



Co-benefits: Social Value of Carbon

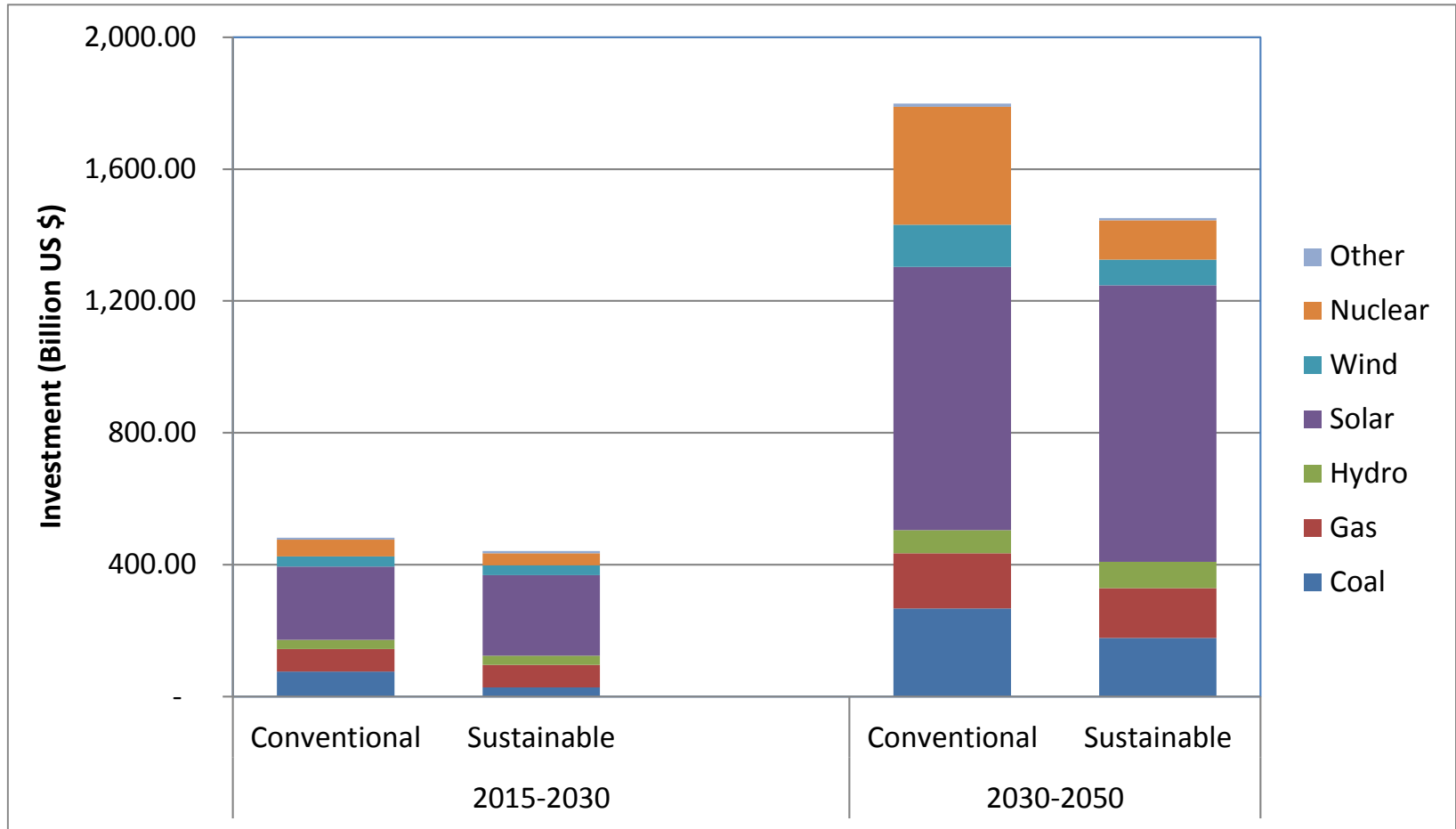
Value Carbon



Revenues from carbon saved in Sustainable Scenario

	2020	2030	2040	2050
CO₂ saved (Million tCO₂)	370.6	671.8	918.9	1049.4
Revenue from CO₂ saved (Bn US \$ 2010)	16.6	45.1	82.3	152.9
Revenue as % of GDP	0.6%	0.8%	0.8%	0.7%

Investments in Electricity Generation



Conclusions

- Both pathways have a positive impact on SDG's though a sustainable pathways ranks higher
- Renewables will be a major part of electricity cleaning in both pathways
- Implementation will require substantial financing and transformational changes in energy supply
- Social value of carbon is significantly lower as compared to a global carbon price

Acknowledgements

Deep Decarbonisation Project