METREX
The network of
European Metropolitan Regions and Areas

EUCO2 80/50
Interreg IVC project 2008-2010

Information Note 1

IPCC 4th Report on Mitigation
Implications

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Information Note 1
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Contents

EUCO2 80/50 - Interreg IVC project 2008-2010
Information Note 1
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Purpose of this report

The dual objective of the EUCO2 80/50 project is to,

Enable Europe's metropolitan regions and areas to devise and adopt informed and effective integrated greenhouse gas (GHG) emissions mitigation measures and strategies to achieve the EU target of an 80% reduction by 2050 and to secure their low carbon energy futures.

The IPCC 4th Report on Mitigation* sets out the global mitigation context and summarises the measures and policies that might be used, immediately and in the longer term, to achieve the reduction in green house gases (GHG) that is required.

The EUCO2 80/50 project will involve the exploration of GHG metropolitan mitigation scenarios and the identification of GHG mitigation strategies to achieve the EU target.

The purpose of this report is to assess the mitigation measures and policies identified by the IPPC and to consider the implications for the EUCO2 80/50 project.

Mitigation and low carbon futures

The IPCC has established that the carbon fuelled global industrialisation, urbanisation, population and economic growth of the last 300 years is not sustainable. Mitigation has to reduce GHG emissions and alternative energy sources have to be introduced. The stored energy of fossil fuels has to be replaced, progressively, by the immediately available energy sources of the sun.

The sun fuels the global cycles of warming and cooling and these result in the air flows, sea currents, surface warming, precipitation and radiant heat that the renewable energy industries can tap using modern technology. The temperature differentials on the globe also allow geothermal and "aqua-thermal" energy (energy islands - see later) to be tapped. These are the basic resources of a low carbon future.

We are therefore in a transition period from a carbon fuelled past to a low carbon future. During this transition, over the next century, GHG mitigation, and the phasing out of fossil fuel dependency, will run in parallel with the phasing in of renewable fuel sources through high technology energy transfer.

A key issue is how such energy is to be stored and transported. It can be transmitted as electricity and also transported as hydrogen. These currently appear to be the most likely low carbon energy sources for the transition phase of the next century.

The IPCC 4th Report reflects these opportunities but does not directly suggest the prospect of a hydrogen economy. It will be important in the EUCO2 80/50 project to have regard both to the imperatives of GHG mitigation measures to reduce fossil fuel usage and to the opportunities to introduce the renewable energy and hydrogen economy.

**IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.*

The IPCC 4th Report - form and content

The IPCC 4th Report takes the following form.

1. Greenhouse gas (GHG) emission trends
2. Mitigation in the short and medium term, across different economic sectors (until 2030)
3. Mitigation in the long-term (beyond 2030)
4. Policies, measures and instruments to mitigate climate change
5. Sustainable development and climate change mitigation
6. Gaps in knowledge.

Sustainable development - Mitigation context

Global greenhouse gas (GHG) emissions have grown increased by 70% between 1970 and 2004. The largest growth has come from the energy supply sector with an increase of 145%. The growth in direct emissions from transport in this period was 120%, industry 65% and land use, land use change, and forestry (LULUCF) 40%. Between 1970 and 1990 direct emissions from agriculture grew by 27% and from buildings by 26%. The latter has since remained at approximately at 1990 levels. However, the buildings sector has a high level of electricity use and hence the total of direct and indirect emissions in this sector is much higher, at 75%, than direct emissions during 1970 to 2004.

Sustainable development - Stakeholder involvement

Addressing climate change can be considered an integral element of sustainable development policies. National circumstances and the strengths of institutions determine how development policies impact GHG emissions. Changes in development paths emerge from the interactions of public and private decision processes involving government, business and civil society, many of which are not traditionally considered as climate policy. This process is most effective when actors participate equitably and decentralized decision making processes are coordinated.

Climate change and other sustainable development policies are often but not always synergistic. There is growing evidence that decisions about macroeconomic policy, agricultural policy, multilateral development bank lending, insurance practices, electricity market reform, energy security and forest conservation, for example, which are often treated as being apart from climate policy, can significantly reduce emissions.

Sustainable development - Economic and environmental synergies

Climate change policies related to energy efficiency and renewable energy are often economically beneficial, improve energy security and reduce local pollutant emissions. Other energy supply mitigation options can be designed to also achieve sustainable development benefits such as avoided displacement of local populations, job creation, and health benefits.

Reducing both loss of natural habitat and deforestation can have significant biodiversity, soil and water conservation benefits, and can be implemented in a socially and economically sustainable manner. Forestation and bio-energy plantations can lead to restoration of degraded land, manage water runoff, retain soil carbon and benefit rural economies, but could compete with land for food production and may be negative for biodiversity, if not properly designed. There are also good possibilities for reinforcing sustainable development through mitigation actions in the waste management, transportation and buildings sectors.

Making development more sustainable can enhance both mitigative and adaptive capacity, and reduce emissions and vulnerability to climate change. Synergies between mitigation and adaptation can exist, for example properly designed biomass production, formation of protected areas, land management, energy use in buildings and forestry.

EUCO2 80/50 - Interreg IVC project 2008-2010
Information Note 1
IPCC 4th Report on Mitigation - Implications

IPCC 4th Report - mitigation measures and policies

The IPPCC 4th Report identifies 96 individual mitigation measures and policies, all of which need to be given consideration in the EUCO2 80/50 project. The following sections abstract these by sector. The tables (1a, 1b, 1c, 2 and 3) afterwards assess them collectively in term of Sustainability (Mitigation to 2030 and beyond 2030 and whether they contribute to a longer term low carbon future) and Subsidiarity (whether they apply to UN/EU/State/Economies, metropolitan or local levels of competence and responsibility for action).

From this assessment it would appear that most measures and policies identified by the IPCC apply to mitigation to 2030 and to the UN/EU/State/Economies level. However, tables 2 and 3 do identify a number of longer term and metropolitan/local level measures and policies that are relevant to the EUCO2 80/50 project.

The Sectors considered in the 4th IPPC Report are,

1. Energy supply
2. Transport
3. Buildings
4. Industry
5. Agriculture
6. Forestry
7. Waste management
8. Lifestyles
9. Policy instruments - Regulations and standards

The text is taken directly from the IPCC Report.

The intention is to relate these measures and policies to those already identified in the METREX report *Measures for Mitigation*, January 2007, which can be downloaded from the METREX web site at www.eurometrex.org

IPCC 4th Report Scenarios

The IPCC Report refers to two families of Mitigation scenarios that have been used to explore possible energy/emission futures. These are summarised in Appendix 1 for reference during the EUCO2 80/50 project.

1 Energy supply

Energy infrastructure investments decisions will have long term impacts on greenhouse gas emissions, because of the long life times of energy infrastructure. It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply to satisfy demand for energy services.

Mitigation measures currently commercially available

1. Investing in the reduction of energy consumption rather than in new energy supply infrastructure
2. Improved supply and distribution efficiency
3. Switching from coal to gas
4. Nuclear power, although safety, weapons proliferation and waste management remain as constraints
5. Renewable energy (hydropower, solar, wind, geothermal and bio energy)
6. Combined heat and power generation
7. Application of Carbon Capture and Sequestration (CCS, e.g. storage of removed CO2 from natural gas) technologies

An increase in the price of fossil fuel could make low-carbon alternative more competitive, but could also lead to the use of high-carbon alternatives such as oil sands and heavy oils.

Mitigation measures that may be commercially available by 2030

8. CCS for gas, biomass and coal-fired electricity generating facilities
9. Advanced nuclear power
10. Advanced renewable energy, Including tidal and waves energy, concentrating solar, and solar PV

Mitigation policies

11. Reduction of fossil fuel subsidies
12. Taxes or carbon charges on fossil fuels

    Resistance by vested interests may make them difficult to implement

13. Feed-in tariffs for renewable energy technologies
14. Renewable energy obligations
15. Producer subsidies

    May be appropriate to create markets for low emissions technologies

2 Transport

The higher the market prices of fossil fuels, the more modal shifts from road to rail and to inland and coastal shipping and from low-occupancy to high-occupancy passenger transportation, as well as land-use, urban planning and non-motorized transport offer opportunities for GHG mitigation, depending on local conditions and policies.

Mitigation measures currently commercially available

16. More fuel efficient vehicles
17. Hybrid vehicles
18. Cleaner diesel engines
19. Bio fuels
20. Shift from road transport to rail and public transport
21. Alternatives such as cycling and walking
22. Land use and transport planning (urban planning that reduces the need for road transport)

Mitigation measures that may be commercially available by 2030

23. Second generation bio fuels
24. Higher efficiency aircraft
25. Advanced electric
26. Hybrid vehicles with more powerful and reliable batteries

Medium term mitigation potential for CO2 emissions from the aviation sector can come from improved fuel efficiency, which can be achieved through a variety of means, including technology, operations and air traffic management. However, such improvements are expected to only partially offset the growth of aviation emissions. Total mitigation potential in the sector would also need to account for non-CO2 climate impacts of aviation emissions.

Mitigation policies

27. Mandatory fuel economy, bio-fuel blending and CO2 standards for road transport

    Partial coverage of vehicle fleet may limit effectiveness

28. Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing

    Effectiveness may drop with higher incomes

29. Influence mobility needs through land use regulations, and infrastructure planning

30. Investment in attractive public transport facilities and non- motorised forms of transport

    Particularly appropriate for countries that are building up their transportation systems

3 Buildings

Opportunities for realising GHG reductions in the building sector exist worldwide. However, multiple barriers make it difficult to realise this potential. These barriers include availability of technology, financing, poverty, higher costs of reliable information, limitations inherent in building designs and an appropriate portfolio of policies and programs

Mitigation measures currently commercially available

31. Efficient lighting and day-lighting
32. More efficient electrical appliances and heating and cooling devices
33. Improved insulation
34. Passive and active solar design for heating and cooling
35. Alternative refrigeration fluids
36. Recovery and recycle of fluorinated gases

Mitigation measures that may be commercially available by 2030

37. Integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control
38. Solar PV integrated in buildings

Mitigation policies

39. Appliance standards and labelling

    Periodic revision of standards needed

40. Building codes and certification

    Attractive for new buildings. Enforcement can be difficult

41. Demand-side management programmes

    Need for regulations so that utilities may profit

42. Public sector leadership programmes, including procurement

    Government purchasing can expand demand for energy-efficient products

43. Incentives for energy service companies (ESCOs)

    Success factor: Access to third party financing

4 Industry

The mitigation potential is highest in energy intensive industries. The slow rate of capital stock turnover, lack of financial and technical resources, and limitations in the ability of firms, particularly small and medium-sized enterprises, to access and absorb technological information are key barriers to full use of available mitigation options

Mitigation measures currently commercially available

44. More efficient end-use electrical equipment; heat and power recovery
45. Material recycling and substitution
46. Control of non-CO2 gas emissions
47. A wide array of process-specific technologies

Many industrial facilities in developing countries are new and include the latest technology. However, upgrading the many older, inefficient facilities remaining in both industrialized and developing countries could deliver significant emission reductions

Mitigation measures that may be commercially available by 2030

48. Advanced energy efficiency
49. CCS for cement, ammonia, and iron manufacture
50. Inert electrodes for aluminium manufacture

Mitigation policies

51. Provision of benchmark information

    May be appropriate to stimulate technology uptake

52. Performance standards

    Stability of national policy important in view of international competitiveness

53. Subsidies, tax credits

54. Tradable permits

    Predictable allocation mechanisms and stable price signals important for investments

55. Voluntary agreements

    Success factors include: clear targets, a baseline scenario, third party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry

5 Agriculture

A large proportion of the mitigation potential of agriculture (excluding bio-energy) arises from soil carbon sequestration, which has strong synergies with sustainable agriculture and generally reduces vulnerability to climate change. Stored soil carbon may be vulnerable to loss through both land management change and climate change.

Mitigation measures currently commercially available

56. Improved crop and grazing land management to increase soil carbon storage
57. Restoration of cultivated peaty soils and degraded lands
58. Improved rice cultivation techniques
59. Livestock and manure management to reduce CH4 emissions
60. Improved nitrogen fertilizer application techniques to reduce N2O emissions
61. Dedicated energy crops to replace fossil fuel use
62. Improved energy efficiency

Mitigation measures that may be commercially available by 2030

63. Improvements of crops yields

The magnitude of the above barriers is higher in the developing countries and this makes it more difficult. Biomass from agricultural residues and dedicated energy crops can be an important bio-energy feedstock, but its contribution to mitigation depends on demand for bio-energy from transport and energy supply, on water availability, and on requirements of land for food and fibre production. Widespread use of agricultural land for biomass production for energy may compete with other land uses and can have positive and negative environmental impacts and implications for food security.

Mitigation policies

64. Financial incentives and regulations for improved land management, maintaining soil carbon content, efficient use of fertilizers and irrigation

    May encourage synergy with sustainable development and with reducing vulnerability to climate change, thereby overcoming barriers to implementation

6 Forestry/forests

About 65% of the total mitigation potential is located in the tropics and about 50% of the total could be achieved by reducing emissions from deforestation. Climate change can affect the mitigation potential of the forest sector (i.e., native and planted forests) and is expected to be different for different regions and sub-regions, both in magnitude and direction. Forest-related mitigation options can be designed and implemented to be compatible with adaptation, and can have substantial co-benefits in terms of employment, income generation, biodiversity and watershed conservation, renewable energy supply and poverty alleviation.

Mitigation measures currently commercially available

65. Forestation
66. Reforestation
67. Forest management
68. Reduced deforestation
69. Harvested wood product management
70. Use of forestry products for bio energy to replace fossil fuel use

Mitigation measures that may be commercially available by 2030

71. *Tree species improvement to increase biomass productivity and carbon sequestration.*
72. *Improved remote sensing technologies for analysis of vegetation/ soil carbon sequestration potential*
73. *Mapping land use change*

Mitigation policies

74. Financial incentives (national and international) to increase forest area, to reduce deforestation, and to maintain and manage forests

    Constraints include lack of investment capital and land tenure issues. Can help poverty alleviation

75. Land use regulation and enforcement

7 Waste management

Existing waste management practices can provide effective mitigation of GHG emissions from this sector: a wide range of mature, environmentally effective technologies are commercially available to mitigate emissions and provide co-benefits for improved public health and safety, soil protection and pollution prevention, and local energy supply. Waste minimization and recycling provide important indirect mitigation benefits through the conservation of energy and materials.

Mitigation measures currently commercially available

76. Landfill methane recovery
77. Waste incineration with energy recovery
78. Composting of organic waste
79. Controlled waste water treatment
80. Recycling and waste minimization

Mitigation measures that may be commercially available by 2030

81. Bio covers and bio filters to optimize CH4 oxidation

Large-scale geo-engineering options, such as ocean fertilization to remove CO2 directly from the atmosphere, or blocking sunlight by bringing material into the upper atmosphere, remain largely speculative and unproven, with the risk of unknown side-effects.

Mitigation policies

82. Financial incentives for improved waste and wastewater management

    May stimulate technology diffusion

83. Renewable energy incentives or obligations

    Local availability of low-cost fuel

84. Waste management regulations

    Most effectively applied at national level with enforcement strategies

8 Lifestyles

Changes in lifestyles and consumption patterns that emphasize resource conservation can contribute to developing a low-carbon economy that is both equitable and sustainable.

85. Education

Education and training programmes can help overcome barriers to the market acceptance of energy efficiency, particularly in combination with other measures

86. Training

In industry, management tools that include staff training, reward systems, regular feedback, documentation of existing practices can help overcome industrial organization barriers, reduce energy use, and GHG emissions

87. Behaviour

Changes in occupant behaviour, cultural patterns and consumer choice and use of technologies can result in considerable reduction in CO2 emissions related to energy use in buildings

88. Transport demand management

Transport Demand Management, which includes urban planning (that can reduce the demand for travel) and provision of information and educational techniques (that can reduce car usage and lead to an efficient driving style) can support GHG mitigation

9 Policy instruments

Barriers to the implementation of mitigation options are manifold and vary by country and sector. They can be related to financial, technological, institutional, informational and behavioural aspects.

Governments have a crucial supportive role in providing appropriate enabling environment, such as, institutional, policy, legal and regulatory frameworks to sustain investment flows and for effective technology transfer – without which it may be difficult to achieve emission reductions at a significant scale. Mobilizing financing of incremental costs of low-carbon technologies is important. International technology agreements could strengthen the knowledge infrastructure.

All instruments can be designed well or poorly, and be stringent or lax. In addition, monitoring to improve implementation is an important issue for all instruments.

Regulations and standards

Regulations and standards generally provide some certainty about emission levels. They may be preferable to other instruments when information or other barriers prevent producers and consumers from responding to price signals. However, they may not induce innovations and more advanced technologies.

89. Integrated policies

Integrating climate policies in broader development policies makes implementation and overcoming barriers easier.

90. Taxes and charges

Taxes and charges can set a price for carbon, but cannot guarantee a particular level of emissions. Literature identifies taxes as an efficient way of internalizing costs of GHG emissions.

91. Tradable permits

Tradable permits will establish a carbon price. The volume of allowed emissions determines their environmental effectiveness, while the allocation of permits has distributional consequences. Fluctuation in the price of carbon makes it difficult to estimate the total cost of complying with emission permits.

92. Financial incentives

Financial incentives (subsidies and tax credits) are frequently used by governments to stimulate the development and diffusion of new technologies.

93. Voluntary agreements

Voluntary agreements between industry and governments are politically attractive, raise awareness among stakeholders, and have played a role in the evolution of many national policies. The majority of agreements have not achieved significant emissions reductions beyond business as usual. However, some recent agreements, in a few countries, have accelerated the application of best available technology and led to measurable emission reductions.

Regulations and standards continued

94. Information instruments

Information instruments (e.g. awareness campaigns) may positively affect environmental quality by promoting informed choices and possibly contributing to behavioural change, however, their impact on emissions has not been measured yet.

95. R and D

RD&D can stimulate technological advances, reduce costs, and enable progress toward stabilization.

96. Carbon pricing

An effective carbon-price signal could realize significant mitigation potential in all sectors.

Modelling studies, consistent with stabilization at around 550 ppm CO2-eq by 2100 show carbon prices rising to 20 to 80 US$/tCO2-eq by 2030 and 30 to 155 US$/tCO2-eq by 2050.

Most top-down, as well as some 2050 bottom-up assessments, suggest that real or implicit carbon prices of 20 to 50 US$/tCO2-eq, sustained or increased over decades, could lead to a power generation sector with low-GHG emissions by 2050 and make many mitigation options in the end-use sectors economically attractive.

1a **EUCO2 80/50** **ASSESSMENT OF THE IPCC 4TH REPORT ON MITIGATION MEASURES AND POLICIES**

			SUSTAINABILITY			SUBSIDIARITY		
	Sectors	Measures and *policies*	Available	Available	By 2030			
			Mitigation - transition to 80/50	Mitigation - zero carbon future	Mitigation - zero carbon future	UN/EU/ States/ Economies	Metropolitan	Local
1	Energy	Investing in the reduction of energy consumption rather than in new energy supply infrastructure	Yes			Yes	Yes	
2	Energy	Improved supply and distribution efficiency	Yes			Yes		
3	Energy	Switching from coal to gas	Yes			Yes		
4	Energy	Nuclear power, although safety, weapons proliferation and waste management remain constraints		Yes		Yes		
5	Energy	Renewable energy (hydropower, solar, wind, geothermal and bio energy)		Yes		Yes	Yes	Yes
6	Energy	Combined heat and power generation	Yes			Yes	Yes	
7	Energy	Application of Carbon Capture and Sequestration technologies	Yes			Yes	Yes	
8	Energy	CCS for gas, biomass and coal-fired electricity generating facilities	Yes			Yes	Yes	
9	Energy	Advanced nuclear power			Yes	Yes		
10	Energy	Advanced renewable energy, Including tidal and waves energy, concentrating solar, and solar PV			Yes	Yes		
11	*Energy*	*Reduction of fossil fuel subsidies*	*Yes*			Yes		
12	*Energy*	*Taxes or carbon charges on fossil fuels*	*Yes*			Yes		
13	*Energy*	*Feed-in tariffs for renewable energy technologies*		*Yes*		*Yes*		
14	*Energy*	*Renewable energy obligations*		*Yes*		*Yes*		
15	*Energy*	*Producer subsidies*		*Yes*		*Yes*		
16	Transport	More fuel efficient vehicles	Yes			Yes		
17	Transport	Hybrid vehicles	Yes			Yes		
18	Transport	Cleaner diesel engines	Yes			Yes		
19	Transport	Bio fuels	Yes			Yes		
20	Transport	Shift from road transport to rail and public transport		Yes			Yes	
21	Transport	Alternatives such as cycling and walking		Yes			Yes	Yes
22	Transport	Land use and transport planning (urban planning that reduces the need for road transport)		Yes			Yes	Yes
23	Transport	Second generation bio fuels			Yes	Yes		
24	Transport	Higher efficiency aircraft			Yes	Yes		
25	Transport	Advanced electric			Yes	Yes		
26	Transport	Hybrid vehicles with more powerful and reliable batteries			Yes	Yes		
27	*Transport*	*Mandatory fuel economy, bio-fuel blending and CO2 standards for road transport*	*Yes*			*Yes*		
28	*Transport*	*Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing*	*Yes*			*Yes*		
29	*Transport*	*Influence mobility needs through land use regulations, and infrastructure planning*	*Yes*				*Yes*	*Yes*
30	*Transport*	*Investment in attractive public transport facilities and non- motorised forms of transport*	*Yes*				*Yes*	*Yes*

1b **EUCO2 80/50** **ASSESSMENT OF THE IPCC 4TH REPORT ON MITIGATION MEASURES AND POLICIES**

			SUSTAINABILITY			SUBSIDIARITY		
	Sector	Measures and *policies*	Available	Available	By 2030			
			Mitigation - transition to 80/50	Mitigation - zero carbon future	Mitigation - zero carbon future	UN/EU/ States/ Economies	Metropolitan	Local
31	Building	Efficient lighting and daylighting	Yes			Yes		
32	Building	More efficient electrical appliances and heating and cooling devices	Yes			Yes		
33	Building	Improved insulation	Yes			Yes		
34	Building	Passive and active solar design for heating and cooling	Yes			Yes	Yes	Yes
35	Building	Alternative refrigeration fluids	Yes			Yes		
36	Building	Recovery and recycle of fluorinated gases	Yes			Yes		
37	Building	Integrated design of commercial buildings including technologies, such as intelligent meters			Yes	Yes		
38	Building	Solar PV integrated in buildings			Yes	Yes		
39	*Building*	*Appliance standards and labelling*	*Yes*			Yes		
40	*Building*	*Building codes and certification*	*Yes*			Yes	*Yes*	*Yes*
41	*Building*	*Demand-side management programmes*	*Yes*			Yes		
42	*Building*	*Public sector leadership programmes, including procurement*	*Yes*			Yes	*Yes*	*Yes*
43	*Building*	*Incentives for energy service companies (ESCOs)*	*Yes*			Yes		
44	Industry	More efficient end-use electrical equipment; heat and power recovery	Yes			Yes		
45	Industry	Material recycling and substitution	Yes			Yes		
46	Industry	Control of non-CO2 gas emissions	Yes			Yes		
47	Industry	A wide array of process-specific technologies	Yes			Yes		
48	Industry	Advanced energy efficiency			Yes	Yes		
49	Industry	CCS for cement, ammonia, and iron manufacture			Yes	Yes		
50	*Industry*	Inert electrodes for aluminium manufacture			Yes	Yes		
51	*Industry*	*Provision of benchmark information*	*Yes*			Yes		
52	*Industry*	*Performance standards*	*Yes*			Yes		
53	*Industry*	*Subsidies, tax credits*	*Yes*			Yes		
54	*Industry*	*Tradable permits*	*Yes*			Yes		
55	*Industry*	*Voluntary agreements*	*Yes*			Yes		
56	Agriculture	Improved crop and grazing land management to increase soil carbon storage	Yes			Yes		
57	Agriculture	Restoration of cultivated peaty soils and degraded lands	Yes			Yes	Yes	Yes
58	Agriculture	Improved rice cultivation techniques	Yes			Yes		
59	Agriculture	Livestock and manure management to reduce CH4 emissions	Yes			Yes		
60	Agriculture	Improved nitrogen fertilizer application techniques to reduce N2O emissions	Yes			Yes		
61	Agriculture	Dedicated energy crops to replace fossil fuel use	Yes			Yes	Yes	Yes
62	Agriculture	Improved energy efficiency	Yes			Yes		
63	Agriculture	Improvements of crops yields			Yes	Yes		
64	*Agriculture*	*Financial incentives and regulations for improved land management*	*Yes*			Yes	*Yes*	*Yes*

1c **EUCO2 80/50** **ASSESSMENT OF THE IPCC 4TH REPORT ON MITIGATION MEASURES AND POLICIES**

			SUSTAINABILITY			SUBSIDIARITY		
	Sector	**Measures and *policies***	Available	Available	By 2030			
			Mitigation - transition to 80/50	Mitigation - zero carbon future	Mitigation - zero carbon future	UN/EU/ States/ Economies	Metropolitan	Local
65	Forestry	Forestation	Yes			Yes	Yes	
66	Forestry	Reforestation	Yes			Yes	Yes	
67	Forestry	Forest management	Yes			Yes		
68	Forestry	Reduced deforestation	Yes			Yes	Yes	
69	Forestry	Harvested wood product management	Yes			Yes		
70	Forestry	Use of forestry products for bio energy to replace fossil fuel use	Yes			Yes		
71	Forestry	Tree species improvement to increase biomass productivity and carbon sequestration			Yes	Yes		
72	Forestry	Improved remote sensing technologies for analysis of vegetation/soil carbon sequestration potenti	Yes			Yes		
73	Forestry	Mapping land use change	Yes			Yes	Yes	Yes
74	*Forestry*	*Financial incentives to increase forest area, reduce deforestation, and maintain and manage forest*	*Yes*			Yes		
75	*Forestry*	*Land use regulation and enforcement*	*Yes*				*Yes*	*Yes*
76	Waste	Landfill methane recovery	Yes				Yes	Yes
77	Waste	Waste incineration with energy recovery	Yes				Yes	Yes
78	Waste	Composting of organic waste	Yes				Yes	Yes
79	Waste	Controlled waste water treatment	Yes				Yes	Yes
80	Waste	Recycling and waste minimization	Yes				Yes	Yes
81	Waste	Biocovers and biofilters to optimize CH4 oxidation			Yes	Yes		
82	*Waste*	*Financial incentives for improved waste and wastewater management*	*Yes*			Yes		
83	*Waste*	*Renewable energy incentives or obligations*		*Yes*		Yes		
84	*Waste*	*Waste management regulations*	*Yes*				*Yes*	*Yes*
85	*Lifestyle*	*Education*	*Yes*			*Yes*	*Yes*	*Yes*
86	*Lifestyle*	*Training*	*Yes*			*Yes*	*Yes*	*Yes*
87	*Lifestyle*	*Behaviour*	*Yes*			*Yes*	*Yes*	*Yes*
88	*Lifestyle*	*Transport demand management*	*Yes*				*Yes*	*Yes*
89	*Regulations*	*Integrated policies*	*Yes*			*Yes*	*Yes*	*Yes*
90	*Regulations*	*Taxes and charges*	*Yes*			*Yes*	*Yes*	*Yes*
91	*Regulations*	*Tradable permits*	*Yes*			*Yes*		
92	*Regulations*	*Financial incentives*	*Yes*			*Yes*		
93	*Regulations*	*Voluntary agreements*	*Yes*			*Yes*		
94	*Regulations*	*Information instruments*	*Yes*			*Yes*		
95	*Regulations*	*R and D*	*Yes*			*Yes*		
96	*Regulations*	*Carbon pricing*	*Yes*			*Yes*		

2 EUCO2 80/50	ASSESSMENT OF THE IPCC 4TH REPORT ON MITIGATION MEASURES AND POLICIES	SUSTAINABILITY			SUBSIDIARITY		
	Zero carbon measures and *policies*	Available	Available	By 2030			
		Mitigation - transition to 80/50	Mitigation - zero carbon future	Mitigation - zero carbon future	UN/EU/ States/ Economies	**Metro-politan**	Local
4 Energy	Nuclear power, although safety, weapons proliferation and waste management remain constraints		Yes		Yes		
5 Energy	Renewable energy (hydropower, solar, wind, geothermal and bio energy)		Yes		Yes	Yes	Yes
13 Energy	*Feed-in tariffs for renewable energy technologies*		*Yes*		*Yes*		
14 Energy	*Renewable energy obligations*		*Yes*		*Yes*		
15 Energy	*Producer subsidies*		*Yes*		*Yes*		
20 Transport	Shift from road transport to rail and public transport		Yes			Yes	
21 Transport	Alternatives such as cycling and walking		Yes			Yes	Yes
22 Transport	Land use and transport planning (urban planning that reduces the need for road transport)		Yes			Yes	Yes
83 Waste	*Renewable energy incentives or obligations*		*Yes*		Yes		
9 Energy	Advanced nuclear power			Yes	Yes		
10 Energy	Advanced renewable energy, Including tidal and waves energy, concentrating solar, and solar PV			Yes	Yes		
23 Transport	Second generation bio fuels			Yes	Yes		
24 Transport	Higher efficiency aircraft			Yes	Yes		
25 Transport	Advanced electric			Yes	Yes		
26 Transport	Hybrid vehicles with more powerful and reliable batteries			Yes	Yes		
37 Building	Integrated design of commercial buildings including technologies, such as intelligent meters			Yes	Yes		
38 Building	Solar PV integrated in buildings			Yes	Yes		
48 Industry	Advanced energy efficiency			Yes	Yes		
49 Industry	CCS for cement, ammonia, and iron manufacture			Yes	Yes		
50 Industry	Inert electrodes for aluminium manufacture			Yes	Yes		
63 Agriculture	Improvements of crops yields			Yes	Yes		
71 Forestry	Tree species improvement to increase biomass productivity and carbon sequestration			Yes	Yes		
81 Waste	Biocovers and biofilters to optimize CH4 oxidation			Yes	Yes		

3 EUCO2 80/50	ASSESSMENT OF THE IPCC 4TH REPORT ON MITIGATION MEASURES AND POLICIES	SUSTAINABILITY			SUBSIDIARITY		
Sectors	Measures and *policies* by metropolitan governance	Available	Available	By 2030			
		Mitigation - transition to 80/50	Mitigation - zero carbon future	Mitigation - zero carbon future	UN/EU/ States/ Economies	**Metro-politan**	Local
1 **Energy**	Investing in the reduction of energy consumption rather than in new energy supply infrastructure	Yes			Yes	**Yes**	
5 **Energy**	Renewable energy (hydropower, solar, wind, geothermal and bio energy)		Yes		Yes	**Yes**	Yes
6 **Energy**	Combined heat and power generation	Yes			Yes	**Yes**	
7 **Energy**	Application of Carbon Capture and Sequestration technologies	Yes			Yes	**Yes**	
8 **Energy**	CCS for gas, biomass and coal-fired electricity generating facilities	Yes			Yes	**Yes**	
20 **Transport**	Shift from road transport to rail and public transport		Yes			**Yes**	
21 **Transport**	Alternatives such as cycling and walking		Yes			**Yes**	Yes
22 **Transport**	Land use and transport planning (urban planning that reduces the need for road transport)		Yes			**Yes**	Yes
29 ***Transport***	*Influence mobility needs through land use regulations, and infrastructure planning*	*Yes*				***Yes***	*Yes*
30 ***Transport***	*Investment in attractive public transport facilities and non- motorised forms of transport*	*Yes*				***Yes***	*Yes*
34 **Building**	Passive and active solar design for heating and cooling	Yes			Yes	**Yes**	Yes
40 ***Building***	*Building codes and certification*	*Yes*			Yes	***Yes***	*Yes*
42 ***Building***	*Public sector leadership programmes, including procurement*	*Yes*			Yes	***Yes***	*Yes*
57 **Agriculture**	Restoration of cultivated peaty soils and degraded lands	Yes			Yes	**Yes**	Yes
61 **Agriculture**	Dedicated energy crops to replace fossil fuel use	Yes			Yes	**Yes**	Yes
64 ***Agriculture***	*Financial incentives and regulations for improved land management*	*Yes*			Yes	***Yes***	*Yes*
65 **Forestry**	Forestation	Yes			Yes	**Yes**	
66 **Forestry**	Reforestation	Yes			Yes	**Yes**	
68 **Forestry**	Reduced deforestation	Yes			Yes	**Yes**	
73 **Forestry**	Mapping land use change	Yes			Yes	**Yes**	Yes
75 ***Forestry***	*Land use regulation and enforcement*	*Yes*				***Yes***	*Yes*
76 **Waste**	Landfill methane recovery	Yes					Yes
77 **Waste**	Waste incineration with energy recovery	Yes				**Yes**	Yes
78 **Waste**	Composting of organic waste	Yes				**Yes**	Yes
79 **Waste**	Controlled waste water treatment	Yes				**Yes**	Yes
80 **Waste**	Recycling and waste minimization	Yes				**Yes**	Yes
84 ***Waste***	*Waste management regulations*	*Yes*				***Yes***	*Yes*
85 ***Lifestyle***	*Education*	*Yes*			*Yes*	***Yes***	*Yes*
86 ***Lifestyle***	*Training*	*Yes*			*Yes*	***Yes***	*Yes*
87 ***Lifestyle***	*Behaviour*	*Yes*			*Yes*	***Yes***	*Yes*
88 ***Lifestyle***	*Transport demand management*	*Yes*				***Yes***	*Yes*
89 ***Regulations***	*Integrated policies*	*Yes*			*Yes*	***Yes***	*Yes*
90 ***Regulations***	*Taxes and charges*	*Yes*			*Yes*	***Yes***	*Yes*

Appendix

IPCC 4th Report - Mitigation scenarios

Longer-term mitigation

The contribution of different technologies to emission reductions required for stabilization will vary over time, region and stabilization level.

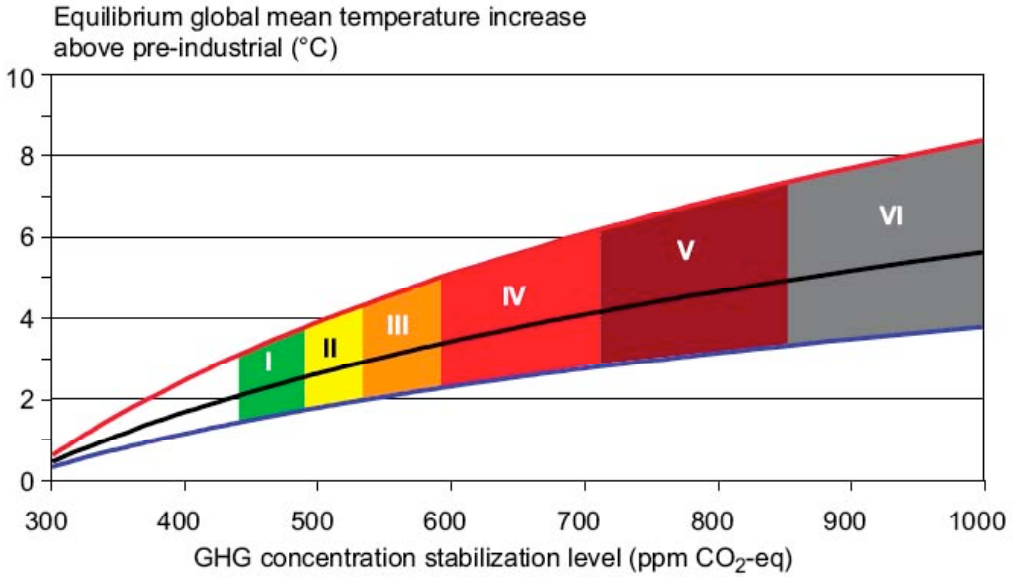
Energy efficiency plays a key role across many scenarios for most regions and timescales.

For lower stabilization levels, scenarios put more emphasis on the use of low-carbon energy sources, such as renewable energy and nuclear power, and the use of CO2 capture and storage (CCS). In these scenarios improvements of carbon intensity of energy supply and the whole economy need to be much faster than in the past.

Including non-CO2 and CO2 land-use and forestry mitigation options provides greater flexibility and cost-effectiveness for achieving stabilization. Modern bio-energy could contribute substantially to the share of renewable energy in the mitigation portfolio.

Climate sensitivity is a key uncertainty for mitigation scenarios that aim to meet a specific temperature level. Studies show that if climate sensitivity is high then the timing and level of mitigation is earlier and more stringent than when it is low.

Delayed emission reductions lead to investments that lock in more emission-intensive infrastructure and development pathways. This significantly constrains the opportunities to achieve lower stabilization levels and increases the risk of more severe climate change impacts.



IPCC Scenarios

The emission scenarios of the IPCC Special Report on Emission Scenarios (SRES)

A1.

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis:

A1F1 - fossil intensive (A1FI),
A1T - non fossil energy sources
A1B - balance across all sources (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies)

A2.

The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

B1.

The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

B2.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.