Highlights from
Climate Change 2007:
Mitigation of Climate Change
Summary for Policy Makers
Contribution of Working Group III to the
Fourth Assessment Report of the Intergovernmental Panel on Climate Change

The Working Group III contribution to the IPCC Fourth Assessment Report (AR4) focuses on new literature on the scientific, technological, environmental, economic and social aspects of mitigation of climate change.[1] The summary for policymakers, released on May 4, 2007, is organized into five sections:

- Greenhouse gas (GHG) emission trends;
- Mitigation in the short and medium term across different economic sectors (until 2030);
- Mitigation in the long-term (beyond 2030);
- Policies, measures and instruments to mitigate climate change; and
- Sustainable development and climate change mitigation.

Key findings of the report are outlined below. Information on the following pages is quoted or paraphrased from the Summary for Policymakers for Working Group III of the AR4. The original document is available at http://www.ipcc.ch/SPM040507.pdf.

GREENHOUSE GAS EMISSION TRENDS

- **Global greenhouse gas (GHG) emissions have grown since pre-industrial times, with an increase of 70% between 1970 and 2004** *(high agreement, much evidence).*
  - The largest growth in global GHG emissions between 1970 and 2004 has come from the energy supply sector (an increase of 145%). The growth in direct emissions in this period from transport 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%, and the latter remained at approximately at 1990 levels thereafter. 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 (75%) than direct emissions.
  - The effect on global emissions of the decrease in global energy intensity (-33%) during 1970 to 2004 has been smaller than the combined effect of global income growth (77 %) and global population growth (69%); both drivers of increasing energy-related CO_2 emissions. The long-term trend of a declining carbon intensity of energy supply reversed after 2000. Differences in terms of per capita income, per capita emissions, and energy intensity among countries remain significant. In 2004 UNFCCC Annex I countries held a

[1] Published since the 2001 IPCC Third Assessment Report (TAR); the 2005 Special Report on CO2 Capture and Storage (SRCCS); and the 2005 Special Report on Safeguarding the Ozone Layer and the Global Climate System (SROC).

20% share in world population, produced 57% of world Gross Domestic Product based on Purchasing Power Parity (GDP_{ppp}) and accounted for 46% of global GHG emissions.

- A range of policies, including those on climate change, energy security, and sustainable development, have been effective in reducing GHG emissions in different sectors and many countries. The scale of such measures, however, has not yet been large enough to counteract the global growth in emissions.

➢ **With current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades** *(high agreement, much evidence).*

- The SRES (non-mitigation) scenarios project an increase of baseline global GHG emissions by a range of 9.7 $GtCO_2$-eq to 36.7 $GtCO_2$-eq (25-90%) between 2000 and 2030. In these scenarios, fossil fuels are projected to maintain their dominant position in the global energy mix to 2030 and beyond. Hence CO_2 emissions between 2000 and 2030 from energy use are projected to grow 45 to 110% over that period. Two thirds to three quarters of this increase in energy CO_2 emissions is projected to come from non-Annex I regions, with their average per capita energy CO_2 emissions being projected to remain substantially lower (2.8-5.1 t CO_2/cap) than those in Annex I regions (9.6-15.1 t CO_2/cap) by 2030. According to SRES scenarios, their economies are projected to have a lower energy use per unit of GDP (6.2 – 9.9 MJ/US$ GDP) than that of non-Annex I countries (11.0 – 21.6 MJ/US$ GDP).

➢ **Baseline emissions scenarios published since SRES, are comparable in range to those presented in the IPCC Special Report on Emission Scenarios (SRES) (25- 135 $GtCO_2$-eq/yr in 2100)** *(high agreement, much evidence).*

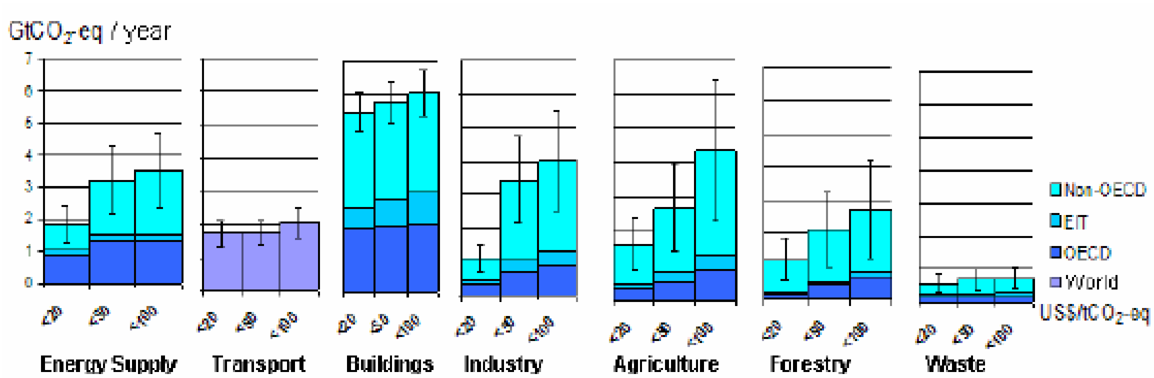
- Studies since SRES used lower values for some drivers for emissions, notably population projections. However, for those studies incorporating these new population projections, changes in other drivers, such as economic growth, resulted in little change in overall emission levels. Economic growth projections for Africa, Latin America and the Middle East to 2030 in post-SRES baseline scenarios are lower than in SRES, but this has only minor effects on global economic growth and overall emissions .
- Representation of aerosol and aerosol precursor emissions, including sulfur dioxide, black carbon, and organic carbon, which have a net cooling effect has improved. Generally, they are projected to be lower than reported in SRES.

MITIGATION IN THE SHORT AND MEDIUM TERM (UNTIL 2030)

➢ **Both bottom-up and top-down studies indicate that there is substantial economic potential for the mitigation of global GHG emissions over the coming decades that could offset the projected growth of global emissions or reduce emissions below current levels** *(high agreement, much evidence).*

Table SPM 3: Key mitigation technologies and practices by sector. Sectors and technologies are listed in no particular order. Non-technological practices, such as lifestyle changes, which are cross-cutting, are not included in this table (but are addressed in paragraph 7 in this SPM).

Sector	**Key mitigation technologies and practices currently commercially available.**	**Key mitigation technologies and practices projected to be commercialized before 2030.**
Energy Supply [4.3, 4.4]	Improved supply and distribution efficiency; fuel switching from coal to gas; nuclear power; renewable heat and power (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; early applications of CCS (e.g. storage of removed CO_2 from natural gas)	Carbon Capture and Storage (CCS) for gas, biomass and coal-fired electricity generating facilities; advanced nuclear power; advanced renewable energy, including tidal and waves energy, concentrating solar, and solar PV.
Transport [5.4]	More fuel efficient vehicles; hybrid vehicles; cleaner diesel vehicles; biofuels; modal shifts from road transport to rail and public transport systems; non-motorised transport (cycling, walking); land-use and transport planning	Second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries
Buildings [6.5]	Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves, improved insulation ; passive and active solar design for heating and cooling; alternative refrigeration fluids, recovery and recycle of fluorinated gases	Integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control; solar PV integrated in buildings
Industry [7.5]	More efficient end-use electrical equipment; heat and power recovery; material recycling and substitution; control of non-CO_2 gas emissions; and a wide array of process-specific technologies	Advanced energy efficiency; CCS for cement, ammonia, and iron manufacture; inert electrodes for aluminium manufacture
Agriculture [8.4]	Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation techniques and livestock and manure management to reduce CH_4 emissions; improved nitrogen fertilizer application techniques to reduce N_2O emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency	Improvements of crops yields
Forestry/forests [9.4]	Afforestation; reforestation; forest management; reduced deforestation; harvested wood product management; use of forestry products for bioenergy to replace fossil fuel use	Tree species improvement to increase biomass productivity and carbon sequestration. Improved remote sensing technologies for analysis of vegetation/ soil carbon sequestration potential and mapping land use change
Waste [10.4]	Landfill methane recovery; waste incineration with energy recovery; composting of organic waste; controlled waste water treatment; recycling and waste minimization	Biocovers and biofilters to optimize CH_4 oxidation



(potential at <US$100/tCO$_2$-eq: 2.4 - 4.7 Gt CO$_2$-eq/yr)	(potential at <US$100/tCO$_2$-eq: 1.6 - 2.5 Gt CO$_2$-eq/yr)	(potential at <US$100 /tCO$_2$-eq: 5.3 -6.7	(potential at <US$100/tCO$_2$-eq: 2.5 - 5.5 Gt CO$_2$-eq/yr)	(potential at <US$100/tCO$_2$-eq: 2.3 - 6.4 Gt CO$_2$-eq/yr)	(potential at <US$100/tCO$_2$-eq: 1.3 - 4.2 Gt CO$_2$-eq/yr)	(potential at <US$100/tCO$_2$-eq: 0.4 - 1 Gt CO$_2$-eq/yr)

Figure SPM 6: *Estimated sectoral economic potential for global mitigation for different regions as a function of carbon price in 2030 from bottom-up studies, compared to the respective baselines assumed in the sector assessments. A full explanation of the derivation of this figure is found in 11.3.*

Figure Notes:

1. The ranges for global economic potentials as assessed in each sector are shown by vertical lines. The ranges are based on end-use allocations of emissions, meaning that emissions of electricity use are counted towards the end-use sectors and not to the energy supply sector.
2. The estimated potentials have been constrained by the availability of studies particularly at high carbon price levels.
3. Sectors used different baselines. For industry the SRES B2 baseline was taken, for energy supply and transport the WEO 2004 baseline was used; the building sector is based on a baseline in between SRES B2 and A1B; for waste, SRES A1B driving forces were used to construct a waste specific baseline, agriculture and forestry used baselines that mostly used B2 driving forces.
4. Only global totals for transport are shown because international aviation is included.
5. Categories excluded are: non-CO2 emissions in buildings and transport, part of material efficiency options, heat production and cogeneration in energy supply, heavy duty vehicles, shipping and high-occupancy passenger transport, most high-cost options for buildings, wastewater treatment, emission reduction from coal mines and gas pipelines, fluorinated gases from energy supply and transport. The underestimation of the total economic potential from these emissions is of the order of 10-15%.

- **In 2030 macro-economic costs for multi-gas mitigation, consistent with emissions trajectories towards stabilization between 445 and 710 ppm CO_2-eq, are estimated at between a 3% decrease of global GDP and a small increase, compared to the baseline. However, regional costs may differ significantly from global averages** (*high agreement, medium evidence).*

Table SPM 4. *Estimated global macro-economic costs in 2030 for least-cost trajectories towards different long-term stabilization levels*

Stabilization levels (ppm CO2-eq)	Median	GDP reduction (%)	Range of GDP reduction
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-53522	Not available	< 3	< 0.12

- **Changes in lifestyle and behavior patterns can contribute to climate change mitigation across all sectors. Management practices can also have a positive role** *(high agreement, medium evidence).*

- **While studies use different methodologies, in all analyzed world regions near-term health co-benefits from reduced air pollution as a result of actions to reduce GHG emissions can be substantial and may offset a substantial fraction of mitigation costs** *(high agreement, much evidence).*

- **Literature since TAR confirms that there may be effects from Annex I countries action on the global economy and global emissions, although the scale of carbon leakage remains uncertain** *(high agreement, medium evidence).*

- **New energy infrastructure investments in developing countries, upgrades of energy infrastructure in industrialized countries, and policies that promote energy security, can, in many cases, create opportunities to achieve GHG emission reductions compared to baseline scenarios. Additional co-benefits are country-specific but often include air pollution abatement, balance of trade improvement, provision of modern energy services to rural areas and employment** *(high agreement, much evidence).*
    - Future energy infrastructure investment decisions, expected to total over 20 trillion US$ between now and 2030, will have long term impacts on GHG emissions, because of the long life-times of energy plants and other infrastructure capital stock. The widespread diffusion of low-carbon technologies may take many decades, even if early investments in these technologies are made attractive. Initial estimates show that returning global energy-related CO_2 emissions to 2005 levels by 2030 would require a large shift in the pattern of investment, although the net additional investment required ranges from negligible to 5-10%.
    - 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. Efficiency improvement has a positive effect on energy security, local and regional air pollution abatement, and employment.

- **There are multiple mitigation options in the transport sector, but their effect may be counteracted by growth in the sector. Mitigation options are faced with many barriers, such as consumer preferences and lack of policy frameworks** *(medium agreement, medium evidence).*
    - Improved vehicle efficiency measures, leading to fuel savings, in many cases have net benefits (at least for light-duty vehicles), but the market potential is much lower than the economic potential due to the influence of other consumer considerations, such as performance and size. There is not enough information to assess the mitigation potential for heavy-duty vehicles. Market forces alone, including rising fuel costs, are therefore not expected to lead to significant emission reductions.

- Biofuels might play an important role in addressing GHG emissions in the transport sector, depending on their production pathway. Biofuels used as gasoline and diesel fuel additives/substitutes are projected to grow to 3% of total transport energy demand in the baseline in 2030. This could increase to about 5-10%, depending on future oil and carbon prices, improvements in vehicle efficiency and the success of technologies to utilize cellulose biomass.

➢ **Energy efficiency options for new and existing buildings could considerably reduce CO_2 emissions with net economic benefit. Many barriers exist against tapping this potential, but there are also large co-benefits** *(high agreement, much evidence)*.

- By 2030, about 30% of the projected GHG emissions in the building sector can be avoided with net economic benefit.

➢ **The economic potential in the industrial sector is predominantly located in energy intensive industries. Full use of available mitigation options is not being made in either industrialized or developing nations** (*high agreement, much evidence*).

➢ **Agricultural practices collectively can make a significant contribution at low cost to increasing soil carbon sinks, to GHG emission reductions, and by contributing biomass feedstocks for energy use** *(medium agreement, medium evidence)***.**

➢ **Forest-related mitigation activities can considerably reduce emissions from sources and increase CO_2 removals by sinks at low costs, and can be designed to create synergies with adaptation and sustainable development** *(high agreement, much evidence).*

- About 65% of the total mitigation potential (up to 100 US$/t$CO_2$-eq) is located in the tropics and about 50% of the total could be achieved by reducing emissions from deforestation.

➢ **Post-consumer waste is a small contributor to global GHG emissions (<5%), but the waste sector can positively contribute to GHG mitigation at low cost and promote sustainable development** *(high agreement, much evidence).*

➢ **Geo-engineering options, such as ocean fertilization to remove CO_2 directly from the atmosphere, or blocking sunlight by bringing material into the upper atmosphere, remain largely speculative and unproven, and with the risk of unknown side-effects. Reliable cost estimates for these options have not been published** *(medium agreement, limited evidence).*

MITIGATION IN THE LONG TERM (AFTER 2030)

➢ **In order to stabilize the concentration of GHGs in the atmosphere, emissions would need to peak and decline thereafter. The lower the stabilization level, the more quickly this peak and decline would need to occur. Mitigation efforts over**

the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels (*high agreement, much evidence*).

Table SPM.5: Characteristics of post-TAR stabilization scenarios [Table TS 2, 3.10][37]

Category	Radiative Forcing	CO_2 Concentration	CO_2-eq Concentration	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity[38], [39]	Peaking year for CO_2 emissions[40]	Change in global CO_2 emissions in 2050 (% of 2000 emissions)	No. of assessed scenarios
	W/m^2	ppm	ppm	°C	Year	percent	
A1	2.5 – 3.0	350 – 400	445 – 490	2.0 – 2.4	2000 - 2015	-85 to -50	6
A2	3.0 – 3.5	400 – 440	490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30	18
B	3.5 – 4.0	440 – 485	535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5	21
C	4.0 – 5.0	485 – 570	590 – 710	3.2 – 4.0	2020 - 2060	+10 to +60	118
D	5.0 – 6.0	570 – 660	710 – 855	4.0 – 4.9	2050 - 2080	+25 to +85	9
E	6.0 – 7.5	660 – 790	855 – 1130	4.9 – 6.1	2060 - 2090	+90 to +140	5
Total							177

- **The range of stabilization levels assessed can be achieved by deployment of a portfolio of technologies that are currently available and those that are expected to be commercialized in coming decades. This assumes that appropriate and effective incentives are in place for development, acquisition, deployment and diffusion of technologies and for addressing related barriers** *(high agreement, much evidence).*
  - 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 CO_2 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.

- **In 2050, global average macro-economic costs for multi-gas mitigation towards stabilization between 710 and 445 ppm CO_2-eq, are between a 1% gain to a 5.5%**

decrease of global GDP. For specific countries and sectors, costs vary considerably from the global average. *(high agreement, medium evidence).*

Table SPM 6*. Estimated global macro-economic cots in 2050 relative to the baseline for least-cost trajectories towards different long-term stabilization targets*

Stabilization levels (ppm CO_2-eq)	Median GDP reduction43 (%)	Range of GDP reduction(%)	Reduction of average annual GDP growth rates (percentage points)
590-710	0.5	-1 – 2	< 0.05
535-590	1.3	slightly negative – 4	<0.1
445- 535	Not available	< 5.5	< 0.12

- **Decision-making about the appropriate level of global mitigation over time involves an iterative risk management process that includes mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity, and attitudes to risk. Choices about the scale and timing of GHG mitigation involve balancing the economic costs of more rapid emission reductions now against the corresponding medium-term and long-term climate risks of delay** *(high agreement, much evidence).*
  - 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 (as shown in Table SPM.6) and increases the risk of more severe climate change impacts.

POLICIES, MEASURES AND INSTRUMENTS TO MITIGATE CLIMATE CHANGE

- **A wide variety of national policies and instruments are available to governments to create the incentives for mitigation action. Their applicability depends on national circumstances and an understanding of their interactions, but experience from implementation in various countries and sectors shows there are advantages and disadvantages for any given instrument** *(high agreement, much evidence).*
  - 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. General findings about the performance of policies are:
    - Integrating climate policies in broader development policies makes implementation and overcoming barriers easier.
    - 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.

- 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.
- 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.
- Financial incentives (subsidies and tax credits) are frequently used by governments to stimulate the development and diffusion of new technologies. While economic costs are generally higher than for the instruments listed above, they are often critical to overcome barriers.
- 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 has 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.
- Information instruments (e.g. awareness campaigns) may positively affect environmental quality by promoting informed choices and possibly contributing to behavioral change, however, their impact on emissions has not been measured yet.
- RD&D can stimulate technological advances, reduce costs, and enable progress toward stabilization.

- **Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes. Such policies could include economic instruments, government funding and regulation** (*high agreement, much evidence*).
  - An effective carbon-price signal could realize significant mitigation potential in all sectors.
  - Modeling studies show carbon prices rising to 20 to 80 US$/t$CO_2$-eq by 2030 and 30 to 155 US$/t$CO_2$-eq by 2050 are consistent with stabilization at around 550 ppm CO_2-eq by 2100. For the same stabilization level, studies since TAR that take into account induced technological change lower these price ranges to 5 to 65 US$/t$CO_2$eq in 2030 and 15 to 130 US$/t$CO_2$-eq in 2050.
    - Most top-down, as well as some 2050 bottom-up assessments, suggest that real or implicit carbon prices of 20 to 50 US$/t$CO_2$-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.

Table SPM.7: Selected sectoral policies, measures and instruments that have shown to be environmentally effective in the respective sector in at least a number of national cases.

Sector	Policies[47], measures and instruments shown to be environmentally effective	Key constraints or opportunities
Energy supply [4.5]	Reduction of fossil fuel subsidies	Resistance by vested interests may make them difficult to implement
	Taxes or carbon charges on fossil fuels	
	Feed-in tariffs for renewable energy technologies	May be appropriate to create markets for low emissions technologies
	Renewable energy obligations	
	Producer subsidies	
Transport [5.5]	Mandatory fuel economy, biofuel blending and CO_2 standards for road transport	Partial coverage of vehicle fleet may limit effectiveness
	Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing	Effectiveness may drop with higher incomes
	Influence mobility needs through land use regulations, and infrastructure planning	Particularly appropriate for countries that are building up their transportation systems
	Investment in attractive public transport facilities and non-motorised forms of transport	
Buildings [6.8]	Appliance standards and labelling	Periodic revision of standards needed
	Building codes and certification	Attractive for new buildings. Enforcement can be difficult
	Demand-side management programmes	Need for regulations so that utilities may profit
	Public sector leadership programmes, including procurement	Government purchasing can expand demand for energy-efficient products
	Incentives for energy service companies (ESCOs)	Success factor: Access to third party financing
Industry [7.9]	Provision of benchmark information	May be appropriate to stimulate technology uptake. Stability of national policy important in view of international competitiveness
	Performance standards	
	Subsidies, tax credits	
	Tradable permits	Predictable allocation mechanisms and stable price signals important for investments
	Voluntary agreements	Success factors include: clear

Sector	Policies[47], measures and instruments shown to be environmentally effective	Key constraints or opportunities
		targets, a baseline scenario, third party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry.
Agriculture [8.6, 8.7, 8.8]	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
Forestry/Forests [9.6]	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.
	Land use regulation and enforcement	
Waste management [10.5]	Financial incentives for improved waste and wastewater management	May stimulate technology diffusion
	Renewable energy incentives or obligations	Local availability of low-cost fuel
	Waste management regulations	Most effectively applied at national level with enforcement strategies

- **Government support through financial contributions, tax credits, standard setting and market creation is important for effective technology development, innovation and deployment. Transfer of technology to developing countries depends on enabling conditions and financing** *(high agreement, much evidence).*

- **Notable achievements of the UNFCCC and its Kyoto protocol are the establishment of a global response to the climate problem, stimulation of an array of national policies, the creation of an international carbon market and the establishment of new institutional mechanisms that may provide the foundation for future mitigation efforts** *(high agreement, much evidence).*
  - The impact of the protocol's first commitment period relative to global emissions is projected to be limited. Its economic impacts on participating Annex-B countries are projected to be smaller than presented in TAR, that showed 0.2-2% lower GDP in 2012 without emissions trading, and 0.1-1.1% lower GDP with emissions trading among Annex-B countries.

- **The literature identifies many options for achieving reductions of global GHG emissions at the international level through cooperation. It also suggests that successful agreements are environmentally effective, cost-effective, incorporate distributional considerations and equity, and are institutionally feasible** *(high agreement, much evidence).*

SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE MITIGATION

- **Making development more sustainable by changing development paths can make a major contribution to climate change mitigation, but implementation may require resources to overcome multiple barriers. There is a growing understanding of the possibilities to choose and implement mitigation options in several sectors to realize synergies and avoid conflicts with other dimensions of sustainable development** *(high agreement, much evidence).*
  - Irrespective of the scale of mitigation measures, adaptation measures are necessary.
  - 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.
  - 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. In other situations, there may be trade-offs, such as increased GHG emissions due to increased consumption of energy related to adaptive responses.

GAPS IN KNOWLEDGE

- **There are still relevant gaps in currently available knowledge regarding some aspects of mitigation of climate change, especially in developing countries. Additional research addressing those gaps would further reduce uncertainties and thus facilitate decision-making related to mitigation of climate change.**