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Recent developments and new challenges in commodity markets, and policy options for commodity-based inclusive growth and sustainable development

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Note by the UNCTAD secretariat

Executive summary

This background note reviews recent developments in key commodity markets and analyses the underlying factors contributing to price volatilities in 2012. The uncertainty of world economic prospects weighed heavily on commodity markets, particularly for oil, minerals, ores and metals. Supply disruptions caused by adverse weather tightened the food market in the third quarter of 2012.

This note identifies four key developments in the commodity economy that are set to change the commodity landscape and pose challenges for commodity-dependent developing countries. They include the shifting energy power balance in the wake of the shale oil and gas revolution in the United States of America, climate change and its potential impact on commodities, the growth of renewable energy and the increasing importance of rare earth metals.

Some policies that are critical for sustainable development and inclusive growth in commodity-dependent developing countries are proposed in this note. In particular, concerted efforts should be made to curb carbon and greenhouse gas (GHG) emissions, increase funding for research and investment in renewable energy and improve regulations to monitor shale oil and gas production so that the economic gains are not made at the expense of human and environmental health.

Contents

Introduction

1. Accra Accord paragraph 208 mandated the Trade and Development Board to establish a multi-year expert meeting on commodities and development. This series of meetings was reaffirmed in paragraph 7 of the Doha Mandate and extends over the next four years: 2013 to 2016.

2. This background note analyses commodity market development over the first 10 months of 2012, focusing on price trends and driving forces of price movements. The three major commodity groups covered in this paper are:

(a) Agricultural commodities and food (agrifood);

(b) Minerals, metals and ores;

(c) Energy – oil, gas and coal.

3. It discusses four emerging developments in the global commodity economy that may have an impact on sustainable and inclusive development in commodity-dependent developing countries. They include the shifting energy power balance in the wake of the shale oil and gas revolution in the United States, climate change and its potential impact on commodities, the growth of renewable energy and the increasing importance of rare earth metals.

4. Finally, it provides some policy recommendations that could assist commodity-dependent developing countries in achieving sustainable development and inclusive growth. Policies that will enhance food security, reduce carbon emissions and diversify the energy mix are highlighted.

I. Recent developments in commodity markets

A. General overview

5. Underpinned by initially strengthening industrial activity,[1] strong demand from developing countries and optimistic market sentiment following the European Central Bank's longer-term refinancing operations, the UNCTAD price index[2] for three groups of commodities – all food,[3] agricultural raw materials, and minerals, ores and metals – rose in the first quarter of 2012 from their lows in December 2011. However, prices fell in the second quarter as a result of the economic slowdown in China, the intensification of the debt crisis in Europe and the appreciation of the dollar against other currencies. The drop was particularly pronounced for agricultural raw materials, and minerals, ores and metals.

6. The third quarter of 2012 witnessed a different price scenario between food and base metals and ores. The food market was tight, mainly due to supply disruptions caused by adverse weather in the United States, Australia and the Black Sea region. Surging maize, wheat and soybean prices put a strain on the food market.

7. On the other hand, the prices of many important base metals and ores continued their downward trend in July and August 2012. Copper prices, despite their brief recovery in

[1] The World Bank, *Global Economic Prospects: Managing Growth in a Volatile World* (Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, June 2012).

[2] Unless otherwise stated, all indices used in this note are UNCTAD price indices.

[3] All food includes food, tropical beverages, and vegetable oilseeds and oils.

July, were significantly lower than a year ago. Metals and ores, key raw materials for construction and manufacturing, are sensitive to the economic performance of major consuming countries. The gloomy economic situation dampened the demand for these commodities. At the same time, the development and expansion of new projects over the last decade increased the global supply of many minerals and metals. In some markets such as aluminium, nickel and zinc, supply exceeded demand, driving down prices further.

8. To boost the economy, the central banks of the eurozone, the United States and Japan eased their monetary policies in September. While the full impact of these policies on economic growth is still unclear, commodity markets responded quickly, with the prices of gold and key base metals rallying.[4]

9. The price of crude oil remained high and volatile during the first 10 months of 2012, due to divergent factors. The uncertainty of the world economic outlook and geopolitical risks in the Middle East, in particular, weighed heavily on oil markets. The economic woes in the eurozone, struggling recovery in the United States and the economic slowdown in emerging countries weakened the demand for crude oil. The economic sanctions on oil exports from the Islamic Republic of Iran removed off the oil market an estimated 0.82 million barrels of crude per day in the third quarter of 2012. This vacuum, however, was filled by the increased outputs from Saudi Arabia, Libya and Iraq.

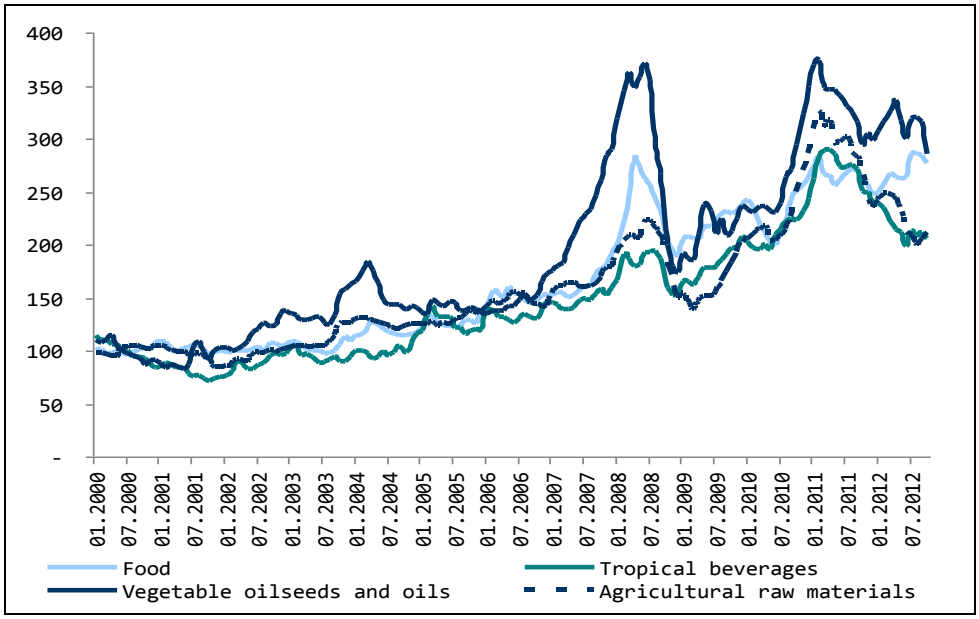
B. Developments in key commodity sectors

1. Food and agricultural commodities

10. During the first 10 months of 2012, the All Food Commodity Price Index remained high, despite short-term price fluctuations. Led by high prices of maize, wheat and soybeans, the Price Index rose sharply to 283 points in July 2012, an increase of 11 per cent from January 2012. However, the price pattern differed within various subgroups of commodities (figure 1).

[4] In September 2012, the average gold price surged to $1,744 an ounce, 1.6 per cent lower than its historical peak set in September 2011. The prices of aluminium, copper, lead, nickel, tin and zinc also spiked considerably compared with August 2012.

Figure 1
Price indices of selected food and agricultural commodity groups, January 2000–October 2012 (2000=100)



Source: UNCTAD, UNCTADstat.

11. During the first quarter of 2012, the Food Price Index rebounded from its 15-month low in December 2011 to reach 266 points in March 2012. Prices stabilized in the following three months before surging to a record high in July, due largely to tight supplies of maize or corn, wheat and low stockpiles. The worst drought in 56 years ravaged the corn belt in the United States, reducing yield prospects and driving up corn prices in that country to an all-time high in July 2012. Poor weather also adversely affected the outlook for wheat production in the Russian Federation, Ukraine and Kazakhstan. Global stocks for maize and wheat are expected to fall to six- and four-year lows, respectively, by the end of 2012–2013.[5]

12. The price of rice was relatively stable as stocks remained high and supply and demand, broadly in balance. The rice-pledging programme in Thailand, which subsidizes farmers, dramatically reduced the country's rice exports in 2011–2012. To date, the impact of this policy on the global rice market is subdued, due to adequate rice stocks and stable supplies from other major exporting countries (e.g. Viet Nam). However, the dynamics of the world rice market might change quickly if other exporting countries also intervene in the market (e.g. export quotas or bans).

13. The spike in major cereal prices raised concerns that another food crisis may be in the offing. The Group of Twenty is closely monitoring global food markets through the Agricultural Market Information System (AMIS) launched in June 2011. While increased transparency may contribute to a better alignment of spot prices in physical markets, it does not address the instability caused by financial speculation in the derivatives markets, which may thus reduce the effectiveness of the AMIS initiative.

[5] International Grains Council, *Grain Market Report*, No. 424, 26 July 2012.

14. High maize prices have also revived the debate on using grains as feedstock to produce biofuels. Under increasing calls for adjustments in the biofuel mandates of the European Union and the United States, the European Commission planned to cap crop-based biofuels to 5 per cent of transport fuel until 2020.[6]

15. Sugar prices were relatively stable at 24 cents per pound (cents/lb) in the first quarter of 2012. However prices dropped in the second quarter, with the average International Sugar Agreement daily price for raw sugar slipping to 20 cents in June. The decline was primarily due to an expected global production surplus and the appreciation of the dollar against the currencies of some major exporting countries. The massive retreat of speculative funds from the sugar futures market further reinforced the bearish sentiments. In July, sugar prices rebounded to 23 cents/lb owing to disappointing harvests in Brazil during May and June as well as concerns about the 2012–2013 harvest in India caused by insufficient monsoons. However, these concerns quickly receded as favourable weather boosted production in Brazil and Australia, thus exerting downward pressure on prices in August and September 2012.

16. The Vegetable Oilseeds and Oils Price Index rose 10 per cent in the four months leading to April 2012. After a large drop in May and June, the Price Index jumped again in the third quarter, mainly driven by soybean prices, which reached a record high of $684 per ton in August 2012, an increase of 21 per cent from June 2012. A combination of factors contributed to the price surge: Concerns about reduced supply in the United States caused by adverse weather, robust demand from Asia and tight stocks.

17. During the first half of 2012, the Tropical Beverages Price Index continued its downward trend, which started in May 2011, with only a slight recovery in the third quarter of 2012. Coffee prices fell by 33 per cent from their high in April 2011, to reach 142 cents/lb in June 2012.[7] The prices of arabica coffee were particularly hit hard due to higher yield prospects in Brazil and rising stocks. In July, coffee prices rebounded to 152 cents/lb, owing to concerns over the impact of heavy rainfall on Brazil's coffee supply.

18. Prices of cocoa beans ranged from 103 cents to 107 cents/lb during the first seven months of 2012. The relatively stable prices resulted from the offsetting effects of an expected production decline in West Africa caused by erratic weather, as well as a sharp fall in cocoa grindings in Europe and North America affected by the economic crisis, versus resilient demand growth in emerging markets.[8] In August and September, prices increased owing to uncertainties surrounding the supply from Côte d'Ivoire, which started to reform its cocoa marketing system in early 2012.

19. The Agricultural Raw Materials Price Index recovered briefly during the first two months of 2012 before a steady decline in the following six months. In September and October, the Price Index rebounded slightly after reaching a 33-month low in August. Cotton prices exhibited a similar trend. After a highly volatile season which saw the Cotton Outlook A Index plunge by 59 per cent in December 2011 from its all-time high in March 2011, cotton prices recovered shortly during the first two months of 2012. However, from March to June 2012, prices fell again before a modest recovery in the third quarter. A supply surplus, the expected surge in global stocks, renewed concerns over the eurozone economy and the strengthening of the dollar contributed to a bearish market.[9]

[6] http://www.reuters.com/article/2012/09/17/us-eu-biofuel-idUSBRE88G0IL20120917.

[7] Refers to coffee composite indicator prices of arabica and robusta coffee.

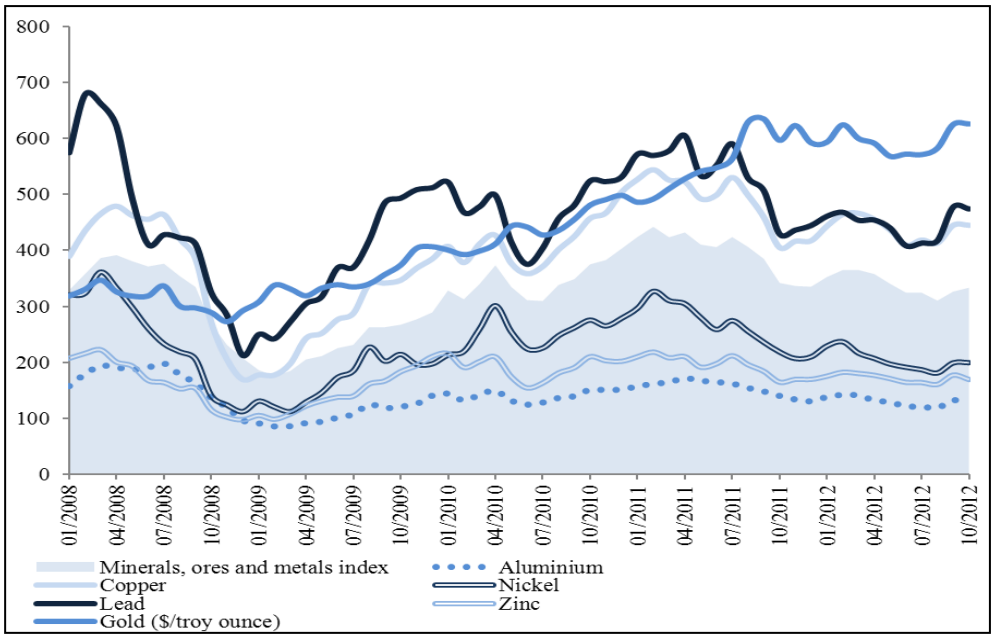
[8] International Cocoa Organization forecasts indicate that world cocoa bean production for the 2011–2012 cocoa year would decline by 8.1 per cent over the previous season, to 3.962 million tons.

[9] Global cotton stocks would represent 61 per cent of global consumption by the end of July 2013, the

2. Minerals, metals and ores

20. The Minerals, Ores and Metals Price Index rebounded during the first quarter of 2012 before falling in the next five months, mainly due to worsening global economic prospects. In August 2012, the price index hit its two-year low of 310 points. However, supported by monetary stimulus plans in major developed economies, the Price Index rose to 327 in September 2012 (figure 2).

Figure 2
Price indices of selected metals, January 2008–October 2012 (2000=100)



Source: UNCTAD, UNCTADstat.
Note: Gold is not included in the UNCTAD Minerals, Ores and Metals Price Index.

21. Copper prices fluctuated on the back of a volatile world economic situation. In the first quarter, driven by strong growth in Chinese copper demand (partly for stockpiling) and abundant liquidity in financial markets, the average London Metal Exchange (LME) cash price surged to $8,307 per ton, up 11 per cent from its level in the fourth quarter of 2011. The second quarter of 2012 saw the average LME cash price decrease by 5 per cent, owing to slowing growth of industrial production and economic activities in China and a deteriorating situation in the eurozone. Though copper prices recovered in the following four months from their low in June, the average price was still 9 per cent lower than the same period in 2011.

22. Prices of nickel, aluminium, lead and zinc increased in January and February 2012, driven by high demand and optimism about global economic prospects. However, prices have slumped since March due to sluggish demand, coupled with oversupply. The price of nickel, a crucial raw material in the production of stainless steel, hit a 38-month low in August 2012. Chronic oversupply, high stocks and weakened demand drove the average aluminium cash price on the LME down to $1,838 per ton in August, the lowest level since October 2009. In June and August 2012 respectively, the prices of lead and zinc hit their

highest stocks–to–use ratio reached since 1998–1999. (International Cotton Advisory Committee, press release, 1 June 2012).

lowest levels since August 2010. In September, however, the prices of these metals surged sharply on the announcement of loosening monetary policies by the central banks of several developed economies.

23. After reaching a high of $1,743 per ounce in February 2012, gold prices retreated in the following months. In the second quarter of 2012, the average gold price dipped to $1,611 an ounce, mainly due to weaker demand both from the jewellery industry and from investment, which together represent over 70 per cent of total gold demand.[10] The price of gold quickly recovered and hit a 12-month high in September as expansionary monetary policies in major developed economies renewed inflationary concerns.

24. The first four months of 2012 saw little movement in iron ore prices, with monthly average spot prices (62 per cent Fe content) ranging between $140 and $148 per dry metric ton.[11] Since May 2012 prices dropped sharply to reach $99 in September, down 44 per cent compared with September 2011. The plunge was due in large part to the high stockpiles and shrinking demand for steel by China's construction and manufacturing industries, and sufficient iron ore supply. The financial turbulence in the eurozone and slowdown of other emerging economies such as Brazil also contributed to the price decline.

3. Energy – oil, gas and coal

Crude oil

25. Against the backdrop of weakening world economic growth, global oil demand was expected to increase by 0.8 per cent in 2012, close to the rate of the previous year (1 per cent), but significantly lower than 3.1 per cent in 2010. Despite geopolitical tensions in the Middle East and elsewhere, world oil production registered remarkable growth. Total crude supply in the first nine months of 2012 was estimated at 90.8 million barrels per day (mbpd), compared with 88.4 mbpd in 2011. The surge was largely due to the substantial increase in the oil production of the Organization of the Petroleum Exporting Countries (OPEC), led by Libya, Saudi Arabia and Iraq, whose production more than offset the decrease in Iranian output. Outside OPEC-member countries, the most important supply growth came from the United States.

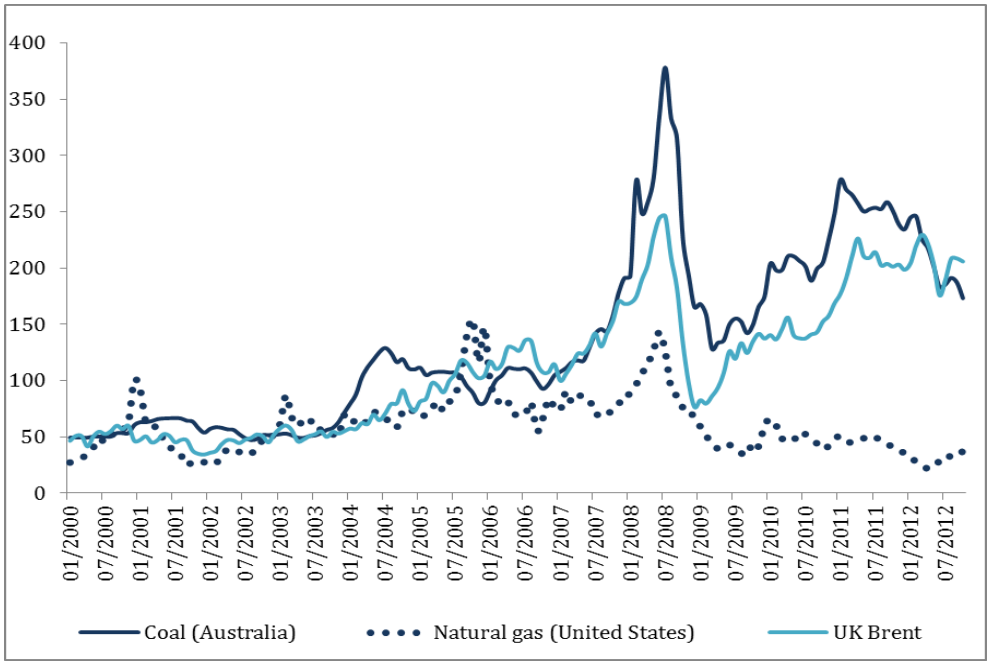
26. In nominal terms, spot prices of crude oil remained high during the first 10 months of 2012. The average Brent oil price was $112.42 per barrel, slightly higher than the average price of $111.30 during the same period in 2011. In March 2012, the Brent oil price surged to $124.93, only 7 per cent lower than the historical peak ($133.90) set in July 2008.

27. The oil market was also volatile (figure 3). After registering an upward course in the first quarter, oil prices plummeted in the following three months before recovering in the third quarter. Monthly average Brent prices fluctuated within the range of $95 and $125 per barrel. In June, prices of Brent oil fell to $95.59, a decline of 14 per cent from May and 23 per cent from its high in March, before recovering to $103.14 (+8 per cent) in July.

[10] The World Gold Council noted that gold demand for the second quarter of 2012 had reached a two-year low of 990 tons on the back of the economic slowdown in China and the depreciation of the Indian rupee.

[11] In this note, the China import Iron Ore Fines 62% Fe spot (CFR Tianjin port) was used as a reference.

Figure 3
Price indices of crude oil, natural gas and coal, January 2000-October 2012 (2005=100)



Source: International Monetary Fund, International Financial Statistics.

28. Oil prices rose considerably during the first three months of 2012 mainly because of rising geopolitical tensions in the Middle East and other supply-side constraints. Threats by the Islamic Republic of Iran to close the Strait of Hormuz in response to bans placed by the European Union and the United States on its crude exports raised concerns about supply disruptions. Furthermore, non-OPEC outages, including conflicts in the Syrian Arab Republic and between Sudan and South Sudan, and technical outages in the North Sea, removed from the market about 750 thousand barrels per day (kb/d) in the first quarter of 2012.

29. Another important factor was increased activity in the derivatives market. Facing supply uncertainties and supported by abundant liquidity in the financial market following the European Central Bank's longer-term refinancing operations, investors intensified their trading activities in the oil derivatives markets. Open interest in all major oil derivatives contracts increased in March. Money managers increased their bets on rising Brent prices by 16,077 futures contracts from 28 February to 27 March.[12]

30. In the second quarter, however, crude prices reversed their upward trajectory. Benchmark Brent prices dropped steeply to an 18-month low in June 2012, losing $29 compared with its high in March 2012. Multiple factors contributed to the bearish market. Disappointing economic data from Europe, the United States and China depressed prices, as the market was worried that the worsening economic outlook would dampen oil demand. Despite initial concerns about supply tightening, global oil supplies increased, compared with 2011. This rare situation was mainly due to the substantial production increase by OPEC. The decline in Iranian crude supply of 0.82 mbpd in the third quarter of 2012 was more than offset by increased production from Libya, Saudi Arabia, and Iraq. OECD crude

[12] International Energy Agency (IEA), *Oil Market Report* (Paris: Organization for Economic Cooperation and Development (OECD)/EIA, 12 April 2012).

stocks have been rising steadily. In the United States, crude oil inventories reached their highest level in more than 20 years. Japan also increased its crude stocks prior to the implementation of the oil embargo on the Islamic Republic of Iran.

31. By the end of June, tensions around the Islamic Republic of Iran's nuclear crisis rose again, as severe sanctions were due to be implemented on 28 June by the United States and on 1 July by the European Union. Concerns about supply disruptions re-emerged. July and August also witnessed a sharp drawdown on crude inventories in response to the steep increase in OECD refinery demand. Further, financial investors increased their net long positions – betting on rising oil prices – in crude oil futures markets in July and August. As a result, Brent prices rebounded sharply in July and August before stabilizing around $113 per barrel in September and October 2012.

Natural gas

32. In contrast to high oil prices, the price of natural gas in the United States continued its downward trend during the first four months of 2012 (figure 3). In April 2012 the average price dropped to $70 per thousand cubic meters, the lowest level since 2000. The sharp decline of gas prices resulted from a supply glut, particularly the a recent surge in shale gas production, as well as record-high stockpiles. Total shale gas production in the United States jumped from 15 billion cubic feet a day (bcf/d) in 2010 to 25 bcf/d in 2012.[13] The higher demand from the power sector, owing to hot weather or to replace coal in electricity generation, pushed gas prices up temporarily, as witnessed in May and July 2012. However, fundamentals remained weak, and the United States market was oversupplied. The gas price for the first 10 months of 2012 averaged $94 per thousand cubic meters, compared with $150 during the same period of 2011.

33. Natural gas prices in Europe and Asia are much higher than in the United States At its lowest level in 2012, natural gas in the United States traded at around one fifth of import prices in Europe and one eighth of those in Japan.[14] The divergence in prices results from different pricing mechanisms used in different regions. In the United States, gas prices are determined by market fundamentals, while in Asia, prices are mainly set by contracts linked to oil prices. In Europe, the long-term take-or-pay contracts that guarantee minimum purchases of gas indexed to oil prices are the customary practice, despite the increase of supply-and-demand-based gas pricing and trading in recent years.[15] The shale-gas boom in the United States and more flexible trade in liquefied natural gas (LNG) have put pressure on the current pricing mechanisms in Europe and Asia and may lead to better-linked regional gas markets.

34. Natural gas is mainly used in electricity generation and as a feedstock in the petrochemicals sector. Cheap and abundant gas in the United States market has displaced coal in the power sector. The United States Energy Information Administration (EIA) projected an increase of 22 per cent natural gas consumption in the electric power sector in 2012, driven by the relative cost advantage of natural gas over coal. In April 2012, for the first time, natural gas was equal to coal in providing 32 per cent of total power generation in the United States.[16]

35. In Europe, however, high gas prices suppressed demand. In 2011, the European Union experienced the sharpest decline in natural gas consumption (-9.9 per cent) on

[13] OPEC, *World Oil Outlook 2012* (Vienna: OPEC Secretariat, 2012).
[14] IEA, *World Energy Outlook 2012* (Paris: OECD/IEA, 2012).
[15] *The Economist*, Gas pricing in Europe: Careful what you wish for, 14 July 2012.
[16] http://www.eia.gov/todayinenergy/detail.cfm?id=6990.

record.[17] To keep business profitable, many power plants substituted coal for natural gas, which increased demand for imported coal.[18] During the first half of 2012, coal exports from the United States, the world's second-largest coal producer, to Europe increased 31.5 per cent, compared with the same period the year before. In particular, exports of steam coal, or thermal coal, which is mainly used in power generation, rose 85 per cent.[19]

Coal

36. The Australian thermal coal spot price, a benchmark in the Asia-Pacific market, averaged $105 per ton in the 10 months to October 2012, compared with $132 during the same period of 2011. Coal prices declined steadily in the first six months of 2012 to reach $93 per ton in June, the lowest level since early 2010. The average price for the third quarter of 2012, though slightly recovered from its June level, was still 6 per cent lower than the previous quarter. In October 2012, the coal price plunged to $88.

37. The dip of thermal coal prices was mainly attributed to ample supply and weak demand from China and the United States, the world's two biggest coal-consuming countries. In China, the deceleration of economic growth in 2012 led to a significant slowdown in coal-fired power generation, thus curbing the demand for thermal coal. In the United States, the switch to a low-cost energy source – natural gas – has effectively reduced the domestic demand for thermal coal. As a result, coal exports from the United States rose sharply.

38. In the six months leading to June 2012, United States coal exports grew by 23.5 per cent, compared with the first half of 2011, despite a decrease of 5.6 per cent in coal production. In particular, United States steam coal exports increased 53.2 per cent to reach 28,481,752 short tons, and exports to the Asia rose 29.1 per cent.[20] This depressed coal prices in the well-supplied Asia-Pacific markets where the better-than-expected weather was favourable to coal production in Indonesia and Australia, the world's top two thermal coal exporters.

39. Chapter II examines four new key developments in the commodity production and trade:

(a) The shifting energy power balance in the wake of the shale oil and gas revolution in the United States;

(b) Climate change and its potential impact on commodities;

(c) The growth of renewable or green energy; (d) the strategic importance of rare earth metals.

40. These developments pose new challenges for all those engaged in global commodity value chains, in particular producers. More importantly they could be critical in price formation in commodity markets in the foreseeable future.

[17] *BP Statistical Review of World Energy June 2012* (London: BP p.l.c., 2012).

[18] See http://topics.nytimes.com/top/news/business/energy-environment/coal/index.html.

[19] EIA, *Quarterly Coal Report April–June 2012*, DOE/EIA-0121 (2012/02Q) (Washington, D.C.: EIA, October 2012).

[20] Ibid.

II. New developments and challenges in commodity production and trade

A. Shifting energy power balance: The shale oil and gas revolution in the United States

41. Barring unexpected catastrophes, the global energy power balance could shift back to North America by the 2020s, thanks to large deposits of unconventional oil and gas[21] that exist in the United States and Canada. The major contributing factor behind this likely phenomenal shift are advances in shale technology – horizontal drilling and hydraulic fracturing (fracking) – that unlock hydrocarbons from sedimentary deposits. As a result, shale gas output has skyrocketed in the United States, from less than 1 per cent of domestic natural gas supply in 2000 to 23 per cent in 2010. EIA projects that shale gas will account for 49 per cent of total dry gas production in that country by 2035.[22]

42. Increasing output and rising gas stockpiles pressured gas prices in the United States (see para. 33). This has provided opportunities to substitute natural gas for coal (in electricity generation) and revive the development and growth of industrial and petrochemical products.

43. The current shale oil and gas boom helped the United States cut its reliance on fuel imports. Its demand for LNG and pipeline gas imports fell sharply. The United States is projected to become a net LNG exporter by 2022, with net exports totalling 1.4 trillion cubic feet.[23] This growth may contribute towards securing the country's goal of energy self-sufficiency and security.

44. Besides changing the energy landscape in North America, the shale gas boom has created a glut in global LNG capacity. In the wake of low gas prices in the United States domestic market and the real potential of the United States becoming a net LNG exporter, energy-dependent countries in Europe and Asia (e.g. China) are being driven to reconfigure their trading patterns, explore and potentially develop their shale gas resources, if any.[24]

45. The real potential of European consumers having access to low-cost gas from the United States is threatening to weaken the current (contractual) marketing structures and the pricing terms of gas sales that are indexed to the price of oil. The Russian Federation, the leading natural gas supplier in Europe, has already allowed portions of its gas sales to be indexed to spot markets and regional hubs, rather than to oil prices. Other countries such as Qatar, which initially aimed to export LNG to the United States market, must seek new trading partners in Europe and Asia. Inevitably, this will affect the price of LNG at all levels – national, regional and international.

46. If current trends prevail, demand for gas will grow, and natural gas may capture an even bigger share of the global primary energy mix. However, as is always the case with major developments in the energy sector, the key questions remain unanswered, and major challenges persist.

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[21] It is estimated that unconventional oil endowments in the United States and Canada are more than 2 trillion barrels and 2.4 trillion barrels, respectively. This compares with conventional oil resources in the Middle East and the Horn of Africa, which amount to 1.2 trillion barrels.

[22] EIA, *Annual Energy Outlook 2012: With Projections to 2035* (Washington, D.C.: EIA, 2012).

[23] Ibid.

[24] In 2011, EIA estimated the technically recoverable shale gas resources in the United States and 32 other countries to be 6,622 trillion cubic feet (http://www.eia.gov/analysis/studies/worldshalegas/).

47. The first question refers to the shale boom's continuity in the United States, and whether it is possible to replicate the United States' experience[25] in other countries that have technically recoverable shale resources.

48. Second, and perhaps the most contentious, are concerns about the use of shale technology and its impact on the environment, particularly water contamination and methane leakage.

49. There is already growing pressure from environmental groups in the United States, the European Union and elsewhere for more regulation of shale production, or failing that, restriction or complete shutdown of shale gas operations. France and Bulgaria have banned shale gas operations, while there is mounting opposition in Germany.

50. A recent study identified loopholes in the current European Union regulations related to shale gas extraction. The report recommended a need to enact new and comprehensive laws covering all aspects of shale operations in order to minimize the damages caused by shale fracking on human and environmental health. [26]

51. Finally, a related question is the role of natural gas in moving towards a low-carbon economy. In terms of emissions of carbon dioxide (CO_2) and GHG, natural gas is more polluting than renewables, but cleaner than coal and oil. Advocates argue that natural gas could play a vital role in combating climate change and meeting carbon emission reduction targets. It could be a transitional fuel on the road towards a clean-energy economy. Largely due to natural gas, CO_2 emissions in the United States resulting from energy consumption during the first quarter of 2012 were the lowest in two decades for any January–March period.[27] Nevertheless, there are concerns that developments in natural gas may stifle much-needed investments and innovations in renewable energy.

B. Climate change and commodities

52. Extreme weather conditions, water availability and sea level rise could have major impacts on agricultural production and mining activities. In the short-term, weather hazards could disrupt commodity supply and increase price volatility. Furthermore, commodity transportation would also be affected by a change in the frequency of storms and extreme weather.

53. The impacts of climate change, if not addressed, may worsen as heat-trapping climate-change accelerants emitted into the Earth's atmosphere continue to increase. According to the CO_2 Emissions and Renewable Investment Action Plan (CERINA Plan), global CO_2 emissions rose by 2.5 per cent to a record 34 billion metric tons (bmt) in 2011. Among the 10 leading CO_2 emitting countries, only three countries – the United States, the Russian Federation and Germany – had reduced emissions over the period 2010–2011. In 2011, China, the United States and India remained the top three emitting countries, with CO_2 emissions of 8.9 bmt, 6.0 bmt and 1.8 bmt, respectively (table 1.).

[25] The shale gas boom in the United States may be attributed to its low cost of capital, large consumer market, low-cost and reliable energy supplies, and well-developed distribution and storage infrastructure.

[26] European Parliament, Directorate-General for Internal Policies, *Impacts of Shale Gas and Shale Oil Extraction on the Environment and on Human Health* (Brussels: 2011).

[27] http://www.eia.gov/todayinenergy/detail.cfm?id=7350.

Table 1
Top 10 carbon-dioxide-emitting countries, 1990–2011

Rank	Country	Carbon dioxide emissions (Million metric tons)			Growth rate (percentage)*	
		1990	*2010*	*2011*	*1990–2010*	*2010–2011*
	World	22 682	33 158	33 992	45.2	2.5
1	China	2 452	8 333	8 876	239.8	6.5
2	United States	5 461	6 145	6 027	12.5	(1.9)
3	India	626	1 708	1 787	172.8	4.6
4	Russian Federation	2 369	1 700	1 674	(28.2)	(1.5)
5	Japan	1 179	1 308	1 311	10.9	0.2
6	Germany	1 029	828	804	19.5	(2.9)
7	Republic of Korea	257	716	739	178.6	3.2
8	Canada	485	605	628	24.7	3.8
9	Saudi Arabia	242	563	609	132.6	8.2
10	Islamic Republic of Iran	199	558	598	180.4	7.2

Source: http://www.cerina.org/co2-2100.
Note: * Secretariat computations based on CERINA Plan data.

54. The role of GHG emissions in climate change and the effects of climate change are topics of an increasingly polarized debate. However, there is general consensus that the effects of climate change, such as global warming, erratic weather patterns and sea level rise, have increased. The Arctic sea glacier shrunk, melting to its lowest extent on record.[28] Agricultural commodities are particularly vulnerable to climate change, as it would affect agricultural production (see box below), trade, and consequently livelihoods, food security and poverty. The impact will be most significant on nations that are resource-poor and highly indebted, suffer a food deficit and are small islands.

[28] http://www.guardian.co.uk/environment/blog/2012/sep/14/sea-ice-climate-change.

Climate change impact on agriculture – selected cases

In 2012, the continental United States experienced its warmest year ever. The worst drought in over 50 years struck two thirds of the nation and scorched the Plains and Midwest corn and soybean belt. Tightening supplies have driven up prices of key grain crops. In addition, receding water levels along the Mississippi river have created low-water choke points, affecting the movement of barges that transport about $7 billion worth of grain, coal and other commodities to suppliers.

The coffee supply chain is threatened by higher temperatures, sustained rainfall and droughts, and more resilient pests and diseases. For this highly temperature-sensitive tree-crop, a half-degree change in temperature can result in a substantial drop in coffee bean yields. For cocoa, another tropical export tree crop, the story is not different. The International Center for Tropical Agriculture predicts a one-degree Celsius temperature increase by 2030 and 2.3 degrees Celsius by 2050, which would be too hot to grow cocoa in Côte d'Ivoire and Ghana – and therefore would result in supply shortages and higher prices for cocoa products such as chocolate.[29]

Furthermore, the production of maize – a critical staple food – is expected to drop by 30 per cent in southern Africa by 2030 as a result of climate change.[30] The Alliance for a Green Revolution in Africa predicts the following climate change impacts on Africa agriculture by 2020: a 50 per cent fall in yields in some countries; 75–220 million people will be exposed to water stress; severe and erratic precipitation will negatively impact Africa's agriculture, which is about 95 per cent rain-fed; and temperatures will rise 5–8 per cent in arid and semi-arid regions.[31]

55. Even though there will be positive gains for some crops in some regions of the world, the general consensus is that climate change will, on the whole, negatively impact agriculture.[32]

C. Renewable green energy

1. Supply and demand

56. Renewable or green energy[33] is the fastest growing subsector in the global energy mix. Total production of renewables increased by 277 per cent between 2000 and 2011 (compared with 68 per cent of growth for coal), even though it accounted for 1.6 per cent of the global energy production in 2011, up from 0.3 per cent in 2000.[34] In 2011, global investment in the renewable energy sector increased by 17 per cent, reaching an unprecedented level of $257 billion, despite uncertainty over economic growth and policy priorities in developed economies.[35] The rapid growth in green energy is buttressed by

[29] http://www.ciatnews.cgiar.org/2011/09/28/too-hot-for-chocolate/.

[30] http://www.rockefellerfoundation.org/what-we-do/current-work/developing-climate-change-resilience/african-agriculture-climate-change.

[31] http://www.world-food-dialogue.ch/documents/10_04/presentation_kagwanja.pdf.

[32] http://www.ifpri.org/sites/default/files/publications/pr21.pdf.

[33] Renewables include biofuels, hydropower, solar, wind (onshore and offshore), biomass, geothermal and ocean tidal waves.

[34] *BP Energy Outlook 2030* (London: BP, January 2013).

[35] Frankfurt School – United Nations Environment Programme Collaborating Centre for Climate &

increasing technological advances, high petroleum prices and carbon pricing (tax), and sustained subsidy measures. (See table 2.)

57. Global wind power accounted for more than half of power generated from renewable sources, with an above average growth rate of 25.8 per cent in 2011. Globally, wind-power-generating capacity increased by a record 40.8 gigawatts to reach 239 gigawatts by the end of 2011. China has the world's largest cumulative installed wind turbine capacity (26 per cent of the world's total), followed by the United States and Germany.[36] In Europe, wind is becoming a major means of generating electricity. In 2011, Denmark generated 28.3 per cent of electricity was from wind power, while in Spain, Portugal and Ireland, the share was more than 15 per cent.[37]

58. Hydroelectricity consumption grew by 1.6 per cent from 2010 to 2011, while solar power rose 86.3 per cent over the same period. Solar's striking growth reflected the increasing investments in solar power (including the boom in photovoltaic installations in Germany and Italy and the spread of small-scale photovoltaics), which grew from $96.9 billion in 2010 to a record $147.4 billion in 2011.[38]

59. With an annual production of 1.18 million barrels a day, global biofuels[39] output stalled in 2011; the first time in a decade, to an annual growth rate of 0.7 per cent. This is explained, in part, by the poor sugarcane crop in Brazil, the world's largest producer of sugarcane-based ethanol, and rising costs for feedstock commodities used in biofuels production.

60. In the United States, 40 per cent of the corn crop and 14 per cent of soybean oil production was used to produce biofuels and other products in the 2010–2011 marketing year. Though the United States became a net exporter of ethanol fuel in 2010, it raised imports of sugarcane ethanol from Brazil during 2010–2011, which qualifies as an advanced biofuel under the renewable fuel standard RFS2 programme.[40]

Table 2
Green energy growth rates in 2011
(percentage)

Renewables	17.7
Biofuels	0.7
Hydropower	1.6
Solar	86.3
Wind	25.8

Source: BP Statistical Review of World Energy (London: June 2012).

61. China's five ethanol plants produced 2,103 million litres (or 1.66 million metric tons – MT) of ethanol in 2011, with output expected to reach 2,433 million litres (or 1.92 million MT). Biodiesel output in 2012 is estimated at 568 million litres (or 500,000 MT).

Sustainable Energy Finance, *Global Trends in Renewable Energy Investment 2012* (Frankfurt: Frankfurt School of Finance & Management gGmbH, 2012).

[36] See footnote 20.

[37] http://www.bp.com/extendedsectiongenericarticle.do?categoryId=9041566&contentId=7075262.

[38] See footnote 46.

[39] Biofuels includes bioethanol, biodiesel and other renewable liquid fuels.

[40] http://www.eia.gov/todayinenergy/detail.cfm?id=8430.

China presently has no subsidies or mandatory-use programmes for fuel ethanol and biodiesel production.[41] India's National Biofuel Policy aims to replace 20 per cent of fossil motor fuel consumption with biofuel (including bioethanol and biodiesel) by the end of the twelfth Five-Year Plan in 2017. However, achieving this target is still challenging. During the 2011–12 fiscal year, India's supply of ethanol is just sufficient to meet its 2 per cent blending (with gasoline) target, while the biodiesel production based on jatropha is commercially insignificant.[42]

62. The rapid growth of biofuels as fuel in the transport industry is largely attributed to government mandates on biofuels and supplemented by government subsidies and high crude oil prices. In Brazil, biofuels account for about 23 per cent of all transport fuel, compared with 4 per cent in the United States and 3 per cent in the European Union.[43] Member States of the European Union are mandated by the Renewable Energy Directive (Directive 2009/28/EC) to reach a minimum of 10 per cent for renewable energy, consumed in transport by 2020.

2. Outlook

63. The long-term outlook (2010–2030) of renewable energy output is positive, as it is expected to grow at 8.2 per cent per year, which is much faster than natural gas (2.1 per cent).[44]

64. With technological advances, the global energy mix will grow more diverse with demand shifting steadily towards alternative energy which is clean and less carbon-intensive. The major drivers in this shift are rising petroleum prices, agreements and actionable platforms to reduce carbon emissions and other GHGs, and increasing concerns about energy security and independence.

D. Rare earth metals

65. In addition to the traditional minerals, ores and metals markets, there is another strategic resource that has gained considerable attention of late. It is the group of 17 rare earth metals (REMs) that are vital to some of the world's fastest growing markets: high-tech devices, petroleum refining, military and defence applications, and clean energy technologies. The 2010 and 2015 composition of world demand – by application – is shown in figure 4.

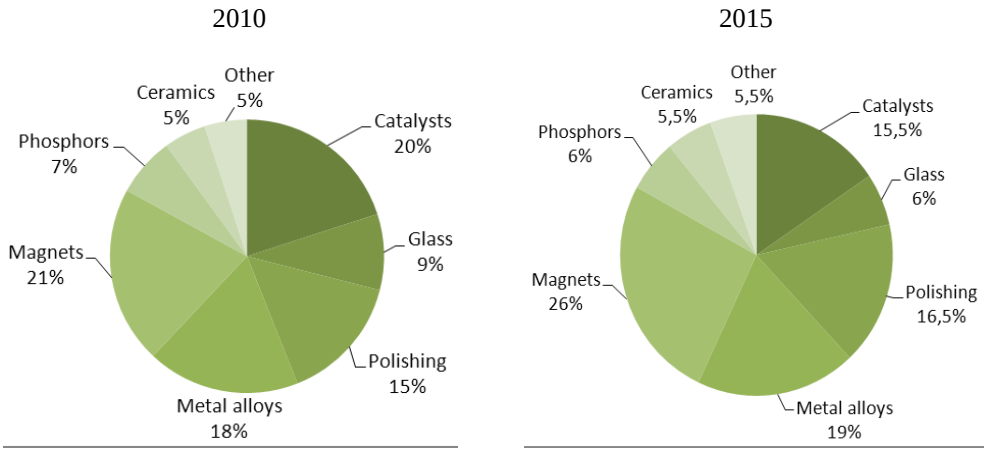
[41] United States Department of Agriculture (USDA) Foreign Agricultural Service, *China, Peoples Republic of Biofuels Annual*, GAIN Report No. 12044, 9 July 2012.

[42] USDA Foreign Agricultural Service, *India Biofuels Annual 2012*, GAIN Report No. IN2081, 20 June 2012.

[43] http://www.iea.org/aboutus/faqs/renewableenergy/.

[44] *BP Energy Outlook 2030*, London, January 2012.

Figure 4
Global demand for rare earth metals by application: 2010 and 2015



Source: Congressional Research Service Report for Congress, June 2012.

1. Supply and demand

66. REMs come in two forms: light and heavy, and are scattered around the world. They are classified as "rare" because the ore deposits are not concentrated in commercially viable quantities. This makes it difficult to mine them cost-effectively. However, advances in seismic technologies, horizontal drilling and multistage fracturing, for example, help unlock new capacity, production and the extraction of REMs.

67. China, the world's largest producer of rare earths, accounts for over 97.3 per cent, or 130,000 metric tons, of the global supplies.[45] Half of the 110 million tons of the world's REM reserves are found in China.[46] The Russian Federation, former countries of the Soviet Union) and the United States have proven reserves of 19 million metric tons and 13 million metric tons, respectively. However both are 100 per cent dependent on imports of REMs.[47] Developing countries with rare earth reserves include Brazil, India, Malaysia, Malawi and South Africa.

68. Over the past decade, global demand for REMs has increased, reaching 136,100 metric tons in 2010. Prices of REMs soared sharply between July 2010 and April 2011.[48] However, in May 2011, prices began a downward trend, mainly due to falling demand and expectations of rising supply. Despite this general trend, prices of light REMs and heavy REMs are not uniform. Prices of some light REMs, such as cerium and lanthanum, were especially hit hard during the downward spiral.

69. Significant growth in demand for rare earths, conservatively estimated to grow at around 9–15 per cent over the past decade, is testament to the end products that are known for their robust performance, high returns on investment, durability and lower carbon emissions.

[45] India accounts for 2.2 per cent of REM production, Brazil 0.4 per cent and Malaysia 0.02 per cent. U.S. Geological Survey, *Mineral Commodity Summaries 2012* (Reston, Virginia: Department of the Interior, 2012).
[46] Ibid.
[47] U.S. Geological Survey, *Mineral Commodity Summaries* 2010 (Washington, D.C.: United States Government Printing Office, 2010).
[48] http://www.bloomberg.com/quote/BNREMRS:IND/chart.

2. Outlook

70. Demand for REMs is expected to escalate in tandem with the growing demand for high-tech end-use products. By 2015, global demand for REMs is estimated to reach between 185,000 metric tons and 210,000 metric tons per year.[49]

71. Uncertainties about proven reserves, production and export levels, and national policies in producing countries, particularly China, continue to influence prices, investor confidence and the availability of, and access to, REMs.[50] However, new sources and additional capacity being developed in Australia, Canada, Greenland, Japan and the United States should, in general, correct the current imbalances that persist in the rare earths marketplace. In addition to adequate mine capacity, capital investments in downstream capacity (processing, value adding, refining and metal alloying) are crucial in this process.

III. The way forward: Policy options

72. The following policy options are put forward for the deliberation of experts and to provide guidance for the secretariat's work on commodities trade and development.

A. Agriculture commodities and food

73. Rising food prices in net-food importing countries pose a serious threat to access to staple food, particularly grain, by those who need it most. How could grain-exporting countries be dissuaded from imposing export bans or quotas during periods of supply shortages?

74. The establishment of regional and national grain reserves, where they have been implemented and successful, should be scaled up and replicated in other countries. This requires financial and technical resources that may be sourced both domestically and externally. Oil-rich developing countries may consider investing portions of their windfall revenues in building and stocking such reserves.

75. Agrifood producers and exporters in developing countries need to effectively integrate and move up the value chain by adding value to their products (e.g. grading, product differentiation and meeting food safety standards) to offset declining prices and increase incomes. Coordination of all links in the chain is crucial.

B. Energy

76. High oil prices lead to substantial windfall revenues for oil-producing countries. There appears to be little positive correlation between resource abundance and broad-based economic development in several exporting countries. These countries may want to invest the windfall revenues in upgrading their productive capacities, sovereign wealth funds, environmental services, including sustainable commodity production, and renewable energy initiatives.

[49] The Industrial Minerals Company of Australia estimates global demand for rare earths will be 185,000 metric tons in 2015, while according to Wang Caifeng, Secretary General of the Chinese Rare Earth Industry Association, global demand is likely to reach 210,000 tons per year by that date.

[50] On 13 March 2012, the United States, the European Union and Japan filed a joint complaint at the World Trade Organization against China's export quota restrictions on REMs.

77. In light of the shale gas and oil revolution in the United States, further research is needed to ascertain, among others, the economic and financial implications of change in pricing regimes, the viability of new operations and returns on investment, the costs of technology, and the potential impacts on natural-gas producing countries in the Asia-Pacific region and Europe. Environmental costs should also be internalized in such processes and supported with sound regulations that protect animal, human and environmental health.

78. Natural gas could be an important element in a carbon emission reduction strategy in the short term. The real challenge is how to ensure that its development will not hinder the growth of renewable energy. Government policies may be crucial in this regard for example, prioritizing renewable energy development through investments and targeted research.

C. Climate change and renewable energy development

79. Climate change mitigation appears daunting. While mitigation could buy time, adaptation strategies and strong international commitments are needed to curb carbon and GHG emissions for sustainable development and inclusive growth. Measures that could be applied to address the impact of climate change on agriculture, and limit carbon and GHG emissions may include the following:

1. Adaptation strategies in agrifood production

80. Agrifood production systems could be made more sustainable and more resilient to climate change. This requires access to information, the use of new irrigation technologies, access to and adoption of drought-resistant varieties, improved pest and disease management practices, and crop diversification, in particular intercropping of traditional staple food crops. Conservation measures (e.g. for water) and promoting ecosystem resistance and resilience would be critical to all adaptation strategies.

81. Forging strategic alliances and coordinating the efforts between partners – public and private entities, civil society organizations and producer organizations – are pivotal to mitigating and/or adapting to the challenges of climate change. Capacity-building – for all stakeholders – to help them respond to extreme climatic variability is fundamental.

82. Additional investments are required in agricultural research/extension, irrigation, climate change knowledge, and infrastructural development. In this context, the commitment by African governments under the Comprehensive Africa Agricultural Development Programme of the New Partnership for Africa's Development to increase the share of agriculture in their national budgets to at least 10 per cent is instructive.

2. International efforts to curb carbon and greenhouse gas emissions

83. Developing renewable energy would contribute to reducing carbon and GHG emissions. In order to drive investments in renewable energy, appropriate policy measures are important, particularly in the early development stages. One such policy is establishing tax credits for green, renewable energy as in the United States, for example. Which other market-based instruments could be used to facilitate the development of renewable energy?

84. There is a need to develop powerful incentives to produce cleaner energy, for example, by shifting the burden of carbon and GHG emissions or by imposing a price by means of a cap or a tax.

85. Developed countries channelled $8 billion into emerging nations in 2010 for large-scale renewable energy and clean fuel production, a fraction of the aid promised by 2020, which may be a result of economic austerity at home. One would expect that as growth

picks up in these countries, they would make efforts to meet their financial pledges made in Copenhagen in 2009 to increase funding – $100 billion-a-year of investment by 2020 – in projects to mitigate and tackle the challenges of climate change.