

# XI ENVIRONMENT, ENERGY AND CLIMATE CHANGE

## I CLIMATE CHANGE RESEARCH AND PUBLIC POLICY: INTERNATIONAL DEVELOPMENTS

### I.1 SCIENTIFIC FINDINGS AND REPORTS RELEASED IN 2012 THROUGH EARLY 2013

Following the OECD report on the environmental outlook to 2050, released on 15 March 2012 and already presented by the Bank of Greece in last year's *Annual Report*,<sup>1</sup> the World Bank released its own report on 8 November 2012 called *Turn Down the Heat – Why a 4°C Warmer World Must be Avoided*.<sup>2</sup> As this snapshot of the latest climate science clearly spells out, without serious policy changes from the global community, the world is plausibly on a path to 4°C warming within the century and the full implementation of *current pledges* to reduce greenhouse gas emissions will not reduce this likelihood by much. For millions of people, the devastating consequences of a 4°C warming would include: the inundation of coastal regions; increasing risks for food production, potentially leading to decreased food security and to much higher under-nutrition and malnutrition rates among the world population; dry regions becoming drier, wet regions becoming wetter; unprecedented heat waves; water scarcity; and irreversible loss of biodiversity. Under this nightmare scenario, the world's poor regions would be hit hardest. As pointed out by Hans Joachim Schellnhuber, Director of the Potsdam Institute for Climate Impact Research (PIK) conducting the research, the Earth system's responses to climate change appear to be *non-linear*; thus, if we venture far beyond the 2°C guardrail, the risk of crossing tipping points rises sharply.

Another major study, conducted by a team of researchers from the UK and Germany and published in mid-January 2013,<sup>3</sup> presents a first global-scale multi-sectoral regional assessment of the climate change impacts that could be avoided through alternative emission policies. According to the analysis, the most stringent emissions policy considered gives a 50% chance of remaining below a 2°C temperature

rise target by 2100, and reduces impacts by 20-65% relative to a business-as-usual pathway conducive to a 4°C warming. The beneficial effects of mitigation policies vary across sectors and regions and, although not very noticeable before 2030, they can strongly influence what will happen by 2100. The magnitude of the impacts avoided is more strongly influenced by the *point in time* (e.g. 2016 or 2030) and the level at which emissions peak, with an earlier and lower emissions peak resulting in reduced impacts. Under the more stringent mitigation policy scenarios, emissions peak in either 2016 or 2030, and decline thereafter at either 2% or 5% per year. Only when emissions peak in 2016 and subsequently decline at a rate of 5% (*pathway 1*) is the temperature rise by 2100 just above 2°C. If emissions peak in 2030 (*pathway 2*), the temperature rise is likely to reach 2.5°C. Under the two “no mitigation” scenarios considered (*pathway 3*), the rise in global average temperature reaches between 4°C and 5.6°C by 2100.

In terms of impacts:

- The global average sea level rise (SLR) by 2100 will reach 30 cm (*pathway 1*), 35 cm (*pathway 2*) or 47-55 cm (*pathway 3*). By comparing the three pathways, it was estimated that some 100 to 161 million people would be spared exposure to greater flooding by 2050 if emissions peak in 2016, against 52 to 120 million if emissions continue to rise until 2030.
- If emissions peak in 2016, between 39 and 68 million fewer people would be exposed to drought by 2050, compared with just 17 to 48 million if emissions peak in 2030.

1 OECD (2012), *Environmental Outlook to 2050: The Consequences of Inaction*. See Bank of Greece, *Annual Report 2011*, pp. 151-152.

2 The report was prepared for the World Bank by the Potsdam Institute for Climate Impact Research (PIK) and Climate Analytics.

3 See N.W. Arnell, J.A. Lowe, S. Brown, S.N. Gosling, P. Gottschalk, J. Hinkel, B. Lloyd-Hughes, R.J. Nicholls, T.J. Osborn, T.M. Osborne, G.A. Rose, P. Smith & R.F. Warren (2013), “A global assessment of the effects of climate policy on the impacts of climate change”, *Nature Climate Change*, advance online publication, 13 January 2013. For a summary of conclusions, see “Climat: le coût humain de l'inaction en détail”, *Le Monde*, 15.1.2013.

– The *decline in crop productivity* could be contained and delayed with stringent emissions policies. For instance, spring wheat productivity could drop by 20% by the 2050s, but such a drop in yields is held off until 2100 if stringent mitigation policies are implemented. Otherwise, productivity could fall by 60%.

## 1.2 POLICY DECISIONS AND CONSIDERATIONS

The 18th United Nations Convention on Climate Change in Doha, Qatar came to a close on 8 December 2012, without any major breakthroughs. Nevertheless, the delegates of some 190 nations agreed on an 8-year extension of the Kyoto Protocol (due to expire) and reiterated the decision taken in Durban in 2011, to continue talks so that a new, comprehensive agreement with enhanced mitigation ambitions may be reached by developed and developing nations by 2015 and brought into effect from 2020 (the Kyoto Protocol is legally binding only for developed nations). Moreover, developed countries committed to revisit their emissions reduction commitments at the latest by 2014, thereby satisfying a demand put forward by developing nations and by the Intergovernmental Panel on Climate Change (IPCC). Among the developed nations, the EU played a critical role in the adoption of these decisions.<sup>4</sup> However, real progress has yet to be seen with the Green Climate Fund, the establishment of which was decided in Durban and the aim of which is to mobilise an annual USD 100 billion in aid by 2020 to help poor (and hard-hit) nations deal with climate change. The developed nations have put off their final decision until end-2013 and till then pledged to contribute as much as they had done in the previous three years.<sup>5</sup>

Despite the slow progress, awareness of the severity of the issue is taking hold. According to “*Global Risks 2013*”, released by the World Economic Forum (WEF) on 8 January 2013 and developed from an annual survey of over 1,000 experts and high-level leaders worldwide, climate change ranks among the top three global risks, together with severe income dis-

parity and chronic fiscal imbalances. While recognising that economic difficulties in many countries have diverted attention from other significant challenges, including environmental ones, the report also warns that “the Earth’s environmental system is simultaneously coming under increasing stress. Future simultaneous shocks to both systems could trigger the ‘perfect global storm’, with potentially insurmountable consequences.”

How have policy-makers responded to these findings? On the occasion of the release of the World Bank report, mentioned previously, World Bank President Jim Yong Kim warned that “a 4°C warmer world can, and must be, avoided” and that “lack of action on climate change threatens to make the world our children inherit a completely different world than we are living in today (...)”. According to Kim, “greater adaptation and mitigation efforts are essential (...). We need a global response equal to the scale of the climate problem (...). But time is very short”. Speaking in Davos on 26 January 2013, Kim stressed that a temperature increase of 4°C would result in “water and food fights everywhere”, and that the 2012 droughts in the US, which pushed up cereal prices, had led to the world’s poor eating less, while, for the first time, extreme weather had been attributed to man-made climate change.

These findings and warnings come with concrete policy proposals:<sup>6</sup> “... *there is a need for urgent action outside the conventions. People everywhere must focus on where we will get the most impact to reduce emissions and build resilience in cities, communities and countries. Strong leadership must come from the six big economies that account for two-thirds of the energy sector’s global carbon dioxide emissions. (...) The world’s top priority must be to get*

<sup>4</sup> See also article by EU Climate Action Commissioner, Connie Hedegaard, “Viser l’accord sur le climat de 2015”, *Le Monde*, 14.12.2012.

<sup>5</sup> Jeffrey Sachs recently criticised the developed nations for not honouring their pledges and presented a straightforward and fair way of financing the Green Climate Fund (“How to make rich countries pay for climate change”, *Financial Times*, 23.10.2012).

<sup>6</sup> See the article by World Bank President Jim Yong Kim “Make climate change a priority”, *The Washington Post*, 24 January 2013.

finance flowing and get prices right on all aspects of energy costs to support low-carbon growth. (...) A second immediate step is to end harmful fuel subsidies globally, which could lead to a 5 percent fall in emissions by 2020.<sup>7</sup> Countries spend more than \$500 billion annually in fossil-fuel subsidies and an additional \$500 billion in other subsidies, often related to agriculture and water, that are, ultimately, environmentally harmful. That trillion dollars could be put to better use for the jobs of the future, social safety nets or vaccines. A third focus is on cities. The largest 100 cities that contribute 67 percent of energy-related emissions are both the center of innovation for green growth and the most vulnerable to climate change. We have seen great leadership, for example, in New York and Rio de Janeiro on low-carbon growth and tackling practices that fuel climate change. (...) Just as the Bretton Woods institutions were created to prevent a third world war, the world needs a bold global approach to help avoid the climate catastrophe it faces today.”

In a similar vein, US President Obama in his second-term inaugural address on 21 January 2013 pledged to “respond to the threat of climate change, knowing that the failure to do so would betray our children and future generations”, noting that “some may still deny the overwhelming judgment of science, but none can avoid the devastating impact of raging fires and crippling drought and more powerful storms. The path towards sustainable energy sources will be long and sometimes difficult. But America cannot resist this transition, we must lead it”. In his 2013 State of the Union address (12 February 2013), President Obama went further to say that if Congress did not act soon, he would instruct his Cabinet to take executive action to reduce pollution, prepare for the consequences of climate change and speed up the transition to more sustainable sources of energy.

Lastly, an OECD scoping paper, dated 30 January 2013, of the initiative “New Approaches to Economic Challenges”, makes two major points:

(a) Economic growth and human development have always depended on access to natural resources and the environment’s ability to absorb waste. The scale of human pressure on these resources is starting to pose potentially large risks to future economic growth and development. The distribution of these risks is likely to be uneven.

(b) Global economic growth over the past decades has come at an increasingly significant cost to the environment and has locked-in future environmental change that will affect future generations. Unless more significant policy action is taken now, continued environmental degradation in the future is likely to pose risks to the economy and to human well-being.

## 2 RECENT DATA ON GREENHOUSE GAS EMISSIONS IN THE EU AND GREECE (2010-2011)

In 2010, EU-27 greenhouse gas (GHG) emissions, excluding land use, land-use change and forestry, came to 4,721 million tonnes of CO<sub>2</sub> equivalent, down by 15.4% from 1990 levels. EU-15 GHG emissions in 2010 came to 3,798 million tonnes (10.6% less than in 1990), accounting for 80.4% of EU-27 emissions (against 76.1% in 1990). Among the older Member States, Germany and the UK accounted for the largest share of European GHG emissions in 2010 (with a combined 32.3% of EU-27 emissions and 40.2% of EU-15 emissions), followed by France (11.1% of EU-27 emissions in 2010) and Italy (10.6%) (see Table XI.1).

As regards the trends in GHG emissions vis-à-vis the targets set under the Kyoto Protocol, it is worth noting that most of the EU-27 Member States are on track to meeting their national targets (see Table XI.1). Among the

<sup>7</sup> Two OECD studies (“Taxing Energy Use” and “The Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels”), published in late January 2013, provide ample documentation on: (a) taxation and energy use and (b) fossil fuel subsidies.

**Table XI.1 Greenhouse gas emissions<sup>1</sup> and the Kyoto Protocol targets**

Country	2010 data							Provisional estimates 2011	
	1990	Kyoto Protocol (base year) <sup>2</sup>	2010	Change 2010 over 2009	Change 2010 over 1990	Change of base year-2010	Kyoto targets 2008-2012	Change 2011 over 2010	Change 2011 over 1990
	(in million tonnes of CO <sub>2</sub> equivalents)			(percentage changes)				(percentage changes)	
Austria	78.2	79.0	84.6	6.1	8.2	7.0	-13.0	-2.3	5.8
Belgium	143.3	145.7	132.5	5.8	-7.6	-9.1	-7.5	-8.4	-15.3
Denmark	68.6	69.3	61.1	0.6	-11.0	-11.9	-21.0	-7.5	-17.7
Finland	70.4	71.0	74.6	12.8	6.0	5.0	0.0	-8.2	-2.8
France	559.9	563.9	522.4	1.5	-6.6	-7.4	0.0	-4.6	-10.9
Germany	1,246.1	1,232.4	936.5	2.7	-24.8	-24.0	-21.0	-1.8	-26.2
Greece	105.0	107.0	118.3	-5.1	12.6	10.6	25.0	-1.3	11.2
Ireland	55.2	55.6	61.3	-0.7	11.2	10.3	13.0	-5.6	5.0
Italy	519.2	516.9	501.3	2.0	-3.5	-3.0	-6.5	-2.2	-5.6
Luxembourg	12.8	13.2	12.1	4.9	-5.9	-8.3	-28.0	-1.8	-7.6
Netherlands	212.0	213.0	210.1	5.6	-0.9	-1.4	-6.0	-6.0	-6.8
Portugal	60.1	60.1	70.6	-5.1	17.5	17.4	27.0	-0.9	16.5
Spain	282.8	289.8	355.9	-2.8	25.8	22.8	15.0	0.1	25.9
Sweden	72.8	72.2	66.2	11.0	-9.0	-8.2	4.0	-5.1	-13.6
United Kingdom	763.9	776.3	590.2	3.1	-22.7	-24.0	-12.5	-6.1	-27.4
<b>EU-15 (older Member States)</b>	<b>4,249.3</b>	<b>4,265.5</b>	<b>3,797.6</b>	<b>2.1</b>	<b>-10.6</b>	<b>-11.0</b>	<b>-8.0</b>	<b>-3.5</b>	<b>-13.8</b>
<b>EU-27</b>	<b>5,583.1</b>	<b>...</b>	<b>4,720.9</b>	<b>2.4</b>	<b>-15.4</b>	<b>...</b>	<b>...</b>	<b>-2.5</b>	<b>-17.5</b>

Source: For 2010: European Environment Agency Technical Report no. 3/2012, *Annual European Union greenhouse gas inventory 1990-2010 and inventory report 2012*, 27.5.2012. For 2011: European Environment Agency Technical Report no. 13/2012, *Approximated EU GHG inventory: Early Estimates for 2011*, 24.10.2012.

<sup>1</sup> Total emissions excluding the "land use change and forestry" sector.

<sup>2</sup> For CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, all Member States chose 1990 as their base year. For HFC, PFC and SF<sub>6</sub>, 12 Member States chose 1995 as their base year, while Austria, France and Italy chose 1990. For Cyprus, Malta and EU-27 neither Kyoto Protocol targets nor respective base year data have been set.

EU-15, eight countries (including Greece) have already overshoot their Kyoto targets, while the remaining seven still have some way to go. ***The target set for Greece under the Kyoto Protocol was for the increase in GHG emissions over the period 2008-2012, relative to the base year, to be contained at 25%. In 2010, Greece's GHG emissions were just 10.6% above 1990 levels, putting the country well on track, a development at least to some extent attributable to the economic downturn.***

Turning to 2011, early estimates published by the European Environment Agency (EEA) in October 2012 indicate that GHG emissions

excluding land use, land-use change and forestry fell between 2010 and 2011 by 1.3% in Greece, 3.5% in EU-15 and 2.5% in EU-27 (see Table XI.1).

### 3 RECENT GREEK LEGISLATION AND OTHER MEASURES ON THE ENVIRONMENT, ENERGY AND CLIMATE CHANGE

– Law 4042/2012 (on the penal protection of the environment and transposition of Directive 2008/99/EC, as well as on the general framework for waste generation and management and transposition of Directive 2008/98/EC) and

Law 4062/2012 (on Project HELIOS and the promotion of the use of energy from renewable sources and transposition of 2009/28/EC, as well as on sustainability criteria for biofuels and bioliquids and transposition of Directive 2009/30/EC) were both presented in last year's *Annual Report*.

– On 9 and 10 August 2012, (a) the Regulatory Authority for Energy (RAE) announced the weighted increase in the special duty for gas emissions reduction (ETMEAR) levied in electricity bills; and (b) the government announced that the licensing process for new photovoltaic (PV) projects would be put on halt (except for PV systems to be mounted on rooftops and projects already fast-tracked) and that it would lower the green energy guaranteed feed-in tariffs (FiTs) for plants licensed but not yet operational.

– On 28 September 2012, the Ministry of Finance announced that it would equate the special consumption tax on heating oil with that of diesel oil, at 80% of the current rate on diesel oil, the lowest level allowed in accordance with EC directives. It also announced the launching of supportive preparations for the disbursement of a heating oil allowance to eligible consumers.

– On 30 October 2012, the Ministries of Finance, Development and Environment presented joint measures to address fuel market distortions. The aims of these measures are to tackle the illegal fuel trade, strengthen competition, modernise legislation and protect consumer interests.

– On 31 October 2012, the adoption of Law 4092/2012 provides for the equating of the consumption tax on heating oil with the consumption tax on diesel oil (Article 5), as well as for the allocation of a heating allowance to eligible households.

– On 3 December 2012, public consultation began on the draft law “Regulation on matters related to Renewable Energy Sources (RES),

and other provisions”, including provisions to facilitate the conclusion of mature RES projects and to restore trust in the guaranteed access to grid networks nearly congested as a result of inactive grid connection offers. The purpose of the new provisions is, among other aims, to rationalise the procedure for booking grid capacity, and to ensure that licences for projects likely to be completed remain in effect.

– On 10 January 2013, RAE announced a further weighted increase in the special duty for gas emissions reduction (ETMEAR) levied in electricity bills (see Section 5, below).

– On 22 January 2013, the Ministry of Environment, Energy and Climate Change reported that 101,154 bank loan applications had been submitted under the programme “Energy Saving at home” (to promote energy saving within the household), of which roughly half had been pre-approved. In 19,212 cases (corresponding to a total budget of €188.9 million), decisions incorporating them into the programme had already been issued. Half of these beneficiaries have received the full loan amount, while the other half had received a down-payment.

– On 5 February 2013, the draft law on the “Energy Performance of buildings – Transposition of Directive 2010/31/EU of the European Parliament and of the Council, and other provisions”, submitted to Parliament on 18 December 2012, was adopted.

\* \* \*

The Greek government had been considering equalising the Special Consumption Tax on heating oil with that on diesel oil since the 2000s as a way of tackling fuel fraud. Apart from the –purely national– motivations behind this measure (and the ensuing increased public revenue), the reduction or removal of fossil fuel subsidies also serves to address climate change, as mentioned previously in Section 1.2. However, the timing of this measure’s implementation in Greece (October 2012)

coincided with a difficult conjuncture, marked by historically high international oil prices and a serious drop in household disposable income due to the protracted recession. The implementation of this measure therefore illustrates the contradictory results that economic policy can have, especially when fiscal constraints and the inefficiency of public administration prevent comprehensive planning. In this particular instance, the hike in the retail price of heating oil caused a shift towards:

(a) the use of firewood, resulting in a significant increase in urban air pollution (suspended particulates, smog), often above allowable levels (health risks);<sup>8</sup>

(b) the use of air-conditioners for heating purposes, putting an additional strain on an already overburdened network; and

(c) the use of natural gas.

Case (a), i.e. the increased recourse to burning firewood, has direct and indirect impacts on health, while cases (a) and (b), i.e. the increased recourse to burning firewood and to air-conditioner use are, in terms of GHG emissions, just as harmful to the environment as the use of heating oil (given that an important share of Greece's power generation is fired by fossil fuels). Moreover, the public revenue gains from the crackdown on fuel fraud and from the increased Special Consumption Tax are likely to be offset, in part if not in full, by the decrease in consumption of heating oil.

A solution in the medium term would be to expand the natural gas grid, while intensifying efforts to improve the energy performance of buildings (e.g. through better insulation) by extending such programmes as "Energy saving at home".

#### 4 ENERGY SECTOR INVESTMENTS

Power generation from renewable energy sources (RES) has, over the past seven years

at least, attracted considerable investment, mainly in wind and photovoltaic (PV) farms. As a result, renewable energy generation (in MWh) increased at an average annual rate of 18% from 2006 to 2011, while in 2011 alone the increase in installed RES capacity relative to one year earlier neared 40%.<sup>9</sup>

With investment in most other sectors having come to a standstill in recent years, the share of energy sector investments in total investment expenditure has risen sharply. In fact, 10 of the 12 projects that qualified for fast-track authorisation under Law 3894/2010 from November 2011 to December 2012 involved renewable energy generation.

Crucial to the future of Greece's energy market will be the privatisation of the Public Gas Corporation (DEPA)-Hellenic Gas Transmission System Operator (DESFA), currently in progress (on 6 November 2012, the Hellenic Republic Asset Management Fund, known as TAIPED, confirmed having received 5 non-binding bids). Apart from the capital inflows, at stake are Greece's energy autonomy; dependence on third non-EU countries; the unbundling of gas transmission services from gas production; and compliance with EU directives.

Energy sector investments, especially those involving generation from renewable energy sources, are considered profitable in the long run in terms of the economy's green balance sheet (lower CO<sub>2</sub> emissions) and permanent job creation. They can also contribute indirectly to sizeably increased value added, when stimulating domestic production of intermediate or capital goods. Such production synergies are expected from some of the fast-tracked energy investments, notably the ones involving photovoltaic (PV) panel production.

<sup>8</sup> See the conference on "Atmospheric pollution in Athens today" held by the postgraduate course "Environment and Health" of the Faculty of Medicine of the University of Athens on 1 February 2013.

<sup>9</sup> According to an ICAP survey (see Green Tank magazine, published by the newspaper Naftemporiki, issue 12, November 2012).

## 5 THE FINAL PROPOSALS OF GREECE'S REGULATORY AUTHORITY FOR ENERGY (RAE) FOR RESTRUCTURING THE DOMESTIC ELECTRICITY MARKET

In view of the implementation of the Third Energy Package<sup>10</sup> and of the European Target Model for electricity market integration by 2015,<sup>11</sup> Greece's Regulatory Authority for Energy (RAE) identified the need for significant structural changes to the domestic electricity market's organisation and operation. On 15 November 2012, after public debate and public consultation, it announced its final proposals for the reshaping of the domestic electricity market. These proposals were endorsed by the Ministry of Environment, Energy and Climate Change on 4 February 2013.<sup>12</sup>

The structural changes proposed by RAE aim to:

- (a) compress power generation and transmission costs;
- (b) create conditions for the domestic market's integration with those of neighbouring countries, as envisaged under the European Target Model;
- (c) ensure non-discriminatory access of all market participants to the country's energy resources (mostly lignite and water);
- (d) eliminate distortions and cross-subsidies in retail tariffs (especially in the low-voltage tariffs that are still regulated); and
- (e) foster reforms in the natural gas market, geared towards reducing infrastructure use costs and strengthening competition in the supply of natural gas.

The proposed structural improvements involve the wholesale electricity market, power generation from renewable energy sources (RES) and the retail electricity market.

### The wholesale electricity market

– The most important proposal from RAE for the wholesale market is the *adoption of the*

*French model for a new organisation of the electricity market (NOME–Nouvelle organisation du marché de l'électricité)*, involving the sale/auction of lignite-fired and possibly hydroelectric power generation through forward contracts at a regulated price range.<sup>13</sup> The central aim of the proposed auctioning procedure is to ensure access to the country's lignite and water resources, and the transfer of at least part of the economic surplus from lignite-fired and hydro power generators to domestic end-users.<sup>14</sup> The consumption contracts are to have different durations depending on the zone, while transitional provisions will also be needed for the smooth and gradual third-party acquisition of a retail market share, so that forward contracts may be used.<sup>15</sup>

Other changes proposed for the wholesale electricity market include:

- <sup>10</sup> The Electricity and Gas Directives of the Third Energy Package (namely Directive 2009/72/EC concerning common rules for the internal market in electricity, and Directive 2009/73/EC concerning common rules for the internal market in natural gas) have already been transposed into Greek law (Law 4001/22 August 2011 on the Operation of Electricity and Natural Gas Markets; Hydrocarbon Exploration, Production and Transmission Networks and other provisions). The purpose of this legislation is to ensure that the necessary conditions are in place for the completion of the single energy market by 2014 in compliance with European Council Decision of 4 February 2011.
- <sup>11</sup> The aims of the EU Target Model for energy are to achieve market coupling and, at more advanced stages, price coupling so as to ensure more efficient use of Trans-European energy networks (TENs). All Member States are required by 2015, even by strong regulatory action, to have established the necessary conditions in their wholesale and retail energy markets for the Target Model's effective implementation and operation.
- <sup>12</sup> The aim of the Ministry of Environment, Energy and Climate Change is for the new regulatory framework on the domestic electricity market to have been completed by the end of the first half of 2013.
- <sup>13</sup> The basic auction design proposed by RAE draws on both the Virtual Power Plant (VPP) approach and the NOME approach for industrial customers. The objective is to combine those features that are most suited to Greece's market conditions, so as to effectively address pressing structural and conjunctural problems in the domestic electricity market.
- <sup>14</sup> To achieve this aim, auction participants are subject to the following specific limitations: (a) lignite and hydro power forward products may only be used for the supply of electricity to end users; and (b) such products may account for only part (roughly 65%) of the total power/energy provided to the end-users served, with the balance coming from other sources.
- <sup>15</sup> RAE has proposed a multiple-round auction, to be completed by mid-2014, of forward energy products, amounting to a total capacity of 1600 MW. The auctions will be in blocks of 10 to 50 MW, with minimum/maximum size limits per participant, so that not only large energy-consuming industries and suppliers, but also smaller industries can participate. The auction will be held in three rounds, with a tentative date of September 2013 set for the first round.

– *Redesigning the Capacity Assurance Mechanism*, especially given the gradual decrease in the load factors of thermal power plants. This mechanism is essential to the sustainable and effective co-existence of conventional and RES power plants.

– *Establishing an Additional Reserves Assurance Mechanism* for the transition period 2013-2014 with the primary aim of supporting the operation of reliable plants, without energy limitations. This will help ensure a greater flexibility of response to grid load fluctuations, thereby preventing any serious problems during the launch of the single energy market in 2015.

– *Drawing up a detailed “Management Code for Hydroelectric Power Plants and Water Resources”* and, more importantly, a methodology for calculating the lowest bid price that a hydroelectric power plant can submit in the wholesale electricity market.

#### Generation from renewable energy sources (RES)

A comprehensive overhaul of the current model for RES development (including guaranteed feed-in tariffs/FiTs and priority grid access to renewable energy producers) is considered necessary to ensure compatibility with the structural and operational changes in the domestic electricity market both during the interim phase 2013-2014 and from 2015 onwards (implementation of the European Target Model for electricity market integration). Proposals in this regard involve reviewing the economic incentives provided by RES support schemes and establishment procedures, as well as the quantitative targets regarding the mix, technological maturity and market penetration of RES technologies so as to ensure that Greece meets its national target in terms of share of RES in gross final energy consumption. RAE also points out the need to contain any further increases in the special duty for gas emissions reduction (ETMEAR) levied on RES and High-Efficiency Cogeneration.<sup>16</sup>

#### The retail electricity market

Retail market distortions caused by regulated supply tariffs need to be removed, so that *customers pay according to the costs they generate*. In other words, supply rates must fully reflect the underlying long-term supply costs across all market segments.<sup>17</sup>

The proposals made by RAE with regard to residential customers include:

(a) *eliminating discriminatory pricing and offering residential customers two tariff options: a single undifferentiated rate, and a day/night rate;*

(b) *slashing the number of public utility service charges, from 13 to 4, as a way to reduce present distortions; and*

(c) *extending eligibility for the Social Tariff for Residential Customers (KOT) to broader categories of customers, while also streamlining eligibility requirements and approval procedures.*<sup>18</sup>

<sup>16</sup> According to a plan by the Ministry of Environment, Energy and Climate Change to gradually reduce and by 2014 to ultimately wipe out the €280 million deficit of the special account used to compensate producers of electricity from RES and High-Efficiency Cogeneration, RAE (by virtue of its decision of 10 January 2013) raised the weighted average special duty for gas emissions reduction (ETMEAR) to €9.3/MWh in 2013, from €8.74 in 2012. This increase, however, entails different percentage changes per customer category. Thus, the ETMEAR duty will cost high-voltage customers 22% less per MWh, but medium-voltage customers 8% more. For households, the impact of the ETMEAR duty increase on their total electricity bills will range from 0.4% to 0.8%, depending on their consumption levels.

<sup>17</sup> Cost-reflective pricing for low-voltage customers is expected to take effect as soon as supply tariffs are deregulated, i.e. on 1 July 2013. However, the latest low-voltage tariffs announced by the Public Power Corporation (PPC) on 13 January 2013, with retroactive effect from 1 January 2013, already mark a first step towards aligning tariffs on generation and transmission costs. Based on these latest tariffs, the weighted average increase in low-voltage rates was 3%.

<sup>18</sup> On 13 January 2013, the PPC announced an extended Social Tariff for Residential Customers (effective retroactively from 1 January 2013) for broader social categories (low income earners, the long-term unemployed, families with three children, the disabled, etc.), while also keeping in place its special lower tariff for households with four children or more. The new Social Tariff for Residential Customers provides a discount of about 42% on the standard residential tariff in effect since 1 January 2013 and applies to the beneficiary's total consumption. The Ministry of Environment, Energy and Climate Change has thus essentially adopted the new Code on Electricity Supply in accordance with an opinion issued by RAE on 8 January 2013, which modernises the service provision framework and enhances the protection of vulnerable consumers.



RAE has furthermore stressed the need to *fully dissociate* the supplying of electricity from third-party tax collection (municipal tax, municipal fees, extraordinary surtax on real estate/EETHDE, public television licence fee), and to *reduce today's stifling energy taxation* (special consumption tax on natural gas used in gas-fired power plants, special consumption tax on oil used in PPC power plants on islands, special consumption tax on electricity).<sup>19</sup>

Finally, as stressed by RAE, the development of a Long-term Energy Plan remains the most pressing need for Greece's energy sector.

## 6 PHASE 2 OF THE WORK ASSIGNED TO THE CLIMATE CHANGE IMPACTS STUDY COMMITTEE (CCISC): PREPARATION OF A STUDY FOR A NATIONAL ADAPTATION STRATEGY TO CLIMATE CHANGE<sup>20</sup>

### 6.1 INTRODUCTION

Following deliberations within the Climate Change Impacts Study Committee (CCISC) in October and December 2012, it was decided that Phase 2 of the CCISC project would focus on contributing to the formulation of a national strategy of *adaptation* to climate change (NSACC). Furthermore, it was agreed that this policy would be:

- aligned with the general orientations of the European Strategy for Adaptation to Climate Change, currently being finalised;
- supported by adequate existing data, in particular the findings of Phase 1 of the Climate Change Impacts study, as reproduced in the technical report,<sup>21</sup> and
- mainstreaming into the broader sectoral policies at the current economic conjuncture, with a focus on potential synergies between growth and climate strategy.

As agreed, the scope of the study will include:

- Homogenisation and enhancement of data available from Phase 1;
- Climate vulnerability analyses of the respective economic sectors;
- Elaboration of a realistic short-list of climate adaptation investment options;
- Formulation of a cohesive methodology for the selection of the optimal adaptation options;
- Proposals for public policy geared towards meeting the adaptation targets.

### 6.2 THE PROBLEM POSED BY ADAPTATION TO CLIMATE CHANGE

The more experience and insight we gain into the climate adaptation potential in the EU, the more aware we become of the difficulties posed by the need for prior institutional adaptation. These difficulties stem from the fact that adaptation is totally different from emission mitigation. More specifically, while mitigation policies have a very long-term impact on global climate conditions (which are a typical example of a public good), adaptation policies can have a long-term impact on the welfare of specific local populations (typical of a private good). Secondly, emissions mitigation has the advantage of being measurable in terms of a clear and universally-accepted physical unit (i.e. tonnes of CO<sub>2</sub> equivalent). As a result, both the effectiveness of mitigation measures and the ensu-

<sup>19</sup> On 24 January 2013, in fulfilment of its consumer protection mandate, RAE released its assessment of the financial repercussions of the new rates recently announced by PPC on the four-month electricity bills of residential and commercial customers. RAE's calculations only cover the electricity supply rates and therefore leave out all taxes (e.g. customs fees, special consumption tax, VAT) and third-party fees for services (real estate tax, municipal fees, public television licence fee) unrelated to the electricity supply. In order to help consumers choose their electricity supplier, RAE intends to release similar assessments on the 2013 rates to be announced by Greece's other electricity suppliers.

<sup>20</sup> This Section is based on the working document drawn up by Professors and CCISC members M. Skourtos, A. Kontogianni, C. Zerefos, A. Xepapadeas, A. Papandreou and E. Sartzetakis.

<sup>21</sup> See "The environmental, economic and social impacts of climate change in Greece", Athens, 2011. This report can be downloaded from [http://www.bankofgreece.gr/BogEkdoseis/ClimateChange\\_FullReport\\_bm.pdf](http://www.bankofgreece.gr/BogEkdoseis/ClimateChange_FullReport_bm.pdf).

ing benefits can be clearly quantified. Such, however, is not the case with climate adaptation: *contrary to what happens with mitigation, the physical result of adaptation can vary across sectors, locations and adaptation technologies.* Consequently, while the results of alternative adaptation measures and technologies in a particular sector should, in principle, be comparable, the variety of metrics in which they are in reality expressed hampers comparability and, ultimately, selection.

It is therefore logical to expect government action and policy for the protection of a public good, such as the climate, but less logical to expect government action for the provision of a private good, such as adaptation to climate change. Taking this reasoning one step further, “autonomous” adaptation to the impacts of climate change, i.e. private adaptation (by producers and consumers through changes in their production and consumption patterns) without explicit policy interventions by governments would appear to be the answer to climate change. A number of factors, however – such as uncertainty about the impacts of climate change and about the effectiveness of adaptation measures – make it essential for the government to assume a leading role in the design and implementation of adaptation actions. Such is the purpose of the European Commission’s White Paper “Adapting to climate change: Towards a European framework for action (COM(2009) 147): *to lay the foundations for effective, multi-level governance for adaptation, with distinct roles to be played by the European, the national and the local authorities.*”

### **6.3 THE INSTITUTIONAL APPROACH TO CLIMATE ADAPTATION IN THE EU**

For years, the EU had centred its climate policy around greenhouse gas emission (GHG) mitigation, advocating openly for the signing and implementation of the Kyoto Protocol. EU climate diplomacy did not, however, have the anticipated results. The reluctance of the biggest “players”, in particular the U.S., China, Canada and India, to ratify the Kyoto Proto-

col led to the failure of the Copenhagen Conference in October 2009 to adopt a legally binding agreement on the reduction of CO<sub>2</sub> emissions. (For more details on what followed, see Section 1.2 above.)

Driven by concerns that global economic growth is likely to remain highly carbon-intensive and that the adverse effects of climate change will continue to multiply, the European Union in June 2007 released a Green Paper entitled “Adapting to climate change in Europe – options for EU action”, COM (2007) 354, as a first official contribution to the global debate on climate adaptation. Published in the wake of extreme weather events that had recently devastated several European nations (with e.g. flash floods and wildfires), the Green Paper marks the start of public consultation on the policy measures needed to reduce the impact and costs of global warming. The Paper examines the impacts of climate change at the regional and sectoral level, and outlines possible adaptation measures of European scope. It also stresses that, according to preliminary estimates of the Stern Review (The Economics of Climate Change, November 2006), with a 3-4°C global average temperature rise, the additional costs of adapting infrastructure and buildings could amount to 1-10% of the total costs invested in construction in OECD countries or USD 15-150 billion each year (0.05-0.5% of GDP). If temperatures are allowed to rise by 5-6°C, the costs of adaptation measures would likely rise exponentially, and their relative effectiveness would diminish.

Some two years later in April 2009, the EU Commission released a White Paper (Adapting to climate change: Towards a European framework for action) that builds on the public consultation launched by the Green Paper in 2007 and adopts the following phased approach: Phase 1 (2009-2012) was to lay the ground work for preparing a comprehensive EU adaptation strategy, and Phase 2 (commencing in 2013) would see the actual strategy implementation. The White Paper also identifies some of the problems with adaptation policies, such as:

- assessing the cost and benefits of adaptation options;
- the problem of maladaptation;
- the need to mainstream adaptation measures into broader economic policy;
- the connection between emission mitigation and adaptation policies;
- the cross-sectoral impacts of adaptation;
- the problem with the financing of adaptation investments.

#### 6.4 EU ADAPTATION STRATEGIES

With the climate change impacts becoming increasingly visible, most European nations have already started to design and implement National Adaptation Plans (NAP), giving priority to the sectors of health, agriculture and water resources and to the impact on sea level rise.<sup>22</sup> The national adaptation strategies do not form a uniform set of proposals and targets, but differ considerably in terms of scope of intervention, target accuracy and extent to which institutional and social factors have been taken into consideration. Such disparities are to be expected given that, as explained previously, adaptation to climate change is a private and – in most cases – a local good. Relevant research is still in its early stages, given that calls for research proposals in thematic areas related to climate change under the EU’s 7th Framework Programme for Research were only announced in late 2012, while the first European Climate Change Adaptation Conference will be held in March 2013.

#### 6.5 THE NATIONAL SUPPORT REFERENCE FRAMEWORK (NSRF) 2014-2020 FOR ADAPTATION TO CLIMATE CHANGE

A very encouraging development is that the new National Support Reference Framework (NSRF) 2014-2020, in course of elaboration since 2012,<sup>23</sup> will be centrally aligned on the

EU strategy “Europe 2020” and will include such flagship initiatives as “supporting the shift towards a low-carbon economy”, “promoting climate adaptation” and “environmental protection and resource efficiency”. It also provides for the establishment of Groups of Experts (with academics and specialists) in each respective field for the elaboration of the Development Plan and the Operational Programmes.

#### 6.6 THE “LEGACY” OF PHASE I OF THE STUDY BY THE CLIMATE CHANGE IMPACTS STUDY COMMITTEE (CCISC)

During Phase 1, the Climate Change Impacts Study Committee (CCISC) produced a first assessment of the environmental, economic and social impacts of climate change in Greece. Its research of the physical impacts of climate change is nearly complete (for the assessment needs of the Study Committee, not for general academic purposes). However, there is still room for fine-tuning research into sectoral economic impacts and for developing research into the social impacts of climate change, still at a very initial stage. Two findings of Phase 1, crucially important to Phase 2, concern the confirmation of Greece’s climatic diversity and the anticipated cost of Greek inaction on climate change. The complexity of Greece’s geomorphology is responsible for a mosaic of climatic conditions, which – combined with local cultural and socio-economic specificities – will make future research on adaptation all the more interesting, but also all the more challenging. Generally speaking, it was estimated that non-action on climate change would result in annual declines in Greek GDP of 2% by 2050 and 6% by 2100. The total cumulative cost for the Greek economy of a *non-action* scenario over the period extending to 2100, expressed as a decline in

<sup>22</sup> For more information, visit the EU climate adaptation portal at <http://climate-adapt.eea.europa.eu/>.

<sup>23</sup> See Ministry for Development and Competitiveness, Special Secretariat for NSRF “1st Circular for the Planning and Elaboration of the Development Programme 2014-2020”, April 2012 (in Greek).

GDP relative to the base year and using a zero discount rate, would amount to €701 billion (at constant 2008 prices).

The Technical Report produced by the Climate Change Impacts Study Committee, in its Section on “Policies and cost of adaptation to climate change”,<sup>24</sup> contains an analysis of the policies and costs of adaptation using the general equilibrium model GEM-E3 and based on adaptation policy data as well as cost data from the sectoral analyses (excluding the sectors of biodiversity, ecosystems and human health). Cost data were also drawn from the international literature. This first cost assessment exercise was able to quantify the macroeconomic costs of adaptation under the extreme climatic conditions of Scenario A2. As shown by the analysis, adaptation action would amount to 1.5% of GDP in 2025-2050, 0.9% of GDP in 2051-2070, and 0.1% of GDP after 2070. Cumulatively till 2100, adaptation to climate change would cost the Greek economy €123 billion (at 2008 prices). The opportunity under Phase 2 to fine-tune the different parameters of adaptation will allow for a more accurate macroeconomic reapplication of the GEM-E3 model.

#### **6.7 ORGANISATION OF PHASE 2 OF RESEARCH BY THE CLIMATE CHANGE IMPACTS STUDY COMMITTEE (CCISC)**

Phase 2 of research will focus on policies and in particular on planned adaptation policies. Such policies typically need an appropriate administrative or legislative framework to be, at least to some extent, in place and encompass both “hard” and “soft” adaptation options. Hard adaptation options usually consist of engineering options for the improvement of transport infrastructure, communications and urban structures, and have the advantage of being fairly easy to assess in terms of cost and benefits. Soft or mild adaptation options, on the other hand, which basically consist of information and incentive policies geared towards changing consumption and production patterns, may have the advantage of costing less;

however, their exact costs and benefits are usually less “tangible” and therefore more difficult to estimate.

The public debate, today, on climate change adaptation policies can obviously not be isolated from the conjuncture of fiscal deficits and recession, both in Greece and worldwide. The fact that Greece’s National Strategy for Adaptation to Climate Change (NSACC) is linked to the country’s current economic situation has two sides:

– On the one hand, the current economic downturn will ultimately prove to have been *shorter-lived* than the impacts of climate change. The recession should therefore not be a deciding factor in any long-term strategy, such as a National Strategy for Adaptation to Climate Change (NSACC).

– On the other hand, the failure of past policies, as highlighted by the current crisis, should heighten our awareness of the public management and policy implications of “governance”. Governance, as a concept, encompasses both formal and informal forms of social management and power. In order to ensure that Greece’s National Strategy for Adaptation to Climate Change (NSACC) is feasible and realistic, the objectives, capacity and limitations of current (and future) governance components in Greece (e.g. public administration, local government, NGOs, professional associations, citizen movements) will need to be taken into due consideration during Phase 2 of research.

For the National Strategy for Adaptation to Climate Change to be realistic, the proposals to be produced by Phase 2 of the research will need to be based on alternative scenarios of future socio-economic development in Greece and worldwide. Other requirements will include: consultation with the social partners, the use of

<sup>24</sup> See “The environmental, economic and social impacts of climate change in Greece”, Athens, 2011, pp. 367-383. The full report can be downloaded from [http://www.bankofgreece.gr/BogEkdoseis/ClimateChange\\_FullReport\\_bm.pdf](http://www.bankofgreece.gr/BogEkdoseis/ClimateChange_FullReport_bm.pdf).

geo-spatial information (GIS maps, databases with GPS coordinates, etc.), as well as synergies and partnerships with other research projects.

Taking all of the above into consideration, the CCISC has set itself the tasks of:

**(a)** Assessing in depth and formulating specific adaptation policies in the priority sectors already studied in part during Phase 1 (i.e. agriculture, sea level rise, tourism, water supply, urban environment, public health, transport networks, etc.). These bottom-up analyses may also contain mitigation policy analyses, to the extent that certain adaptation policies are directly tied to emission reduction. In any event, due to the uncertainty surrounding the impacts of climate change as well as the cost, timing and effectiveness of adaptation action, the proposed adaptation policies will need to be “adaptive” (*adaptive* adaptation).

**(b)** Mainstreaming the sectoral adaptation policies into broader public policies in the sectors concerned, especially under the present circumstances of economic recession and major cut-backs in funding. To this end, the analyses mentioned in the previous paragraph (a) will need to be combined with a review of the institutional role of the banking and insurance sectors in the support of sectoral adaptation (and mitigation) policies. The recording and critical analysis of initiatives combining climate change and entrepreneurship would also be particularly warranted.

**(c)** Holding consultations with all the stakeholders, i.e. decision makers, central and local government officials, professional groups and social partners in general, in an aim to explore specific matters and stimulate research. Consultation has been shown to be an indispensable tool for:

– linking research with the practical needs of users;

– monitoring the social acceptance of research findings;

– completing research data and informing on new options.

**(d)** Implementing a small-scale ‘pilot programme’ of adaptation action in a selected geographic area of Greece, based on the findings of Phase 1 and in part of the studies of Phase 2, with a view to fostering an integrated approach to adaptation adoption and to underscoring the difficulties in similar efforts.

## **6.8 STRUCTURE OF RESEARCH FOR THE NATIONAL STRATEGY FOR ADAPTATION TO CLIMATE CHANGE (NSACC)**

In order to ensure that the research effort meets all of the objectives outlined above, the study will be structured into three main sections as follows:

**I. General overview.** Presentation and documentation of the need for climate adaptation. Objectives of the National Strategy for Adaptation to Climate Change. Review of climate data for Greece. Selection of the climate scenarios and presentation of methodology tools.

**II. Key sector analysis (adaptation).** The key sector analysis under Phase 1 covered: aquatic ecosystems, sea level rise, fisheries and aquaculture, agriculture, forestry, biodiversity and ecosystems, tourism, the built environment, transport, health and the mining industry. The same key sectors will be studied under Phase 2, taking into account that some of them are typically ecosystemic (aquatic ecosystems, forestry, biodiversity, coastal areas), while others are market-related (fisheries and aquaculture, agriculture, tourism, mining) or network- and infrastructure-related (cities, transport, water supply, health). To avoid a reoccurrence of the inevitable overlapping between sectors that took place during Phase 1, a new typology will need to be designed for Phase 2, with the definite inclusion of two sectors, namely the energy sector and marine ecosystems.

Each sector analysis should be structured as follows:

**(a) Vulnerability analysis.** Analysis of the respective key sector's geophysical/ecosystemic as well as socioeconomic vulnerability, using appropriate indicators. Expected (direct and indirect) impacts of climate change in both the short and the long term. Analysis of the impacts in terms of cost, range, onset, reversibility and distributional effects.

**(b) Adaptive capacity.** Assessment of each key sector's adaptive capacity, in terms of technology, institutions, human capital, access to financing, etc.

*The analyses (a) and (b) will enable us to prioritise the adaptation needs.*

**(c) Adaptation measures.** Drawing-up of a short-list of potential adaptation technologies, measures and policies ("hard" and "soft"). Each of the technologies, measures or policies is to be short-listed on the basis of multiple criteria, including: intended objectives; direct and indirect outcome; timing and spatial considerations; positive or negative impacts on other sectors; contribution to greenhouse gas emissions mitigation; construction and operating costs; ease of financing; required expertise; and institutional coverage.

**(d) Priority analysis and target selection.** From the short-list of potential adaptation

technologies, measures and policies established under (c), one or more (combined) measures will be selected and recommended, based on the adaptation targets in each sector and the selection criteria adopted. Consultation with all stakeholders will be vital at this stage on e.g. the suitability of the proposed measures, the accuracy of cost and effectiveness estimates, the relative importance of the criteria. Standard forms of priority analysis include cost/benefit analysis, cost/effectiveness analysis and multi-criteria approaches.

**(e) Target implementation/funding.** Once the targets have been set and the measures for their implementation selected, we will seek to determine whether appropriate institutional frameworks and financing tools are in place. At this stage the potential for mainstreaming the selected sectoral policies into broader development and fiscal strategies will be examined.

**III. Supporting sectors (i.e. banking and insurance sectors).** Section III of research for the elaboration of a National Strategy for Adaptation to Climate Change will examine the potential for public and private finance to strengthen and support climate adaptation projects in Greece through appropriate banking and insurance products.