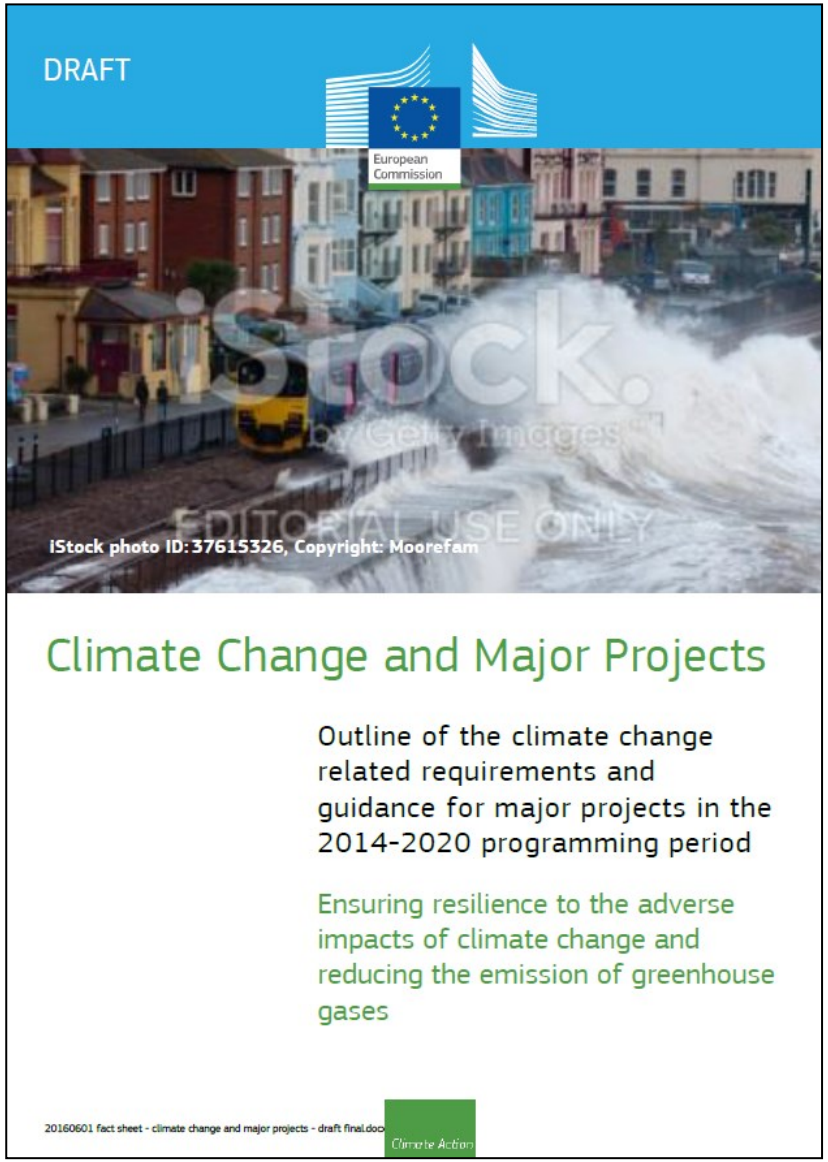
Climate Change and Major Projects

Presented by Claus Kondrup, European Commission, DG Climate Action,
at the JASPERS Networking Event *"Climate Change Adaptation: Vulnerability and Risk Assessment and the Resilience of Major Infrastructure Projects"*,
at the EIB Brussels Office, 7-8 June 2016



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- Climate change requirements part of the legal basis for major projects 2014-2020
- EU Adaptation Strategy 2013:
  - Resilient infrastructure
  - Climate proofing policies
  - Adapting infrastructure to climate change (SWD)
  - Guidelines for Project Managers: Making vulnerable investments climate resilient
- Policy objective 2014-2020: climate mainstreaming across the board, at least 20% climate related expenditure

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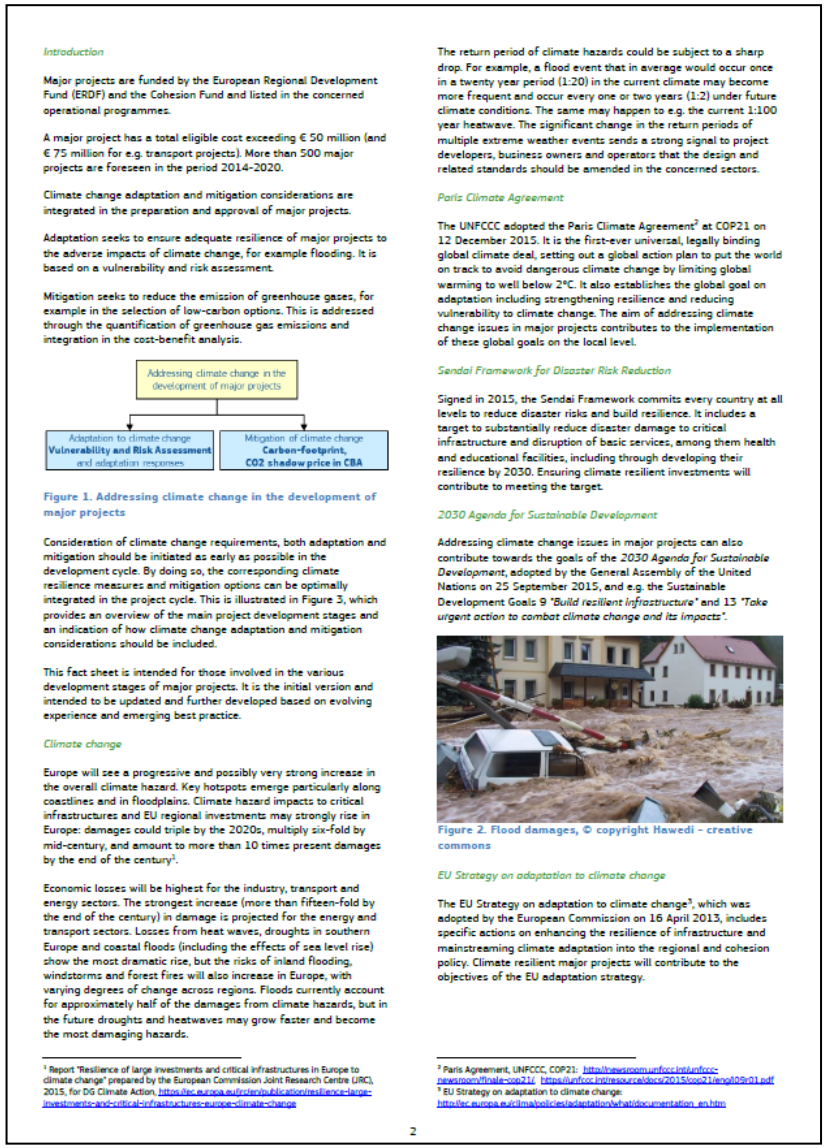

Introduction

Major projects are funded by the European Regional Development Fund (ERDF) and the Cohesion Fund and listed in the concerned operational programmes.

A major project has a total eligible cost exceeding € 50 million (and € 75 million for e.g. transport projects). More than 500 major projects are foreseen in the period 2014-2020.

Climate change adaptation and mitigation considerations are integrated in the preparation and approval of major projects.

Adaptation seeks to ensure adequate resilience of major projects to the adverse impacts of climate change, for example flooding. It is based on a vulnerability and risk assessment.

Mitigation seeks to reduce the emission of greenhouse gases, for example in the selection of low-carbon options. This is addressed through the quantification of greenhouse gas emissions and integration in the cost-benefit analysis.

Addressing climate change in the development of major projects

Adaptation to climate change: **Vulnerability and Risk Assessment** and adaptation responses

Mitigation of climate change: **Carbon-footprint, CO2 shadow price in CBA**

Figure 1. Addressing climate change in the development of major projects

Consideration of climate change requirements, both adaptation and mitigation should be initiated as early as possible in the development cycle. By doing so, the corresponding climate resilience measures and mitigation options can be optimally integrated in the project cycle. This is illustrated in Figure 3, which provides an overview of the main project development stages and an indication of how climate change adaptation and mitigation considerations should be included.

This fact sheet is intended for those involved in the various development stages of major projects. It is the initial version and intended to be updated and further developed based on evolving experience and emerging best practice.

Climate change

Europe will see a progressive and possibly very strong increase in the overall climate hazard. Key hotspots emerge particularly along coastlines and in floodplains. Climate hazard impacts to critical infrastructures and EU regional investments may strongly rise in Europe: damages could triple by the 2020s, multiply six-fold by mid-century, and amount to more than 10 times present damages by the end of the century[1].

Economic losses will be highest for the industry, transport and energy sectors. The strongest increase (more than fifteen-fold by the end of the century) in damage is projected for the energy and transport sectors. Losses from heat waves, droughts in southern Europe and coastal floods (including the effects of sea level rise) show the most dramatic rise, but the risks of inland flooding, windstorms and forest fires will also increase in Europe, with varying degrees of change across regions. Floods currently account for approximately half of the damages from climate hazards, but in the future droughts and heatwaves may grow faster and become the most damaging hazards.

The return period of climate hazards could be subject to a sharp drop. For example, a flood event that in average would occur once in a twenty year period (1:20) in the current climate may become more frequent and occur every one or two years (1:2) under future climate conditions. The same may happen to e.g. the current 1:100 year heatwave. The significant change in the return periods of multiple extreme weather events sends a strong signal to project developers, business owners and operators that the design and related standards should be amended in the concerned sectors.

Paris Climate Agreement

The UNFCCC adopted the Paris Climate Agreement[2] at COP21 on 12 December 2015. It is the first-ever universal, legally binding global climate deal, setting out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. It also establishes the global goal on adaptation including strengthening resilience and reducing vulnerability to climate change. The aim of addressing climate change issues in major projects contributes to the implementation of these global goals on the local level.

Sendai Framework for Disaster Risk Reduction

Signed in 2015, the Sendai Framework commits every country at all levels to reduce disaster risks and build resilience. It includes a target to substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030. Ensuring climate resilient investments will contribute to meeting the target.

2030 Agenda for Sustainable Development

Addressing climate change issues in major projects can also contribute towards the goals of the *2030 Agenda for Sustainable Development*, adopted by the General Assembly of the United Nations on 25 September 2015, and e.g. the Sustainable Development Goals 9 *"Build resilient infrastructure"* and 13 *"Take urgent action to combat climate change and its impacts"*.

Figure 2. Flood damages, © copyright Hawedi - creative commons

EU Strategy on adaptation to climate change

The EU Strategy on adaptation to climate change[3], which was adopted by the European Commission on 16 April 2013, includes specific actions on enhancing the resilience of infrastructure and mainstreaming climate adaptation into the regional and cohesion policy. Climate resilient major projects will contribute to the objectives of the EU adaptation strategy.

[1] Report 'Resilience of large investments and critical infrastructures in Europe to climate change' prepared by the European Commission Joint Research Centre (JRC), 2015, for DG Climate Action. https://ec.europa.eu/jrc/en/publication/resilience-large-investments-and-critical-infrastructures-europe-climate-change

[2] Paris Agreement, UNFCCC, COP21: http://newsroom.unfccc.int/unfccc-newsroom/finale-cop21/ https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

[3] EU Strategy on adaptation to climate change: http://ec.europa.eu/clima/policies/adaptation/what/documentation_en.htm

- Major projects
- Adaptation + Mitigation (resilience + GHG Emissions)
- Climate change impacts:
  - Increase in overall climate hazards, key hotspots (coastlines, floodplains)
  - Extremes, return period
- Context, e.g.:
  - Paris Climate Agreement
  - EU Adaptation Strategy

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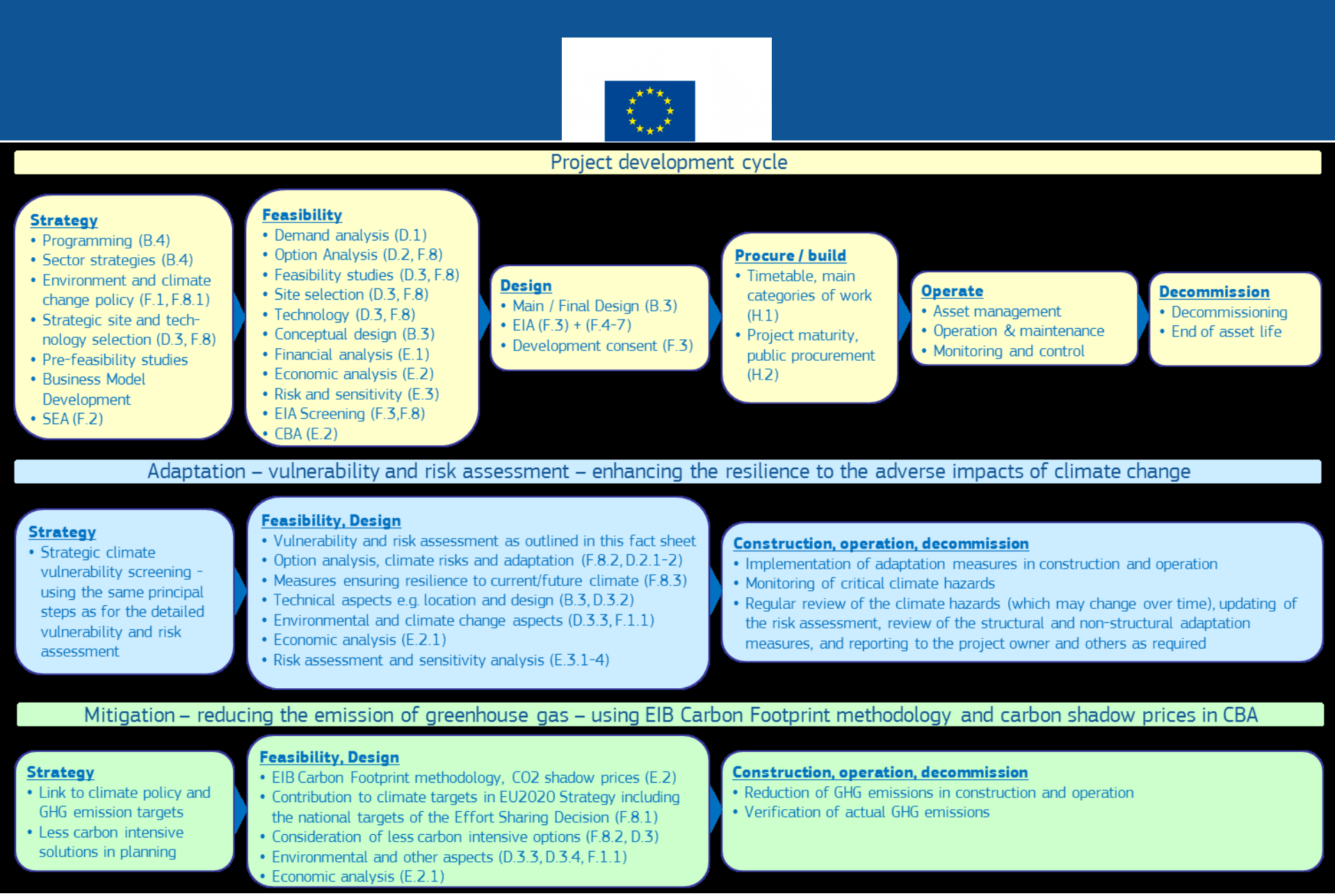

Consideration of climate change requirements should be initiated as early as possible in the project development cycle

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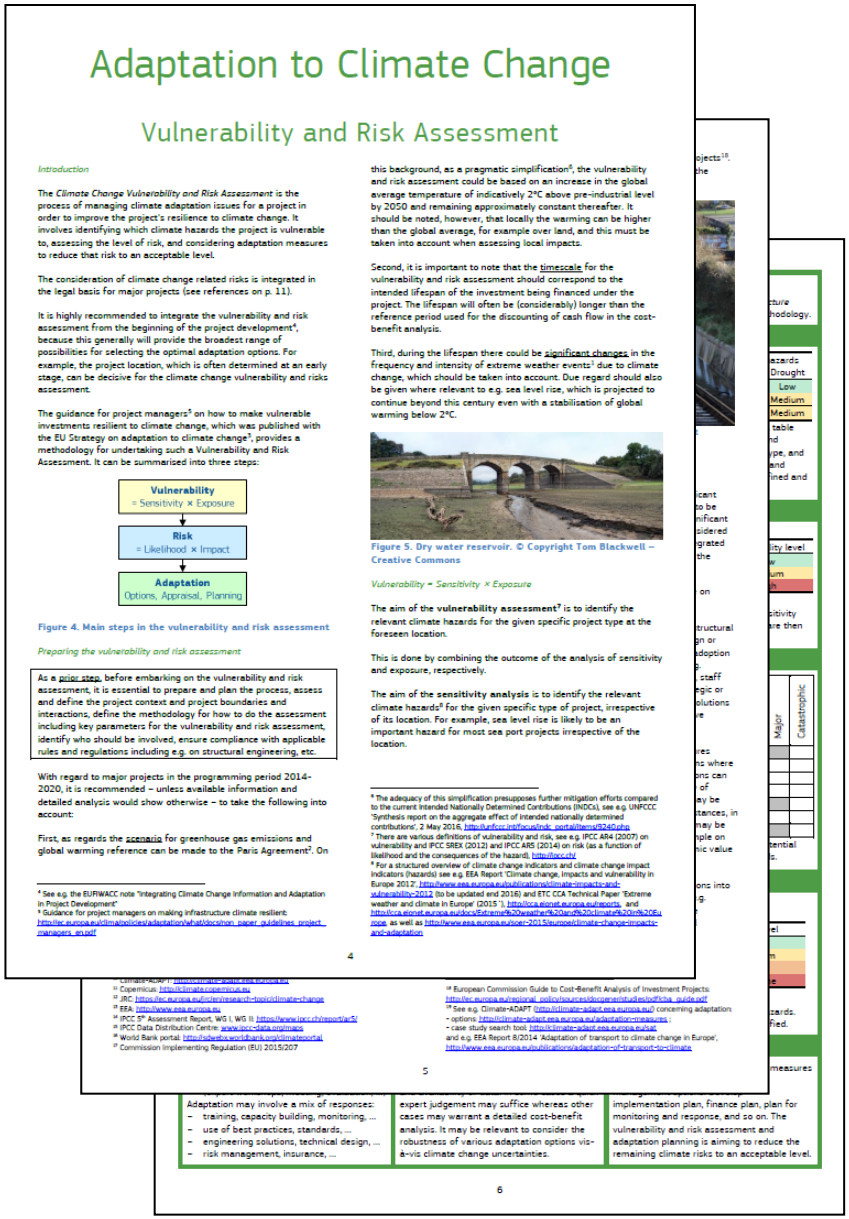

Adaptation to Climate Change

Vulnerability and Risk Assessment

Introduction

The *Climate Change Vulnerability and Risk Assessment* is the process of managing climate adaptation issues for a project in order to improve the project's resilience to climate change. It involves identifying which climate hazards the project is vulnerable to, assessing the level of risk, and considering adaptation measures to reduce that risk to an acceptable level.

The consideration of climate change related risks is integrated in the legal basis for major projects (see references on p. 11).

It is highly recommended to integrate the vulnerability and risk assessment from the beginning of the project development[4], because this generally will provide the broadest range of possibilities for selecting the optimal adaptation options. For example, the project location, which is often determined at an early stage, can be decisive for the climate change vulnerability and risks assessment.

The guidance for project managers[5] on how to make vulnerable investments resilient to climate change, which was published with the EU Strategy on adaptation to climate change[6], provides a methodology for undertaking such a Vulnerability and Risk Assessment. It can be summarised into three steps:

Vulnerability
= Sensitivity × Exposure

Risk
= Likelihood × Impact

Adaptation
Options, Appraisal, Planning

Figure 4. Main steps in the vulnerability and risk assessment

Preparing the vulnerability and risk assessment

As a prior step, before embarking on the vulnerability and risk assessment, it is essential to prepare and plan the process, assess and define the project context and project boundaries and interactions, define the methodology for how to do the assessment including key parameters for the vulnerability and risk assessment, identify who should be involved, ensure compliance with applicable rules and regulations including e.g. on structural engineering, etc.

With regard to major projects in the programming period 2014-2020, it is recommended – unless available information and detailed analysis would show otherwise – to take the following into account:

First, as regards the scenario for greenhouse gas emissions and global warming reference can be made to the Paris Agreement[7]. On this background, as a pragmatic simplification[8], the vulnerability and risk assessment could be based on an increase in the global average temperature of indicatively 2°C above pre-industrial level by 2050 and remaining approximately constant thereafter. It should be noted, however, that locally the warming can be higher than the global average, for example over land, and this must be taken into account when assessing local impacts.

Second, it is important to note that the timescale for the vulnerability and risk assessment should correspond to the intended lifespan of the investment being financed under the project. The lifespan will often be (considerably) longer than the reference period used for the discounting of cash flow in the cost-benefit analysis.

Third, during the lifespan there could be significant changes in the frequency and intensity of extreme weather events[9] due to climate change, which should be taken into account. Due regard should also be given where relevant to e.g. sea level rise, which is projected to continue beyond this century even with a stabilisation of global warming below 2°C.

Figure 5. Dry water reservoir. © Copyright Tom Blackwell – Creative Commons

Vulnerability = Sensitivity × Exposure

The aim of the **vulnerability assessment**[7] is to identify the relevant climate hazards for the given specific project type at the foreseen location.

This is done by combining the outcome of the analysis of sensitivity and exposure, respectively.

The aim of the **sensitivity analysis** is to identify the relevant climate hazards[8] for the given specific type of project, irrespective of its location. For example, sea level rise is likely to be an important hazard for most sea port projects irrespective of the location.

[4] See e.g. the EUFIWACC note 'Integrating Climate Change Information and Adaptation in Project Development'.
[5] Guidance for project managers on making infrastructure climate resilient: http://ec.europa.eu/clima/policies/adaptation/what/docs/non_paper_guidelines_project_managers_en.pdf

[6] The adequacy of this simplification presupposes further mitigation efforts compared to the current Intended Nationally Determined Contributions (INDCs), see e.g. UNFCCC 'Synthesis report on the aggregate effect of intended nationally determined contributions', 2 May 2016, http://unfccc.int/focus/indc_portal/items/9240.php
[7] There are various definitions of vulnerability and risk, see e.g. IPCC AR4 (2007) on vulnerability and IPCC SREX (2012) and IPCC AR5 (2014) on risk (as a function of likelihood and the consequences of the hazard), http://ipcc.ch/
[8] For a structured overview of climate change indicators and climate change impact indicators (hazards) see e.g. EEA Report 'Climate change, impacts and vulnerability in Europe 2012', http://www.eea.europa.eu/publications/climate-impacts-and-vulnerability-2012 (to be updated end 2016) and ETC CCA Technical Paper 'Extreme weather and climate in Europe' (2015), http://cca.eionet.europa.eu/reports, and http://cca.eionet.europa.eu/docs/Extreme%20weather%20and%20climate%20in%20Europe, as well as http://www.eea.europa.eu/soer-2015/europe/climate-change-impacts-and-adaptation

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6

Prior steps
prepare, plan, define, …

Vulnerability
= Sensitivity × Exposure

Risk
= Likelihood × Impact

Adaptation
Options, Appraisal, Planning

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Mitigation of climate change

Introduction

Mitigation of climate change is about reducing the emissions of greenhouse gases (GHG) and limiting global warming. Major projects can contribute in this regard, for example through the design and selection of low-carbon options.

A cost-benefit analysis is required[20] for all major projects including quantification[21] of the project's GHG emissions. This applies to all major projects, irrespective of the project category and the level of absolute and relative emissions.

Early and consistent attention to the emission of greenhouse gases in the various development stages of the major projects will help in applying better and more climate friendly solutions.

Carbon Footprint Methodology for major projects

The *Guide to Cost-Benefit Analysis of Investment Projects*[18] includes the evaluation of GHG emissions. The proposed approach to integrate climate change externalities into the economic appraisal is based, in part, on the EIB Carbon Footprint Methodology, which is published on EIB's website[22]. This methodology includes the default emissions calculation approach for e.g.:

- Waste water and sludge treatment
- Waste treatment management facilities
- Municipal solid waste landfill
- Road transport
- Rail transport
- Urban transport
- Building refurbishment

Steps in the carbon footprint assessment

The carbon footprint methodology includes the following main steps:

1. Define project boundary
2. Define the assessment period
3. Emission scopes to include
4. Quantify absolute project emissions (A_B)
5. Identify and quantify baseline emissions (B_B)
6. Calculate relative emissions ($R_B = A_B - B_B$)

The absolute (A_B) GHG emissions are the annual emissions estimated for an average year of operation for the project.

The baseline (B_B) GHG emissions are those emissions which would arise from the expected alternative scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would have occurred in the absence of the project.

The relative (R_B) GHG emissions represent the difference between the absolute project emissions and the baseline scenario emissions.

The absolute and relative emissions should be quantified for a typical year of operation. For certain projects, for example transport projects where the traffic is forecasted to increase over time, it is recommended to select the year with the highest level of emissions.

[20] Regulation (EU) No 1303/2013, Article 101(e)
[21] Commission Implementing Regulation (EU) 2015/207, Article 3 and section 2.3.3 of Annex III
[22] Methodologies for the Assessment of Project GHG Emissions and Emission Variations: http://www.eib.org/about/documents/footprint-methodologies.htm

The carbon assessment should be included throughout the project development cycle including as a tool in the ranking and selection of options – with a view to promote low-carbon considerations and options.

The project boundary defines what is to be included in the calculation of the absolute, baseline and relative emissions.

The carbon footprint methodology uses the concept of "scope" as defined by the Greenhouse Gas Protocol[23].

Table 2 illustrates the three scopes that are part of the carbon footprint methodology and the particular consideration of indirect emissions for road, rail, and urban public transport infrastructure.

Scope	Road, rail and urban public transport infrastructure	All other projects
Scope 1 emissions direct emissions that occur from sources within the project boundary – burning of fossil fuels, industrial process	If applicable: Fuel combustion, process / activity, fugitive emissions	Yes: Fuel combustion, process / activity, fugitive emissions
Scope 2 emissions indirect emissions from purchased electricity	If applicable: Transport (mainly electric rail) infrastructure projects that are operated by the owner of the infrastructure	Yes: Electricity, heating, cooling
Scope 3 emissions other indirect emissions not under the control of the project	Yes: Indirect GHG emissions from vehicles using transport infrastructure including modal shift effects	If applicable: Direct and exclusive upstream or downstream scope 1 and 2 emissions

Table 2. Examples of scope 1, 2 and 3 emissions for selected project types

Figure 7. Green urban transport can reduce pollution, GHG emissions, and enhance resilience to climate and weather extremes, © copyright Nxenara – Creative Commons

Baselines for the carbon footprint and the cost-benefit analysis

The baseline for the carbon footprint methodology is often referred to as the "likely alternative" to the project, and the baseline for the cost-benefit analysis as the "counterfactual baseline scenario". For certain projects there may be a difference between these baselines.

[23] The Greenhouse Gas Protocol 'A Corporate Accounting and Reporting Standard': www.ghgprotocol.org and http://www.ghgprotocol.org/standards/corporate-standard

In such cases it is important to ensure consistency between the quantification of GHG emissions and the cost-benefit analysis. This aspect should be adequately described in the cost-benefit analysis and summarized in the information on the Major Project.

CO2 shadow prices in the Cost-Benefit Analysis

The *Guide to Cost-Benefit Analysis of Investment Projects*[18] includes the evaluation of GHG emissions and refers to the EIB unit cost of GHG emissions[24].

The application of carbon pricing to a project has the effect of penalising the economic performance of carbon-intensive projects.

Figure 8. iStock photo ID: 14087075, Copyright: ssuaphoto

Chapter 4 of the EIB Guide to Economic Appraisal of Investment Projects[25] sets out the approach to include external costs, and the cost of carbon in particular. Drafted in early 2013, it presents estimates of the economic cost of carbon over the period 2010 to 2030 based on the recommendations of a study conducted by the Stockholm Environment Institute (SEI). Given the long asset life of some of the capital-intensive assets it is now necessary to extend the cost of carbon over a longer time period.

The estimates rise in real terms at an increasing rate over time as illustrated in Table 3 below, which complements table 2.10 in the *Guide to Cost-Benefit Analysis of Investment Projects* by covering the extended period until 2050.

Estimate	Value 2010 emission	Annual adders 2011 to 2030	Annual adders 2031-2040	Annual adders 2041-2050
High	40	2	4	8
Central	25	1	2	4
Low	10	0.5	1	2

Table 3. Shadow price of carbon, (EUR / t CO2e), in 2006 prices

[24] EIB Carbon pricing, see annex 2, http://www.eib.org/attachments/strategies/eib_climate_strategy_en.pdf
[25] EIB Economic Appraisal of Investment Projects: http://www.eib.org/infocentre/publications/all/economic-appraisal-of-investment-projects.htm

The central estimate for the economic cost of greenhouse gas emissions (carbon shadow price) in the period 2015-2050, in EUR per tonnes of CO2-equivalent, in 2015-prices, is shown in the table below:

Year	EUR / tCO_2e	Year	EUR / tCO_2e	Year	EUR / tCO_2e	Year	EUR / tCO_2e
		2021	42	2031	54	2041	80
		2022	43	2032	57	2042	84
		2023	44	2033	59	2043	89
		2024	45	2034	61	2044	94
2015	35	2025	46	2035	64	2045	98
2016	36	2026	47	2036	66	2046	103
2017	37	2027	49	2037	68	2047	107
2018	38	2028	50	2038	70	2048	112
2019	39	2029	51	2039	73	2049	117
2020	40	2030	52	2040	75	2050	121

Table 4. Carbon shadow price, EUR/t CO2e, in 2015 prices

Figure 9. Example of green urban transport. Further greening can reduce GHG emissions and air pollution. Stock photo ID:62465860, Copyright: Hans Laubel

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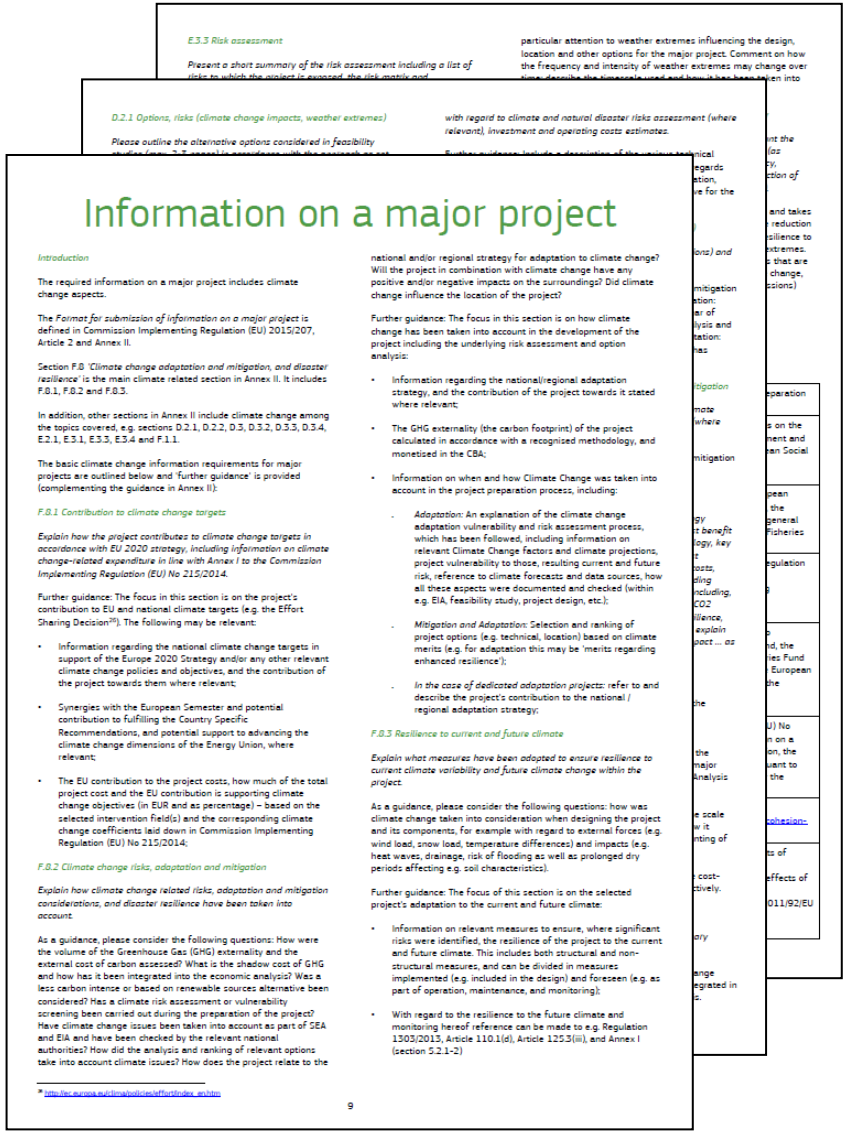

Information on a major project

Introduction

The required information on a major project includes climate change aspects.

The *Format for submission of information on a major project* is defined in Commission Implementing Regulation (EU) 2015/207, Article 2 and Annex II.

Section F.8 '*Climate change adaptation and mitigation, and disaster resilience*' is the main climate related section in Annex II. It includes F.8.1, F.8.2 and F.8.3.

In addition, other sections in Annex II include climate change among the topics covered, e.g. sections D.2.1, D.2.2, D.3, D.3.2, D.3.3, D.3.4, E.2.1, E.3.1, E.3.3, E.3.4 and F.1.1.

The basic climate change information requirements for major projects are outlined below and 'further guidance' is provided (complementing the guidance in Annex II):

F.8.1 Contribution to climate change targets

Explain how the project contributes to climate change targets in accordance with EU 2020 strategy, including information on climate change-related expenditure in line with Annex I to the Commission Implementing Regulation (EU) No 215/2014.

Further guidance: The focus in this section is on the project's contribution to EU and national climate targets (e.g. the Effort Sharing Decision[8]). The following may be relevant:

- Information regarding the national climate change targets in support of the Europe 2020 Strategy and/or any other relevant climate change policies and objectives, and the contribution of the project towards them where relevant;
- Synergies with the European Semester and potential contribution to fulfilling the Country Specific Recommendations, and potential support to advancing the climate change dimensions of the Energy Union, where relevant;
- The EU contribution to the project costs, how much of the total project cost and the EU contribution is supporting climate change objectives (in EUR and as percentage) – based on the selected intervention Field(s) and the corresponding climate change coefficients laid down in Commission Implementing Regulation (EU) No 215/2014;

F.8.2 Climate change risks, adaptation and mitigation

Explain how climate change related risks, adaptation and mitigation considerations, and disaster resilience have been taken into account.

As a guidance, please consider the following questions: How were the volume of the Greenhouse Gas (GHG) externality and the external cost of carbon assessed? What is the shadow cost of GHG and how has it been integrated into the economic analysis? Was a less carbon intense or based on renewable sources alternative been considered? Has a climate risk assessment or vulnerability screening been carried out during the preparation of the project? Have climate change issues been taken into account as part of SEA and EIA and have been checked by the relevant national authorities? How did the analysis and ranking of relevant options take into account climate issues? How does the project relate to the national and/or regional strategy for adaptation to climate change? Will the project in combination with climate change have any positive and/or negative impacts on the surroundings? Did climate change influence the location of the project?

Further guidance: The focus in this section is on how climate change has been taken into account in the development of the project including the underlying risk assessment and option analysis:

- Information regarding the national/regional adaptation strategy, and the contribution of the project towards it stated where relevant;
- The GHG externality (the carbon footprint) of the project calculated in accordance with a recognised methodology, and monetised in the CBA;
- Information on when and how Climate Change was taken into account in the project preparation process, including:
  - *Adaptation*: An explanation of the climate change adaptation vulnerability and risk assessment process, which has been followed, including information on relevant Climate Change factors and climate projections, project vulnerability to those, resulting current and future risk, reference to climate forecasts and data sources, how all these aspects were documented and checked (within e.g. EIA, feasibility study, project design, etc.);
  - *Mitigation and Adaptation*: Selection and ranking of project options (e.g. technical, location) based on climate merits (e.g. for adaptation this may be 'merits regarding enhanced resilience');
  - *In the case of dedicated adaptation projects*: refer to and describe the project's contribution to the national / regional adaptation strategy;

F.8.3 Resilience to current and future climate

Explain what measures have been adopted to ensure resilience to current climate variability and future climate change within the project.

As a guidance, please consider the following questions: how was climate change taken into consideration when designing the project and its components, for example with regard to external forces (e.g. wind load, snow load, temperature differences) and impacts (e.g. heat waves, drainage, risk of flooding as well as prolonged dry periods affecting e.g. soil characteristics).

Further guidance: The focus of this section is on the selected project's adaptation to the current and future climate:

- Information on relevant measures to ensure, where significant risks were identified, the resilience of the project to the current and future climate. This includes both structural and non-structural measures, and can be divided in measures implemented (e.g. included in the design) and foreseen (e.g. as part of operation, maintenance, and monitoring);
- With regard to the resilience to the future climate and monitoring hereof reference can be made to e.g. Regulation 1303/2013, Article 110.1(d), Article 125.3(iii), and Annex I (section 5.2.1-2)

[8] http://ec.europa.eu/clima/policies/effort/index_en.htm

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- F.8.1 Contribution to CC targets
- F.8.2 Risks, adaptation, mitigation
- F.8.3 Climate resilience
- D.2.1 Options, climate risks
- D.2.2 Selection criteria
- D.3 Feasibility (GHG, Impacts):
  - D.3.2 Technical aspects
  - D.3.3 Climate change aspects
- D.3.4 Reference table
- E.2.1 Economic analysis
- E.3.1 Risk assessment, sensitivity
- E.3.4 Additional assessments …
- F.1.1 Consistency with env. policy

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Thank you for your attention

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Directorate-General for Climate Action ("DG CLIMA")
http://ec.europa.eu/clima

Fact sheets on climate mainstreaming in ESIF:
http://ec.europa.eu/clima/publications/index_en.htm#Mainstreaming

EU Strategy on Adaptation to Climate Change:
http://ec.europa.eu/clima/policies/adaptation/what/documentation_en.htm
http://ec.europa.eu/clima/policies/adaptation/index_en.htm

European Climate Adaptation Platform:
http://climate-adapt.eea.europa.eu/







For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact:

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