North Sea Transition Authority

Explanatory Note on Valuation of Greenhouse Gas Emissions

Purpose of Economic Appraisals and Standard Assumptions

The document can be found on the NSTAs website.

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Purpose

The OGA Strategy[1] makes clear that quantification of the societal costs of greenhouse gas (GHG) emissions is an integral component of expected economic value estimates for activities undertaken in the UKCS. Economic welfare at UK level will be highest when the pre-tax net present value (NPV) of oil and gas resources is maximised, taking into account the societal costs of associated GHG emissions.

Valuing all production related GHG emissions is therefore vital to ensure relevant persons take full account of climate change impacts when appraising new and incremental developments. To ensure a consistent, transparent and evidence-based framework, this note provides further information on which assumptions should be used to calculate societal carbon costs.

It is intended to aid economic appraisals of activities that will result in changes in emissions and to support decision making with regard to selecting projects and development options consistent with the obligations in the OGA Strategy and Stewardship Expectation 11.[2] The NSTA will follow this carbon valuation approach as part of the wider economic appraisal framework in order to support regulatory decision making.

OGA Strategy

The updated OGA Strategy came into force in February 2021. The Central Obligation states that:

> *"Relevant persons must, in the exercise of their relevant activities, take the steps necessary to:*
>
> *a. secure that the maximum value of economically recoverable petroleum is recovered from the strata beneath UK waters; and in doing so,*
>
> *b. take appropriate steps to assist the Secretary of State in meeting the net zero target, including by reducing as far as reasonable in the circumstances greenhouse gas emissions from sources such as flaring and venting and power generation, and supporting carbon capture and storage projects."*

"Economically recoverable" is defined as:

> *"Economically recoverable in relation to petroleum means those resources which could be recovered at an expected (pre-tax) market value greater than the expected (pre-tax) resource cost of their extraction, where costs include both capital and operating costs (including carbon costs) but exclude sunk costs and costs (such as interest charges) which do not reflect current use of resources. In bringing costs and revenues to a common point for comparative purposes a 10% real discount rate will be used. Where relevant, UK Government carbon appraisal values for all greenhouse gas emissions will be used combined with the associated real terms social discount rate."*

A footnote to the definition states that:

> *"At the time of publication, current UK Government carbon appraisal values are published by the Department for Business, Energy & Industrial Strategy [BEIS]; current real terms social discount rates are published by HM Treasury."*

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[1] OGA Strategy, February 2021

North Sea Transition Authority (NSTA): The OGA Strategy - 2020 - Publications - News &
publications (nstauthority.co.uk)

[2] NSTA Stewardship Expectation 11, March 2021. See Paragraph B.1. North Sea Transition Authority (NSTA): Stewardship Expectation 11 – Net Zero - 2021 - Publications - News &
publications (nstauthority.co.uk)

GHG Emissions Values

Government and by extension the NSTA are required to take full account of the impacts of climate change on society in appraising policies and projects where the use of significant new and existing public resources is required.

The Department for Energy Security and Net Zero (DESNZ, formerly BEIS) publishes GHG emissions values ("carbon appraisal values") which are used for valuing impacts on emissions.[3] The current values (published 2021) are reproduced below for ease of reference in **Annex A**. They represent a monetary value that society places on one tonne of carbon dioxide equivalent (£/tCO2e in 2020 prices) and are calculated based on estimated marginal abatement costs consistent with the UK's national and international climate commitments, including net zero and a series of interim carbon budgets.

The current published values extend to 2050 and to capture the range of uncertainty, a plus or minus 50% sensitivity range has been deemed appropriate around the central series. To obtain values post-2050, it is advisable to apply a real annual growth rate of 1.5% to the range of 2050 values.

Carbon appraisal values are not intended as forecasts of market-based carbon prices under the UK Emissions Trading Scheme (ETS) - which covers only CO2 emissions from in-scope installations - so they are not the basis for estimating the financial costs to companies from future emissions. The UK ETS sets a declining cap on the total level of CO2 emissions and allows companies to trade allowances, resulting in a price that fluctuates with the market. Companies are expected to develop their own objective view on future UK ETS prices for commercial assessments of returns to new or incremental investments.

GHG Conversion Factors

Each GHG has a different Global Warming Potential (GWP). Emissions of non-CO_2 gases therefore need to be converted into tonnes of CO_2 equivalent (CO2e) prior to valuing these emissions using the carbon appraisal values. Recommended conversion factors are included in **Annex B**.

Societal Carbon Costs and Discount Rates

Annual estimates of emissions in CO2e units are required over the lifetime of a project. Quantified annual emissions are then multiplied by the corresponding carbon appraisal value for that year to calculate a series of undiscounted annual carbon costs in 2020 prices.

Discounting is a standard tool to compare values over different time periods. The present value of societal carbon costs for all greenhouse gases should be calculated using HM Treasury's Green Book social time preference discount rate.[4] This measures the rate at which society values the present compared to the future and provides a series of discount factors which are applied to costs and benefits in appraisal. The standard social discount rate is currently set at 3.5% in real terms. In the longer term (beyond 30 years) the rate declines in a series of steps to allow for future uncertainty.

Discounted carbon costs are then used as an integral component of economic appraisals in determining whether projects or options therein are expected to maximise net overall value to the UK. Apart from carbon costs, present values for all other costs of extraction and for all revenue streams are to be calculated using a 10% real discount rate as set out in the OGA Strategy definition of "economically recoverable".

Standard Economics Template (SET)

The NSTA specifically requests information from Licensees on emissions and associated costs along with other field level data in relation to its regulatory role with regard to Field Development Plans (including Addendums) and Cessation of Production.

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[3] DESNZ (2021), Valuation of greenhouse gas emissions: for policy appraisal and evaluation

Valuation of greenhouse gas emissions: for policy appraisal and evaluation
https://www.gov.uk/government/publications/valuing-greenhouse-gas-emissions-in-policy-appraisal/valuation-of-greenhouse-gas-emissions-for-policy-appraisal-and-evaluation

[4] HM Treasury (2022), The Green Book, Central Government Guidance on Appraisal and Evaluation. See Table 6, Page 120.

https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

The required data is collected via the NSTA Standard Economics Template (SET).[5]

[5] Link to the Standard Economics Template (SET) is available via: North Sea Transition Authority (NSTA): Field development plans - Development - Exploration &
production (nstauthority.co.uk)

Worked Example

The following in Box 1, provides a simplified example of applying carbon values and the social discount rate to estimate the societal value of an expected change in emissions.

Box 1. Valuing societal changes in GHG emissions

An incremental field development is being appraised by a Licensee which includes consideration of investments in decarbonisation technologies with the aim of reducing GHG emissions over the lifetime of the project.

The decarbonisation option is expected to result in emissions saving relative to a base case of 100,000 tonnes of CO_{2e} per year, resulting in cumulative emissions savings of 1 $MtCO_2e$ over a project lifetime of 10 years. The emissions are valued using the DESNZ central carbon values as shown in the table below, which results in savings in present value (PV) terms of £225 million (MM), using the 3.5% real social discount rate. Sensitivity analysis would also be carried out using the High and Low series.

The discounted value of emissions saving can then be used within the wider appraisal of costs and benefits to determine which option is expected to maximise net overall value to the UK in accordance with the Strategy definition.

		2021	**…**	**2030**
Annual emissions savings	tCO_2e	100,000	…	100,000
Carbon Values	£/tCO_2e	245	…	280
Annual value of GHG savings (undiscounted)	2020 £MM	24.5		28.0
PV of GHG savings (3.5% real discount rate)	2020 £MM		225	

ANNEX A: DESNZ (2021) Carbon Values in £2020 prices per tonne of CO2 equivalent (£/tCO2e)

Year	Low Series	Central Series	High Series
2020	120	241	361
2021	122	245	367
2022	124	248	373
2023	126	252	378
2024	128	256	384
2025	130	260	390
2026	132	264	396
2027	134	268	402
2028	136	272	408
2029	138	276	414
2030	140	280	420
2031	142	285	427
2032	144	289	433
2033	147	293	440
2034	149	298	447
2035	151	302	453
2036	153	307	460
2037	156	312	467
2038	158	316	474
2039	161	321	482
2040	163	326	489
2041	165	331	496
2042	168	336	504
2043	170	341	511
2044	173	346	519
2045	176	351	527
2046	178	356	535
2047	181	362	543
2048	184	367	551
2049	186	373	559
2050	189	378	568

NOTES:

1. The current DESNZ carbon values were published in September 2021 and will be reviewed every 5 years in line with setting the UK's carbon budgets. Under exceptional circumstances, reviews outside the 5-yearly cycle may be necessary if changes affecting the evidence or policy regime are significant enough to warrant a review. The NSTA will use the latest DESNZ published carbon values.

ANNEX B: Recommended Greenhouse Gas (GHG) conversion factors for expressing emissions in equivalent tonnes of carbon dioxide (tCO2e)

Greenhouse Gas (GHG)	Global warming potential per unit mass (relative to CO_2)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous Oxide (N_2O)	265

NOTES:

1. Source: Intergovernmental Panel on Climate Change (IPCC), 2013, The Physical Science Basis. See Table 8.7, page 714. The conversion factors incorporate Global Warming Potential (GWP) values for 100-year time horizon excluding climate-carbon feedbacks for non-CO_2 gases (GWP_{100} with no cc fb).
2. Methane (CH_4): Standard Economic Template (SET) data submissions should be reported in tonnes of methane from all applicable sources e.g., venting, flaring and fugitives. The scope is equal to that reported in the Environmental and Emissions Monitoring System (EEMS).

North Sea Transition Authority

The North Sea Transition Authority is the business name for the Oil & Gas Authority, a limited company registered in England and Wales with registered number 09666504 and VAT registered number 249433979. Our registered office is at Sanctuary Buildings, 20 Great Smith Street, London, SW1P 3BT.

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