



An Roinn Caiteachais Phoiblí
Sheachadadh PFN agus Athchóirithe
Department of Public Expenditure
NDP Delivery and Reform

Infrastructure Guidelines

Central Technical References and Economic Appraisal Parameters

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1 Introduction

This document sets out the key central technical references and parameter values for use in financial and economic appraisal.

1.1 Central Technical References

Quantifying costs for the purposes of financial analysis is an important step in preparing business cases, and carrying out appraisals as well as evaluations. The central technical reference for estimation of staff costs and the related overhead component is set out in section 2 of this document.

1.2 Central Economic Appraisal Parameters

The main economic appraisal parameter values have been updated by the Department of Public Expenditure, NDP Delivery and Reform in July 2019.

These new parameter values apply to all economic appraisals and evaluations undertaken in compliance with the Infrastructure Guidelines (formally the Public Spending Code) and should be used by Government Departments and State agencies undertaking economic appraisals. The new parameter values should also be used by practitioners commissioned to carry out appraisals of public expenditure programmes, projects and proposals.

This document and the guidance on each parameter should be read in conjunction with “A Guide to Economic Appraisal: Carrying Out a Cost Benefit Analysis, [available here](#).”

This guidance supersedes previous guidance regarding economic appraisal parameters provided in the Public Spending Code 2013 and 2015.

1.2.1 OBJECTIVES

The central economic appraisal parameters are in place to ensure that there is consistency across the analysis being conducted such as Cost Effectiveness Analysis (CEA) and Cost Benefit Analysis (CBA). The objectives of providing central parameters is to:

- Enhance accuracy and precision in the conduct of economic appraisals across the public sector;
- Ensure that there is consistency in the preparation of economic appraisals;

- Support practitioners in the development of appraisals to inform spending decisions.

The key values were revised based on a review of the literature and consultation with the Irish Government Economic and Evaluation Service (IGEES).

1.2.2 NEW PARAMETER VALUES

The updated values are summarized in Table 1. While precise estimates for parameters can be a matter of debate, the overall aim is to anchor appraisals in a set of central values which facilitates consistency and clarity.

Table 1: Central Economic Appraisal Parameter Values

Central Economic Appraisal Parameters	Values
Social Discount Rate	4% Note: for projects with long time horizons a declining discount rate applies
Shadow Price of Labour	80% - 100%
Shadow Price of Public Funds	130%
Shadow Price of Carbon	Please see the annual schedule of shadow carbon prices in Section 6 of this document

1.2.3 SECTORAL PARAMETERS

The list of parameters in Table 1 is not exhaustive. Individual Departments and public bodies should also quantify additional parameters applicable in their own sectors where relevant expertise and project experience have developed over time. Departments are also responsible for providing more detailed guidance regarding the application of parameters for their specific sectors of responsibility.

1.2.4 SECTORAL APPRAISAL FRAMEWORKS

Government Departments with responsibility for oversight of sectoral guidance are required to ensure that their appraisal frameworks are consistent with the Infrastructure Guidelines and updated guidance relating to the central parameters.

Revisions and updates to sectoral appraisal frameworks must be approved by the Department of Public Expenditure, NDP Delivery and Reform. Departments developing or overseeing new sectoral appraisal and evaluation frameworks for the first time are required to submit these to the Department of Public Expenditure, NDP Delivery and Reform.

2 Calculation of Staff Costs

Summary

The calculation of staff costs is a key variable in appraisals of public spending and public sector reform proposals. This area was reviewed by the Department of Public Expenditure and Reform taking account of actual data regarding variable overheads across the civil service and imputed pension costs presented in an actuarial review of public sector pensions. This section outlines a framework for estimating staff costs by providing a composite, average parameter of 25% in respect of the overhead component of staff costs on a general basis. This section also highlights those situations where application of the 25% parameter is not appropriate and notes that appraisal of each direct and indirect cost is recommended in the first instance through consultation with the relevant Corporate Services Unit.

2.1 Overview

Quantification of staff costs and overheads is an important element of appraisal both for new spending proposals as well as for public sector reform measures which may involve a reduction in staff headcount. As a rule, for the purposes of detailed appraisal, estimates of pay and non-pay costs should always be prepared in the first instance on a cost-by-cost basis using the information available through the relevant Corporate Services Unit and Management Information Systems. In many cases, however, such an approach may prove highly resource-intensive and the “principle of proportionality” will dictate that a standard estimation methodology be used instead, based on service-wide averages. This document sets out a framework for estimating staff costs and also provides a formula for daily and hourly rates.

2.2 Staff Costs: Key Components

It is important that staff costs are fully taken into account when making decisions that involve changes to the level of resources. For example, establishment of a new Agency or the creation of new functions for a Department or Agency may result in a need for additional staff. Conversely, a reform initiative such as external service provision could result in a structural headcount reduction over time. Staffing costs will be a key variable in decisions of this nature, and it is important that they are accounted for fully and consistently. A framework to assist officials in estimating staffing costs is set out in summary form in Table 2.

Table 2: Framework for Estimating Staffing Costs

	Cost Component	Methodology
A.	Pay	Midpoint of pay range using formula below
B.	Direct Salary Cost	Pay + Employers PRSI
C.	Total Salary Cost	B + Imputed pension cost (see Tables 3A and 3B)

D.	Total Staff Cost	C + 25% of A in respect of 'overheads'
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2.3 Direct Salary Cost

Direct Salary Cost is defined as the gross wage or salary paid to an individual at the relevant grade, based on the midpoint of pay range, plus the associated employer's PRSI payment. An average salary cost should be worked out for each grade based on the current salaries Circular 22/2017 issued by Department of Public Expenditure, NDP Delivery and Reform. This is achieved by taking a cash value midway between the scale minimum and the highest point, or Long Service Increment (LSI), as appropriate.

PRSI rates are subject to change under Government policy and the Department of Employment and Social Protection guidelines should be consulted for the most recent rates that pertain to each employee category¹.

Total salary cost is defined as direct salary cost plus an imputed employer pension contribution. Employing public servants normally results in the creation of entitlements to pensions which are payable in the future. The employee currently meets a proportion of the cost through employee pension contributions and additional superannuation contributions. However the balance is a deferred cost which is borne by the State. In estimating the total cost of employing a civil servant, allowance must be made for this deferred cost. The imputed pension contribution is based on gross salary, and not direct salary cost, because employers' PRSI payments are not reckonable for pension purposes.

The estimated costs for certain cohorts of the Public Service are set out in Tables² 3A and 3B. It should be noted that these figures represent the cost of pension less normal employee contributions and that no adjustments have been made to allow for Additional Superannuation Contributions (ASC) paid by employees.

Table 3A: Standard Accrual Categories – Cost of Pension less Normal Employee Contributions

	Pre-2013 Cohorts	Post-2013 Cohorts
Civil Servant	27%	8%
Teacher	29%	9%
Nurse	28%	8%
Engineer	33%	10%
Hospital Consultant	46%	14%

¹ The Department of Employment & Social Protection 2019 PRSI rates and user guide is [Available here](#).

² For further details regarding the cost of pension provision in the public sector, please see the Department of Public Expenditure and Reform Technical Paper *Actuarial Review of Pension Provision in the Irish Public Service and a Comparison with the Private Sector* (2017) [Available here](#).

Average ³	29%	9%
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Table 3B: Fast Accrual Categories – Cost of Pension less Normal Employee Contributions

	Pre-2013 Cohorts	Post-2013 Cohorts
Garda	53%	14%
High Court Judge	71%	39%

2.4 Total Staff Cost

Total staff cost is defined as total salary cost plus 25% for overheads. Each officer requires office space, materials, use of telephones, computers, postage service etc. It is estimated that an addition of 25% to direct salary cost is appropriate to reflect these overhead costs. This is a composite figure applicable to the generality of civil service situations and includes but not limited to costs for accommodation, utilities, support and back-office staff, training, travel, etc.

With respect to accommodation costs, it should be noted that in those instances where accommodation is owned by the State, although there may be no cash outlay with respect to rent, it still represents an economic cost, and must be factored into the decision-making process concerning resources or overheads.

The 25% figure is recommended as a norm both in situations where additional staff are being recruited, and where staff numbers are being reduced. While it is the case that there are few immediate overhead savings arising when a staff member leaves and is not replaced (unlike in the hiring scenario where many of the costs are borne up-front), it is entirely valid to count a proportion of overhead as part of the staff cost savings. Over the medium term, a structural headcount reduction will yield proportionate overhead savings: for example, fewer IT licences and property leases will be required to be renewed, with consequent reductions in utility bills, and replacement costs for hardware and furniture will be lower.

The overhead percentage should be reviewed to reflect any changes in overhead profile (for example due to increased efficiencies) as required.

It is important to note that these are average costs and are applicable only on a general basis. When preparing estimates of staff costs, it is appropriate to consult with the relevant Corporate Services unit in the first instance in order to appraise direct and indirect costs on a cost-by-cost basis. Where more specific information is available, it should be used, particularly if there are additional costs in

³ An average notional employer contribution rate was calculated for public service employees with broadly similar benefit structures and salary progression i.e. Civil Servants, National School Teachers, Nurses and Engineers. Hospital Consultants were excluded from the average as their average cost of accrual is higher due to their faster than average salary progression.

respect of specialist equipment or accommodation, or higher levels of travel and subsistence, for example.

2.5 Daily and Hourly Rates

Daily and hourly staff costs in respect of any grade conditioned to a 43 hour (gross), 37 hour (net) week can be calculated by using the following general formulae based on Department of Public Expenditure, NDP Delivery and Reform Circular 11/2013.

Daily Rate for a grade:

$(\text{Annual cost for a grade} \div (251 \text{ less annual leave entitlement}))$

Hourly Rate for a grade:

$(\text{Annual cost for a grade} \div ((251 \text{ less annual leave entitlement}) \times 7.4 \text{ hours}))$

2.6 Situations where use of the composite rate may not be appropriate

Certain decisions that could lead to a material change in resourcing – for example the establishment of a new agency, or conversely the closure of an agency – may lead to a step change in overheads, involving inter alia the acquisition or disposal of office accommodation. In these cases, the use of the composite 25% factor would not be appropriate, and it is important that consideration be given to the actual costs involved in the context of the costing of total cost of staff time. The factors to be taken into account will include: the number of staff to be accommodated, the proposed space allocation per head, the ancillary functions proposed such as public spaces and meeting rooms, the location considered appropriate, the availability of suitable accommodation and the balance between supply and demand in the office accommodation market which will affect the cost per square meter which can be agreed.

In situations where the accommodation is owned by the State an appropriate level of imputed rent should be calculated (OPW can assist with this). Consideration should also be given to the level of IT spend that will be necessary to support the added staff. If you are unsure as to the level of accommodation costs which may be involved, or if specialist accommodation is required, you should seek the advice of the OPW.

3. Social Discount Rate for Economic Appraisal – 4%

Summary:

This section sets out the Social Discount Rate (SDR) which should be used in relation to economic appraisals. It provides a description of the methodology used to arrive at the social discount rate and how the social discount rate is typically applied. The areas of hyperbolic discounting and other discount rates in the public sector are also explored.

3.1 Overview

When comparing the costs and benefits of a prospective public project over time, standard practice under economic appraisal is the use of a discount rate. This permits assessment of a project's net-worth in present terms.

It is evident that the costs and benefits of a project will often occur at different points in the project's lifecycle. For example, in a construction project costs generally arise and peak in the short term while construction occurs whereas benefits generally emerge in the medium to longer term as the investment is utilised. Assuming that society values costs and benefits differently depending on how far into the future they arise, a social discount rate should be used to convert future income streams into their value today (present value) to permit the inclusion of time preference for appraisal purposes.

The Social Discount Rate for application in economic appraisal of current and capital expenditure proposals carried out in accordance with the requirements of the Infrastructure Guidelines is now set at 4%. This represents a 1% downward revision from the historical 5% rate set during the 2015 review. This new rate of 4% should be applied to a project's future costs and benefits expressed in constant prices i.e. the value of costs and benefits should not be adjusted to take account of general inflation⁴.

3.2 Methodology

The updated Discount Rate parameter value is based on analysis presented in a 2018 staff paper by the Department of Public Expenditure, NDP Delivery and Reform⁵. This should be consulted for further information. The methodology employed is consistent with the approach outlined in previous guidelines regarding the discount rate; the analysis found that the Social Rate of Time Preference (SRTP) method was most appropriate in the estimation of the discount rate. The SRTP methodology bases its estimation of the SDR on three components: the rate of pure social time preference, the elasticity of the marginal utility of consumption, and the expected future rate of consumption growth. Empirical and secondary evidence on each of the SRTP components was gathered, and potential ranges for each parameter were laid out. Practice

⁴ Adjustments to prices over time may be made if there will be changes to the price of a good or service relative to all other goods and services. (See *Guide to Economic Appraisal: Carrying Out a Cost Benefit Analysis* [Available here](#).)

⁵ O'Callaghan, D. and Prior, S. (2018) *Central Technical Appraisal Parameters – DPER Staff Paper, Dublin* [Available here](#).

from other jurisdictions, EU Commission guidance and the academic literature was also taken into account, as well as analysis of the origin, and potential implications of social discounting. From these the current SDR was estimated.

It is a requirement that a centrally set SDR is applied across economic appraisals and other forms of NPV analysis to ensure uniformity of approach and consistency in calculating present values across the public sector. This also facilitates the comparison of projects within and across sectors.

The following formula should be used when applying the discount rate for NPV purposes. The discount rate should not be used as a method to account for risk. This should be addressed separately in a sensitivity and scenario analyses.

Applying the Social Discount Rate

Formula

*Discounted value = (Future value or cashflow) * relevant discount factor*

Discount factor =

Where n = time period

Application - Example

Determine the discount factor for a cash-flow of €5m in year 3 of a project. Solution:

Discount factor = = 0.88899

*Net Present Value = €5m * 0.88899 = €4.44m*

3.3 Hyperbolic Discounting

As discussed in the background research documentation⁶, a large majority of projects will fall within the general time horizon upper limit of 30 years. For the few projects for which it can be shown a longer time horizon is justified however, use of hyperbolic discounting is permissible. There are several theoretical justifications for applying hyperbolic discounting for projects. The methodology employed in informing the recommended long-term discount factors was through giving consideration to the uncertainty around the fundamental SRTP parameters, and calculating a declining rate based on that uncertainty.

⁶ O'Callaghan, D. and Prior, S. (2018) *Central Technical Appraisal Parameters – DPER Staff Paper*, Dublin [Available here](#).

While practitioners should employ hyperbolic discounting by using the published discount factors set out in Table 4 (available in Excel [here](#)), expressed in exponential terms, an equivalent decline would be as follows; years 0-30 discounted at 4%, years 31-60 discounted at 3.5%, years 61-100 discounted at 3%, years 101-175 discounted at 2.5%, years 176-275 discounted at 2%, and at 1.5% thereafter.

3.4 Other Discount Rates

There are other discount rates which are applied in specific circumstances and these include:

- Commercial Projects undertaken by Commercial Semi State Bodies: These bodies generally apply discount cash flows for commercial projects using the relevant cost of capital or a project specific rate.
- PPP Projects: The discount rates for PPP projects are set by the National Development Finance Agency (NDFA) available [here](#).

Table 4: Appropriate Discount Factors for Use in Long-Term Discounting

Year	Discount Factor	Year	Discount Factor	Year	Discount Factor	Year	Discount Factor
0	1.0000	31	0.2979	62	0.1035	93	0.0414
1	0.9615	32	0.2878	63	0.1005	94	0.0402
2	0.9246	33	0.2781	64	0.0976	95	0.0390
3	0.8890	34	0.2687	65	0.0948	96	0.0379
4	0.8548	35	0.2596	66	0.0920	97	0.0368
5	0.8219	36	0.2508	67	0.0893	98	0.0357
6	0.7903	37	0.2423	68	0.0867	99	0.0347
7	0.7599	38	0.2341	69	0.0842	100	0.0337
8	0.7307	39	0.2262	70	0.0817	101	0.0329
9	0.7026	40	0.2186	71	0.0794	102	0.0321
10	0.6756	41	0.2112	72	0.0770	103	0.0313
11	0.6496	42	0.2040	73	0.0748	104	0.0305
12	0.6246	43	0.1971	74	0.0726	105	0.0298
13	0.6006	44	0.1905	75	0.0705	106	0.0290
14	0.5775	45	0.1840	76	0.0685	107	0.0283
15	0.5553	46	0.1778	77	0.0665	108	0.0276
16	0.5339	47	0.1718	78	0.0645	109	0.0270
17	0.5134	48	0.1660	79	0.0626	110	0.0263
18	0.4936	49	0.1604	80	0.0608	111	0.0257
19	0.4746	50	0.1550	81	0.0590	112	0.0250
20	0.4564	51	0.1497	82	0.0573	113	0.0244
21	0.4388	52	0.1446	83	0.0557	114	0.0238
22	0.4220	53	0.1398	84	0.0540	115	0.0233
23	0.4057	54	0.1350	85	0.0525	116	0.0227
24	0.3901	55	0.1305	86	0.0509	117	0.0221
25	0.3751	56	0.1261	87	0.0495	118	0.0216
26	0.3607	57	0.1218	88	0.0480	119	0.0211
27	0.3468	58	0.1177	89	0.0466	120	0.0206
28	0.3335	59	0.1137	90	0.0453		
29	0.3207	60	0.1098	91	0.0439		
30	0.3083	61	0.1066	92	0.0427		

4 Shadow Price of Labour: 80% - 100%

Summary:

This section sets out the Shadow Price of Labour (SPL) for use in economic appraisals. The guidance provides that the appropriate range for the SPL is between 80% and 100%, to be employed in appraisal. In general, a value of 100% should be adopted. However, it is acknowledged that in specific circumstances (i.e. labour market conditions which are immediately relevant to the particular sector and/or region where new employment will be generated) the use of a value between 80% and 100%, where robustly justified, is permissible.

4.1 Overview

When considering the labour costs of a project in economic appraisal, the market cost of labour (wage paid) may not, in some cases, be the same as the economic or social cost of labour (the cost to society). This may be the case due to distortions and imperfections in the labour market. An example of this is where there is underemployment of resources (e.g. high levels of unemployment). As such, the Shadow Price of Labour (SPL) is a parameter which adjusts the cost of labour in appraisal, in order to account for the social opportunity cost. This note outlines the permissible usage for applying the SPL in the appraisal of publicly funded projects.

For general projects the market rate of labour (i.e. SPL = 100%) is most appropriate for appraisal purposes; this is not the case only where there is clear evidence that shadow prices are required. Where an SPL value other than 100% is employed, the minimum possible value is 80%.

Practitioners of economic appraisal, when using an SPL value other than 100% must base their selection on objective evidence and criteria, focussing in particular, on sectoral conditions. Sensitivity analysis must always be conducted on the upper bound of the scale i.e. 100%. This range of acceptable values is consistent with previous centrally-set rules⁷.

4.2 Description

The SPL is a parameter designed to incorporate the social opportunity cost of newly generated employment in appraisal. In a situation where newly created employment causes a move into more valuable/productive employment sectors, the social opportunity cost (i.e. the cost of leaving the previous area of work) will be lower than the social value of the new work. In this case, it therefore makes sense to incorporate this net benefit into appraisal, by adjusting the cost of labour downward.

An often cited appropriate example of the SPL usage is the case of industrial development in previously agrarian economies. The movement from low productivity farm labour to semi-skilled industry or manufacturing. The large scale move into more productive sectors comprises a collective economic benefit.

In developed countries appropriate usage of the SPL is not as clear-cut; use of the SPL is appropriate in cases where unemployment will clearly be reduced as a result of job creation. It

⁷ CSF Evaluation Unit, Department of Finance (1999), *Proposed Working Rules for Cost Benefit Analysis*, Dublin.

should be noted however that research has shown that job creation does not reduce unemployment one-for-one⁸. Application is further complicated by the potential of inducing migration flows through employment creation, which while economically beneficial in the long run, does not constitute a move to higher productivity within the existing labour market.

The defined appropriate range is based on a 2018 staff paper by the Department of Public Expenditure, NDP Delivery and Reform⁹. The paper found that the existing range of 80 to 100% remained appropriate in the context of the theoretical literature, appraisal practice in Ireland and international practice. The paper highlighted the need for clear justification to be provided for deviations from 100% in the context of current labour market conditions.

4.3 Methodology

The shadow price of labour should be project specific since it is derived from the local labour market conditions (e.g. unemployment, regional variations, migration) and labour skills profiles associated with projects.

In estimating shadow prices within this range, it is recommended that a sectoral approach is taken in the first instance – particularly for enterprise related projects. This is because the sectoral level is where labour market characteristics are most evident.

The criteria, assumptions and evidence used to justify the selection of the shadow price of labour should be transparently presented with any appraisal. In particular, detailed justification should be provided for the use of an SPL less than 100% in the context of labour market conditions.

4.4 Application

In applying the sectoral shadow wage rates, the range of considerations which can also inform the relevant rate to be applied include, among others:

- Rate of sectoral unemployment
- Vacancy levels and unfilled vacancies
- Migration flows
- Skill levels
- Regional considerations

A range of 80 to 100% for the shadow price of labour implies that 0-20% of the benefit accruing from the labour component of a project may be included in the appraisal. For example, it is frequently argued that construction projects have employment impacts, particularly in the short term.

Convention dictates that the adjustment be applied to the cost side, i.e. any benefit of employment generation be included by adjusting the cost of labour (giving us its shadow price). The shadow price of labour applies not just to labour costs incurred at the outset of the project but also to labour costs arising over the course of a project, where this is practicable.

⁸ Honohan (1998), *Key Issues of Cost Benefit Methodology for Irish Industrial Policy*, Dublin

⁹ O'Callaghan, D. and Prior, S. (2018) *Central Technical Appraisal Parameters* – DPER Staff Paper, Dublin. [Available here](#).

In the case of projects where employment generation is an explicit project objective however, i.e. generated employment is an output rather than an input into the project and is thus not considered as a project cost, the residual of the SPL may be applied to the benefit side.

As a hypothetical example, if an intervention is expected to generate one job, where the salary is €100,000 per annum and SPL is estimated at 90%, the undiscounted annual benefit is equal to $(1 - 90\% = 10\%) * €100,000 = €10,000$.

5 Shadow Price of Public Funds - 130%

Summary:

This section sets out the parameter value for the Shadow Price of Public Funds (SPPF) at 1.3 or 130%. It briefly presents the rationale for the adjustment of publicly funded cash-flows under economic appraisal, as reflecting economic distortion resulting from taxation. It outlines the methodology employed in the estimation of the parameter, and the considerations taken into account in its revision. Finally it offers practitioner guidance on how the parameter should be used under economic appraisal.

5.1 Overview

Government taxation which distorts market prices will necessarily alter the incentives faced by economic agents when making decisions. In some cases, where a tax raises the price of a good with negative externalities (such as polluting goods, or unhealthy goods), the consequent reduction in economic activity may be positive for society. Most taxes however are necessarily levied on economic goods which contribute positively to economic growth, such as labour (PAYE), consumption goods (VAT), profits (corporation tax). On the margin, this causes a reduction in economic activity in comparison to that which would otherwise have occurred, creating a deadweight loss for society. This opportunity cost of taxation is often referred to as the Shadow Price of Public Funds.

The task of economic appraisal is to consider the widest possible range of positive or negative implications for society arising from expenditure, including opportunity costs of investment. In this respect it therefore makes sense to consider the deadweight loss associated with taxation as a cost in the appraisal of publicly funded expenditure.

The estimated deadweight loss associated with taxation is €0.30 per €1 collected, meaning the estimated value of the Shadow Price of Public Funds in Ireland is set at 1.3, or 130%.

5.2 Description

The Shadow Price of Public Funds is a technical parameter for use in economic appraisal. The parameter is employed to account for the distortionary effects of taxation, such as productive and consumptive decisions which are different than they would be relative to a counterfactual scenario of no tax. The actual SPPF will vary according to the specificities of the given tax system; for example, the relative size of the different tax sources as a proportion of the overall tax base will affect the parameter value, as different tax sources generally have differing distortionary effects. Similarly the marginal rate of tax will affect the parameter, as higher marginal rate of tax generally implies disproportionately higher rates of economic distortion.

5.3 Methodology

The 2018 revision of the central technical parameters¹⁰ found the existing SPPF of 130% to be appropriate, based on a detailed literature review and analysis of international practice. Notably the review considered the findings of a 2018 empirical study on the elasticity of taxable income, conducted by the Department of Finance and ESRI, which focused on the distortionary impacts of income taxation¹¹. The current rate of 130% has been in place since the 2015 revision of the central technical parameters.

5.4 Application

In practice, the SPPF should be applied to the net public financial costs of a project in appraisal, increasing the values by 30%. In the case that some costs of individual projects will be borne by EU grant aid or private contributions, the net public financial cost should be reduced by the amount of their contribution.

In certain cases, it may also be appropriate to adjust benefits by the same percentage. This applies to taxation flows on the benefits side. For example, net additional flows in income taxes directly and solely attributable to a project/proposal would be increased by 30% to reflect the shadow price of public funds.

Project appraisers may also include an illustrative scenario based on a shadow price of public funds of 100% to indicate the impact of the shadow price of public funds on the results of the appraisal.

¹⁰ O'Callaghan, D. and Prior, S. (2018) *Central Technical Appraisal Parameters* – DPER Staff Paper, Dublin. [Available here.](#)

¹¹ Acheson, J. Stanley, B. Kennedy, S and Morgenroth E. (2018), 'The Elasticity of Taxable Income'. ESRI and the Department of Finance Joint Research Programme on the Macro-Economy, Taxation and Banking. [Available here.](#)

6 Shadow Price of Carbon

Summary:

This section sets out the parameter values for the shadow price of carbon to be employed in economic appraisal. This is based on work carried out by the Climate Research Unit in the Department of Public Expenditure, NDP Delivery and Reform. The shadow price of carbon is used to monetise the value of emissions from the “basket of seven” greenhouse gases. This can be done by converting their values into carbon dioxide equivalents and applying the shadow carbon prices. This shadow price is based on the likely cost to Ireland of removing these emissions from the atmosphere. The cost values are provided in Table 6 of this document.

On the basis of recommendations provided by the Department of Environment, Climate and Communications (DECC), economic appraisals should monetise other non-greenhouse gas emissions, where these may be relevant to air quality or noise. Recommended values are provided in this paper for the cost of Particulate Matter with a diameter of less than 2.5 and 10 micrometers (PM2.5 and PM10), Nitrogen Oxide (NOx), Non-Methane Volatile Organic Compounds (NMVOCs) and Sulphur Oxide (SOx). The infrastructure guidelines do not provide central values to monetise noise.

6.1 Overview

Since 2019 greenhouse gas emissions have been valued at the expected marginal cost society will face to remove greenhouse gas emissions sufficient to reach binding greenhouse gas emissions targets. Ireland’s climate targets at both national and EU level have increased significantly in ambition since the previous review of the shadow price of carbon. Therefore, it was necessary to update the shadow price of carbon used in public sector economic appraisal to ensure that it aligns with the national ambition on climate action, as set out in the Climate Action & Low Carbon Development (Amendment) Act 2021.

The Climate Research Unit in the Department of Public Expenditure, NDP Delivery and Reform undertook a review of the guidance on valuing greenhouse gas emissions in the Infrastructure Guidelines in 2023. The resulting recommendations are set out in this guidance. For further detail see ‘*Revising the Shadow Price of Carbon used in Public Sector Economic Appraisal*’, [available here](#).

6.2 Description

The main recommendations in relation to valuing emissions in economic appraisals are highlighted in Table 5. The Climate Research Unit in the Department of Public Expenditure, NDP Delivery, and Reform published further supplementary guidance in March 2024 on the application of the updated shadow price of carbon, [available here](#). This will assist Departments and Public bodies in calculating the greenhouse gas emissions attributable to

investment decisions and provide guidance on the practical application of the shadow price of carbon so as to ensure the consistency and comparability of sectoral measures. Further queries regarding emissions monetisation should be directed to the Climate Research Unit in the Department of Public Expenditure, NDP Delivery, and Reform.

Table 5: Valuing Emissions in Economic Appraisal

Valuing Emissions in Economic Appraisal	
1	Economic appraisals are required to value emissions from the “basket of seven” greenhouse gases (GHGs) which can be converted into CO₂e (carbon dioxide equivalent) using GWP (Global Warming Potential) conversion rates – Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Sulphur Hexafluoride (SF₆), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Nitrogen Trifluoride (NF₃) - where emissions are considered relevant, significant and practicable for inclusion. In any cases where emissions are not considered to be relevant, significant or practicable for inclusion, public bodies should note how this conclusion was arrived at in the CBA. These emissions should then be monetised according to the shadow price of carbon, outlined in Table 6 below.
2	The shadow price of carbon is based on the estimated cost to Ireland of removing emissions from the atmosphere, or the marginal abatement cost. The price of carbon for the 2024-2050 period is based on modelling to derive the marginal abatement cost associated with the agreed sectoral emissions ceilings and our net-zero 2050 target, which was undertaken by UCC MaREI using the TIMES Ireland Model (TIM). For the 2050-2055 period, a 4% annual increase was applied to derive the shadow price of carbon. The price of emissions is then held constant (valued at the 2055 price).
3	The shadow price of carbon applies the same value to all greenhouse gas emissions, regardless of whether the emissions are in the ETS sector or the Non-ETS sector.
4	Greenhouse Gas Emissions should be converted into CO₂e using the latest available and Intergovernmental Panel on Climate Change adopted conversion factors for GWP¹².
5	Economic appraisals are required to monetise the value of emissions of other specified non-GHG emissions (NOX, SO₂, PM and noise) where such emissions are considered relevant, significant and practicable for inclusion. In any cases where emissions are not considered to be relevant, significant or practicable for inclusion, public bodies should note how this conclusion was arrived at in the economic appraisal. These emissions should then be monetised according to the values for non-

¹² Use of the 100-year Direct Global Warming Potential (GWP) values from IPCC AR5 is recommended as the best measure currently available to convert other gases into CO₂e. See Annex 1 of report for the latest Direct Global Warming Potentials from IPCC 5th Review (AR5).

	greenhouse gas pollutants included in this document. These values were updated as part of the 2023 review, based on EU reference values for damage costs in the transport sector. These values are provided in Table 7. For more specific advice on sectoral damage costs outside the transport sector, please contact the Air Quality Unit in the Department of the Environment and Communications. The infrastructure guidelines do not provide central values to monetise noise. Departments and public bodies should use values considered applicable in their own sectors where noise is considered relevant, significant and practicable for inclusion.
6	The introduction of a carbon tax impacts on the appropriate price of CO₂e for inclusion in economic appraisals. The shadow price is used to account for the external costs associated with CO₂e emissions. If this is partially or fully internalised in the product or input purchase price through the carbon tax then the price needs to be adjusted to reflect this and avoid double counting. This readjustment should be performed by deducting the level of the carbon tax for the relevant year where it is included in costs. This adjustment should be applied in the construction and operation phases. As per Sections 27, 28 & 29 of the Finance Act 2020, the carbon tax is expected to increase by €7.50 a tonne each year out to 2029. Therefore, it is necessary to ensure the rate used in an appraisal is appropriate.
7	CO₂e emissions from materials directly attributable to the construction phase of a project which are purchased from organisations/facilities/installations operating within the EU ETS should not be included in the quantification of emissions for a project scenario as this would be double counting.
8	Direct CO₂e emissions from sources within the State's jurisdiction, including those from direct construction and operation should be included in economic appraisals bearing in mind not to double count (see previous point). In certain instances consideration may need to be given by project managers to indirect emissions. For example, any rebound effects that the project may give rise to.

6.3 Valuing CO₂e emissions

All greenhouse gas emissions associated with a project should be monetised using the following values:

Table 6: Shadow Price of Carbon 2024-2055 (per tonne of CO₂e) for all GHG Emissions

Shadow Price of Carbon € ₂₀₁₈ /tCO ₂	
2024	322
2025	335
2026	349
2027	363

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2028	377
2029	392
2030	408
2031	424
2032	441
2033	459
2034	477
2035	496
2036	516
2037	537
2038	558
2039	580
2040	604
2041	628
2042	653
2043	679
2044	706
2045	735
2046	764
2047	794
2048	826
2049	859
2050	890
2051	926
2052	963
2053	1001
2054	1041
2055	1083

Table 7: Valuations for the estimated damage costs of non-greenhouse gas pollutants from Transport

Valuations for estimated damage costs of non-greenhouse gas pollutants (€ ₂₀₁₆ /tonne)							
PM 2.5			PM10	NOx		NMVOCs	SOx
Rural	Suburban	Urban ¹³		Rural	Urban		
68,000	183,000	568,000	12,200	10,100	17,600	1,700	11,800

¹³ In accordance with the Commission's guidelines, Urban only applies to cities larger than 0.5 million inhabitants.