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Principles for the aggregation of relevant knowledge submitted by NER 300 projects

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Joint Research Centre

European Commission
Joint Research Centre
Institute for Energy and Transport

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1 Introduction

NER 300 is an EU funding programme for the demonstration of carbon capture and storage (CCS) and innovative renewable energy (RES) technologies at the pre-commercial stage. The aim of NER 300 is to establish a demonstration programme comprising the best possible CCS and RES projects and involving the Member States. The programme intends to support a wide range of CCS technologies (pre-combustion, post-combustion, oxyfuel, and industrial applications) and RES technologies (bioenergy, concentrated solar power, photovoltaics, geothermal, wind, ocean, hydropower, and smart grids). NER 300 also seeks to leverage a considerable amount of private investment and/or national co-funding across the EU, boost the deployment of innovative low-carbon technologies and stimulate the creation of jobs in those technologies within the EU.

NER 300 is funded from the sale of emission allowances from the new entrants' reserve (NER) set up for the third phase of the EU emissions trading system (EU ETS). 300 million allowances are reserved for the financing of commercial-scale CCS and innovative RES demonstration projects according to Art. 10a(8) of the EU ETS Directive.[1]

The funds from the sales are to be distributed to projects selected through two rounds of calls for proposals, covering 200 and 100 million allowances respectively. Decision 2010/670/EU lays down the criteria and measures for the financing of NER 300 projects (NER 300 Decision).[2] The first call was launched on 9 November 2010 and the award decision was adopted on 18 December 2012[3] with an amendment on 31 January 2014[4]. Total awards are worth about 1.2 billion EUR. 22 innovative RES projects from 15 technology sub-categories across 15 Member States are funded. No CCS projects have been awarded funding.

Knowledge sharing requirements are built into the legal basis of the programme as a critical tool to lower risks in bridging the transition to large-scale production of innovative renewable energy and CCS deployment. The legal basis obliges project sponsors to submit annually to the European Commission relevant knowledge (RK) gained during that year in the implementation of their project (see Annex 2 and 3 of the Award Decision**Error! Bookmark not defined.**). There are two types of relevant knowledge to be ollected and shared defined by the level of sensitivity. Level 1 (L1) knowledge is to be shared with all NER 300 projects of the same technology category and any other project which has agreed to share information. One L1 community will be set up for each technology category. Level 2 (L2) knowledge is of general interest and includes collated and anonymised L1 knowledge. The target audience for L2 is the general public, industry, research, government, NGO and other interest groups and associations.

DG CLIMA manages the NER 300 programme for the European Commission. The Institute for Energy and Transport (IET) of the Joint Research Centre (JRC) supports DG CLIMA in the implementation of the knowledge sharing from 1 December 2013 to 31 December 2016 under the Administrative Arrangement 071201/2013/666129/CLIMA.C.1.

One of the purposes of Task 1 (Dissemination strategy) of Work Package 2 of the Administrative Arrangement is to develop a short document outlining the principles to be applied for the preparation of the annual report. In particular, this document shall identify how information may be meaningfully collated and anonymised for L1 and L2 dissemination.

[1] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emissions allowance trading scheme of the Community

[2] Commission Decision of 3 November 2010 laying down criteria and measures for the financing of commercial demonstration projects that aim at the environmentally safe capture and geological storage of CO2 as well as demonstration projects of innovative renewable energy technologies under the scheme for greenhouse gas emission allowance trading within the Community established by Directive 2003/87/EC of the European Parliament and of the Council

[3] Commission Implementing Decision of 18 December 2012. Award Decision under the first call for proposals of the NER300 funding programme. C(2012) 9432

[4] Commission Implementing Decision of 31 January 2014 amending Commission Implementing Decision C(2012) 9432 so as to modify the Award Decision under the first call for proposals of the NER300 funding programme. C(2014) 383

2 Overview

The sharing and dissemination strategy for the NER 300 programme is structured around the L1 and L2 division (Table 1). Both levels have their own goals and audience and thus demand a different strategy. Knowledge to be disseminated will be aggregated and anonymized at both L1 and L2.

Table 1 RK templates and recipient level for dissemination

RK Part		Recipient Level
A1	Technical set-up and performance (technology, resource and energy yield assessment, operation and maintenance)	L1
A2	Technical set-up and performance (energy produced)	L2
B	Cost levels	L1 and L2
C1	Project management (planning issues, stakeholder management, risks and lessons learnt)	L1
C2	Project Management (good practices)	L2
D	Environmental impact	L1 and L2
E	Health and safety	L1 and L2

This report outlines the principles to be applied in the preparation of the annual report. In particular, this document identifies how sensitive information may be meaningfully collated and anonymised for L1 and L2 distribution. In Section 3, the portfolio of the suggested methods that will be used for aggregation and anonymisation is explained. In Section 4, the selection and application of the methods is shown for a specific example. The technology category WIN was used as an example.

For CCS or RES categories with only one or two projects (where data aggregation will not be feasible), a different approach will apply. In this case, the Commission will discuss directly with the relevant project sponsor a dedicated approach on how to disseminate its information. This could be done by e.g. anonymising all data and agreeing not to disseminate the most sensitive ones, such as project costs and performance.

If other non-NER 300 projects (funded for example by EEPR, or Horizon 2020) will agree to share relevant knowledge from their experience on terms similar to those receiving NER 300 funding, they could be involved in the knowledge sharing exercise in future.

3 Methods for aggregation and anonymisation

According to the legal basis of the NER 300 programme, the Commission may aggregate relevant knowledge and disseminate it when it contributes to the overall goals of the knowledge sharing mechanism:

1) de-risking of CCS and/or RES with regard to scaling up to commercial size;
2) acceleration of the deployment of CCS and/or innovative RES;
3) increasing the undertaking of, and confidence in, CCS and/or RES by the wider public;
4) maintenance of a competitive market.[5]

In order to reach these goals, it was proposed that there are a number of reasons for L1 knowledge aggregation:"

- Where specific data and information is considered important to be communicated at a broader level, this can be aggregated in a manner that 'de-sensitizes' information considered to be too commercially sensitive to be released on a general level (e.g. cost breakdown);
- Where it is considered important to aggregate knowledge in order to communicate best practice in a more general area between similar projects (e.g. good practice in developing health and safety plans);

[5] Article 8, paragraph c of the Specifications for the Legally Binding Instrument

- Where relevant knowledge is considered important to be communicated at a broader level, however the information is of a highly technical nature, and thus may need simplified in order to make it accessible."[6]

Often, a combination of the reasons mentioned above might occur in practise. The aggregation process has to guarantee that the result cannot be ascribed to individual projects. In general, it will not be feasible to develop a standard aggregation procedure as the relevant knowledge provided might vary. Various methods to aggregate and desensitise results exist and different methods can be used for numerical, textual, and graphical information. They are presented in the following sections.

3.1 Numerical data

Numerical data has to be submitted in several parts of the RK templates. The numerical data has the form of time series (e.g. monthly energy yields or monthly performance) or can be just in the form of absolute single numbers (e.g. number of site visits made in a specific year). In addition, cost data with a breakdown according to specific cost categories will be submitted. Different aggregation methods will be used depending on the type of numerical data.

3.1.1 Time series data

Time series data for one specific project, e.g. the performance of a project over a year (Table 2) will be aggregated using relative instead of absolute numbers (indexes). This allows displaying a trend over time without giving absolute numbers. In addition, charts and diagrams could be used to display the numerical information (Figure 1).

Table 2 Example for aggregation of time series data of one project

	January	February	March	April	May	June	July	August	September	October	November	December
Energy output in kWh	16	18	21	23	24	23	20	22	23	25	20	17
Rel. output (avg = 100)	76	86	100	110	114	110	95	105	110	119	95	81

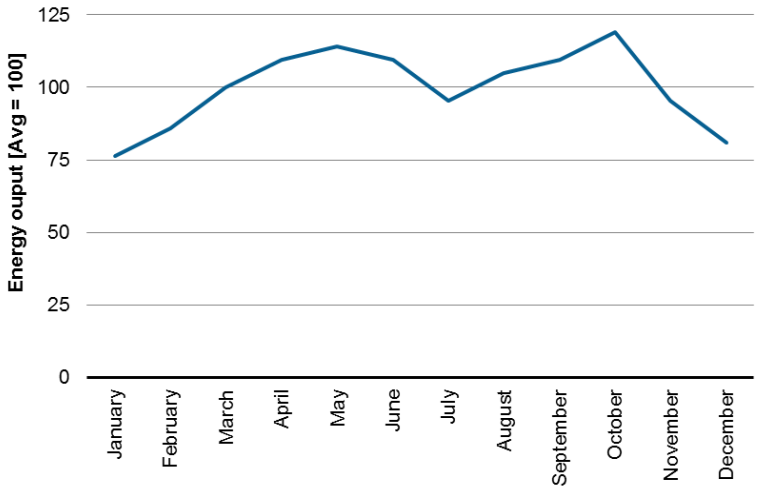

Figure 1 Example for aggregation of time series data of one project

[6] AEA: Knowledge Sharing Requirements - NER300 Decision - Level 1 relevant knowledge. AEA, Didcot, 2011

Time series data of several projects will be aggregated calculating absolute average numbers and the range of absolute numbers across projects (Table 3). If only one or two projects exist in a specific technology category, no aggregation will be performed and data across projects will not be disseminated. An example of a diagram to be used to display the information is given in Figure 2.

Table 3 Example for aggregation of time series data across projects

	January	February	March	April	May	June	July	August	September	October	November	December
Project A	16	18	21	23	24	23	20	22	23	25	20	17
Project B	18	20	22	26	32	30	29	28	27	26	22	24
Project B	30	29	28	33	34	36	40	42	39	32	33	34
Minimum	16	18	21	23	24	23	20	22	23	25	20	17
Maximum	30	29	28	33	34	36	40	42	39	32	33	34
Average	21	22	24	27	30	30	30	31	30	28	25	25

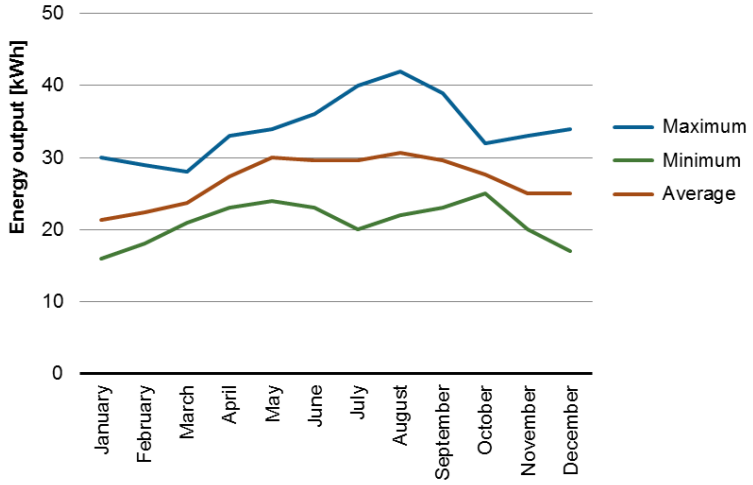

Figure 2 Example for aggregation of time series data across projects

3.1.2 Cost data

Cost data from an individual project can be aggregated by presenting relative numbers for the cost breakdown (Table 4). In addition, it would also be possible to give rounded relative values for a specific project only and thus hide the precise number (Table 4, last row).

Table 4 Example for aggregation of cost data of one project

	Salaries	Advertising	Materials	Fuel costs	Insurances	Taxes	Total
Absolute value (EUR)	120	45	20	10	20	10	**225**
Relative value (%)	53	20	9	4	9	4	**100**
Rounded to 5% steps	50	20	10	5	10	5	**100**

For aggregation of cost data across projects, averages and ranges of absolute numbers can be calculated (Table 5). Of course, also relative average numbers can be produced. If only one or two projects exist in a specific technology category, no aggregation will be performed and data across projects will not be disseminated or an ad-hoc agreement on how to treat data will be negotiated between the Commission and the relevant project sponsor(s), as indicated in Section 2. The results can then also be displayed using charts and diagrams (Figure 3).

Table 5 Example for aggregation of cost data across projects

	Salaries	Advertising	Materials	Fuel costs	Insurances	Taxes	Total
Project A	120	45	20	10	20	10	**225**
Project B	80	10	30	20	10	30	**180**
Project C	130	40	30	20	20	20	**260**
Average absolute	110	32	27	17	17	20	**222**
Average relative	50%	14%	12%	8%	8%	9%	**100%**
Range	80-130	10-45	20-30	10-20	10-20	10-30	**180-260**

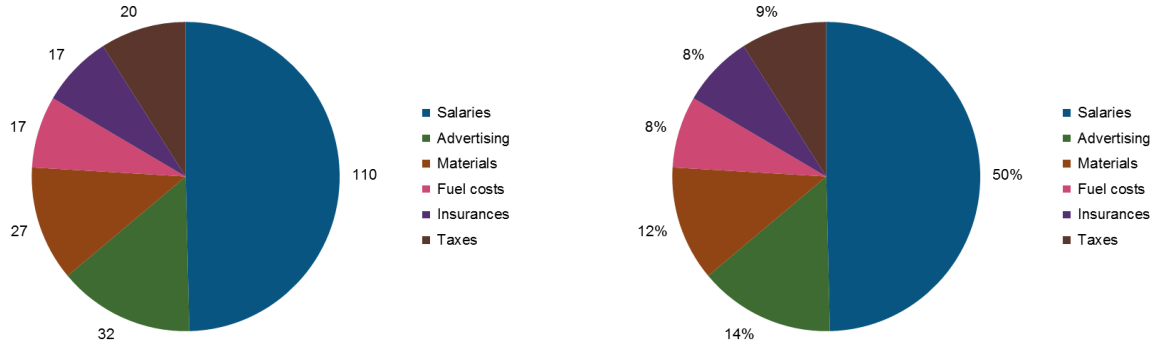

Figure 3 Example for graphical representations of cost data across projects (left: absolute average numbers, right: relative average numbers)

3.1.3 Absolute single numbers

In some cases, absolute single numbers will be submitted (e.g. weight to power ratio of a turbine, number of site visits made). In this case, no aggregation for one specific project can be performed. Aggregation across projects will be made using averages and ranges of absolute numbers across projects. If only one or two projects exist in a specific technology category, no aggregation will be performed and data will not be disseminated or an ad-hoc agreement on how to treat data will be negotiated between the Commission and the relevant project sponsor(s), as indicated in Section 2.

3.2 Text information

In many sections of the RK templates, information in text form is required. To disseminate L1 information from one specific project to L1 and L2 audience, information will be removed or desensitised so results cannot be ascribed to individual projects, organisations or persons. Items that will be removed could include e.g. supplier details, material characteristics, and specificities relating to the innovation within a project.

Aggregated and anonymised L1 information can also be disseminated on L1 and L2 by summarising text across projects.

3.3 Graphical information

For certain technology categories, the submission of technical charts and diagrams is part of the RK template (e.g. block flow diagrams, heat and mass balance). This could contain potentially sensitive and confidential information but also highly technical information. By aggregation and simplification,

the commercial risks of dissemination could be eliminated and at the same time allow communication to a wider audience.

An example for this case is given in Figure 4 which shows a detailed block flow diagram for a subcritical pulverized coal boiler with CO_2 capture. From such a detailed diagram, a simplified version can be extracted. This simplified version would not contain sensitive information and would also be easier to understand for a non-technical audience. The simplified version could thus be disseminated to a wider audience (Figure 5).

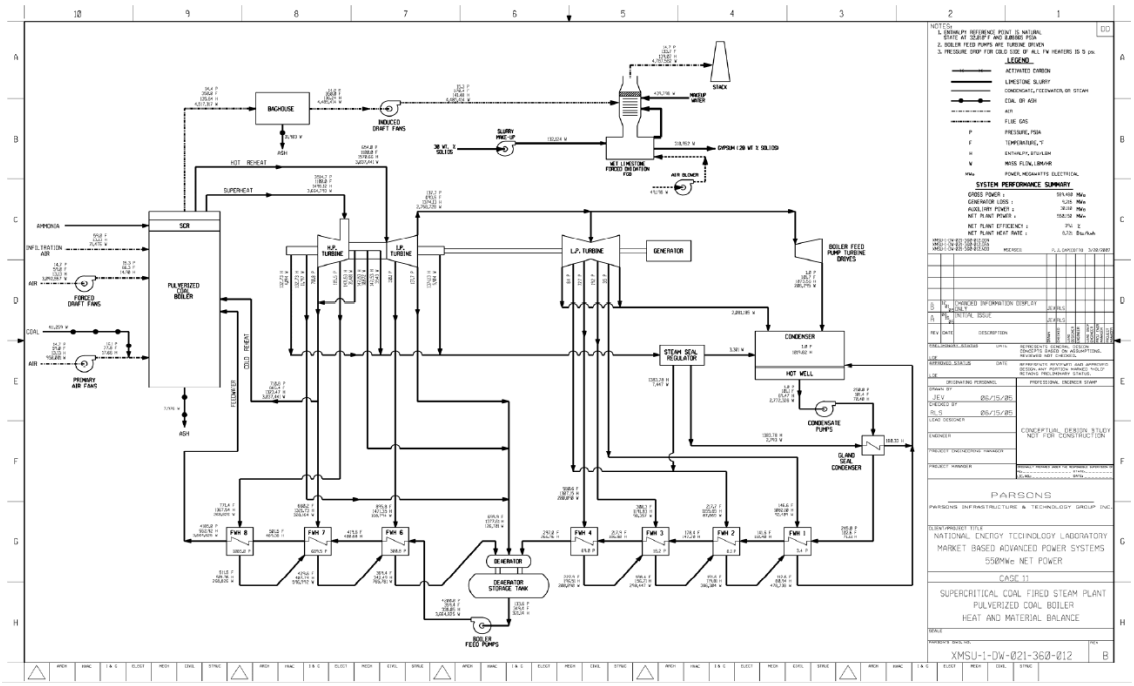

Figure 4 Example for detailed block flow diagram[7]

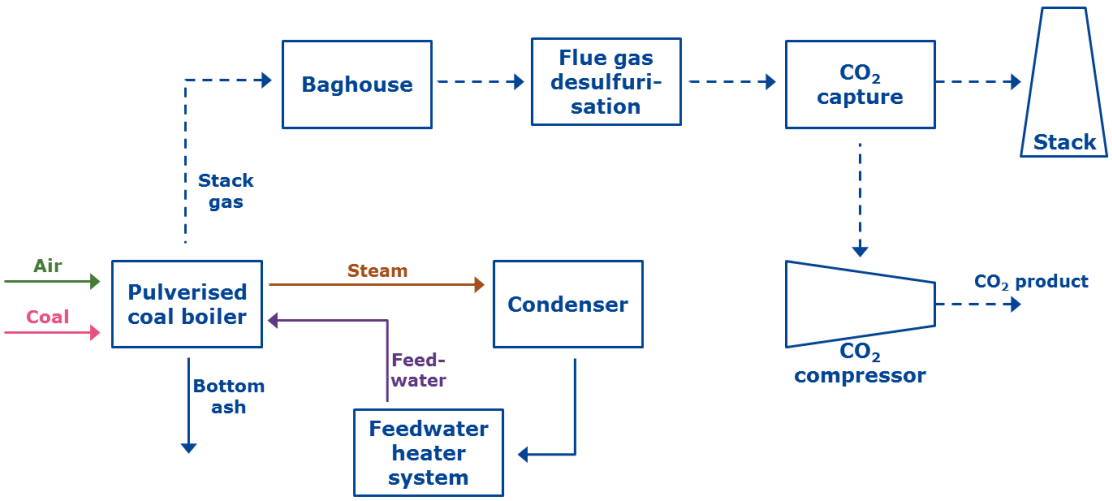

Figure 5 Example for a simplified block diagram[6]

[7] DOE/NETL: Cost and Performance Baseline for Fossil Energy Plants. Volume 1: Bituminous Coal and Natural Gas to Electricity. Final Report 2007. DOE/NETL-2007/1281

3.4 Summary of methods

A summary of the portfolio of methods is shown in Table 6. For each method, a method number has been assigned. This number is used in the summary of methods used for the example of the technology category WIN (Section 4.9).

Table 6 Overview of methods used for aggregation

Method	Type of data	Description	Example	Audience
N1	Numerical data, time series	Relative numbers, indexed, for one project.	Monthly energy performance plot	L1
N2	Numerical data, time series	Average absolute numbers and ranges across projects.	Monthly energy performance plot	L2
N3	Numerical data, cost data	Relative cost breakdown for one project.	Breakdown of investment costs	L1
N4	Numerical data, cost data	Average relative cost breakdown across projects.	Breakdown of investment costs	L2
N5	Numerical data, cost data	Average absolute numbers and ranges across projects.	Total investment costs	L2
N6	Numerical data, single numbers	Average absolute numbers and ranges across projects	Weight to power ratio of a turbine, number of site visits made	L1 and L2
T1	Text information	Information will be removed (e.g. supplier details, material characteristics) or desensitised so results cannot be ascribed to an individual project.	Plant design, technical description of installation	L1 and L2
T2	Text information	Summarising text across projects.	Plant design, technical description of installation	L1 and L2
G	Graphical information	Aggregation and simplification of graphical information (e.g. block flow diagrams) Sensitive information will be removed.	Block flow diagram	L1 and L2

4 Example: detailed procedure for RK/RES/WIN

In the following, the technology category WIN and the knowledge sharing template RK/RES/WIN will be used as an example to describe in detail the aggregation procedures foreseen. A similar procedure will be set up for the RK templates of the remaining technology categories once the consultation with Member States and Project Sponsors is completed.

4.1 Part A.1: Technical set-up and performance (L1)

The contents of part A.1 contain L1 knowledge only. In the Award Decision, it is stated that: "[…] sharing in Technical Set-up and Performance category is expected to be at the level of the various component processes and technologies deployed. It is anticipated that deployment of renewable technologies will be best advanced by the facilitation of exchange of information between developers/operators. The default position is that members agree to share as much information as

possible on topics proposed by the Commission, unless there is a serious, legitimate and substantiated commercial concern."

4.1.1 Part A.1.1 (Technical description)

The contents of part A 1.1 (technical description) of the current WIN template is shown in Table 7.

Table 7 RK Template RK/RES/WIN Part A.1.1

Subsection	Item
A1.1.1	An overview of the wind farm and associated infrastructure including a summary of the design and, for offshore projects, an indication of the average water depth and distance from shore. Please place a particular emphasis on the innovative aspects of the project.

Dissemination on L1

All information submitted in A1.1 will be shared amongst L1 recipients.

Dissemination on L2

The anonymisation and aggregation methods foreseen to disseminate on L2 for this part of the template are the summary of text information for an individual project (T1) and across projects (T2).

4.1.2 Part A.1.2 (Turbine technology)

The contents of part A.1.2 (turbine technology) of the current WIN template is shown in Table 8.

Table 8 RK Template RK/RES/WIN Part A.1.2

Subsection	Item
A1.2.1	A summary of the wind turbine design, including detailed description of turbine blades, hub, drive train and housing/nacelle, generator, tower, foundation, connections and any electrical conversion plant (transformer, converters etc.) contained within the turbine structure. When describing foundations, please provide: - the technical description of the wind turbine structural foundation solution(s), including transition piece where applicable, including design basis, dimensions, tolerances, corrosion protection and other relevant aspects. Comment on any deviations from the design phase and reasons therefore. - details of 'J tubes' or alternative method for connecting inter-array export cables to foundation - description of the monthly average site conditions experienced during the implementation of the project, including (wave and wind) - details of method used for connecting inter-array export cables between the seabed and foundation/turbine In terms of grid integration equipment, please provide: - a summary of any substation used (either onshore or offshore, if applicable), including locations, plant (including layout of equipment and other facilities within the substation) and access arrangements. Include any remedial alterations made to the design or operation due to unanticipated performance - details for the foundation solution of the offshore substation (if applicable) - description of the substation services (if applicable), e.g. for power generation, as well as their electrical equipment, e.g. reactive compensation, switchgear, transformers, power conversion and others. Comment on compliance measures with relevant legislation and design standards - cabling used (both inter-array and power export ones), including their technical details (e.g. AC transmission or DC transmission, materials used, dimensions, corrosion protection, voltages used, cable rating and other relevant parameters), ground conditions along the cable route, cable laying technology and details of connection to turbines and substation. Include deviations from the expected performance and any remedial alterations made to the design or operation - details of redundancy in system and control measures to be taken during unavailability of power export system Finally, please highlight areas of the power plant which have deviated from the proposed design, and reasons therefore
A1.2.2	A summary of remote communications for wind turbine control and instrumentation used, including a description of the operation and plant condition data to be transferred and communications technology. Comment on any deviations from the design phase and reasons therefore.
A1.2.3	Provide details of the turbine installation process undertaken, including installation technologies used, types of vessels and their contribution (if applicable), weather risks, methods and tools used to overcome terrain complexity (for onshore projects) and necessary shore-side facilities (for offshore projects). Furthermore, provide a description of the final structure / layout of the wind farm.
A1.2.4	Based on the performance and experience gained during the project programme thus far, comment on the suitability of the technology to be scaled-up, including any required changes in design, construction methods or materials and any risks foreseen.

Dissemination on L1

Information submitted in A1.2.1 will be shared amongst L1 recipients on an aggregate level only. Similarly, information submitted in A1.2.2 and A.1.2.3 will be summarised. The text summary and graphical information methods (T1 and G) will be applied for A1.2.1-A1.2.3. All the information from A.1.2.4 will be shared amongst L1 recipients.

Dissemination on L2

For dissemination on L2, aggregation will be performed for all items (A1.2.1 to A 1.2.4). The text summary methods (T1, T2) will be used to desensitise and aggregate information (Section 3.2). In case graphical information will be presented by the project sponsor, the methods from Section 3.3 (G) will also be deployed.

4.1.3 Part A.1.3 (Resource and energy yield assessment)

The contents of part A.1.3 (resource and energy yield assessment) of the current WIN template is shown in Table 9.

Table 9 RK Template RK/RES/WIN Part A.1.3

Subsection	Item
A1.3.1	An actual energy performance plot/curve displaying a monthly average electricity production over the previous operative year, along with total yearly generation versus total project capacity. Include deviations from the expected performance and any remedial alterations made to the design or operation.
A1.3.2	Based on the performance of the Project, comment on the accuracy of the energy yield assessment used to complete the Project Proposal. Include an appraisal of the techniques used for data collection to monitor site wind conditions and the accuracy of wind flow/wake loss modelling.
A1.3.3	Provide both the final weight to power ratio of a turbine (not including foundation/support structures) in kg/kW and also the estimated lifetime capacity factor in kW/kWh (where the lifetime electricity production should be determined from average performance achieved to date in the project, extrapolated to a stated design lifetime).
A1.3.4	Describe the observed extreme wind speeds and turbulence characteristics at the site, and any necessary alterations made to the wind turbine.

Dissemination on L1

For dissemination on L1, information submitted in A1.3 will be aggregated summarising the text for specific projects (T1). The energy performance plot from A.1.3.1 will be aggregated using relative numbers (N1, Figure 1). The numbers submitted in A1.3.3 will be shared only after aggregation across projects according to method N2 (Section 3.1.3).

Dissemination on L2

For dissemination on L2, information submitted in A1.3 will be aggregated summarising the text for specific projects and across projects (T1 and T2). The energy performance plot from A1.3.1 will be disseminated using averages and ranges across all projects within the technology category (method N2, Figure 2). As for dissemination on L1, the numbers submitted in A1.3.3 will be shared only after aggregation across projects according to method N2 (Section 3.1.3).

4.1.4 Part A.1.4 (Operation and maintenance)

The contents of part A.1.4 (operation and maintenance) of the current WIN template is shown in Table 10. Numerical information submitted under A1.4.1, A1.4.2, and A1.4.3 will be treated as explained in Section 3.1.3.

Table 10 RK Template RK/RES/WIN Part A.1.4

Subsection	Item
A1.4.1	Number of site visits made and downtime hours for corrective maintenance
A1.4.2	Number of site visits made and downtime hours for preventive maintenance
A1.4.3	Total number of maintenance and repair hours over the project lifetime (to date) per wind turbine

Subsection	Item
	[total_hrs/nb_turbines]
A1.4.4	If applicable, vessel types and number of vessels per type applied for maintenance

Dissemination on L1

For dissemination on L1, information submitted in A1.4.1 and A1.4.2 will be aggregated to arrive at total number of site visits made and total downtime hours for maintenance. For information from A.1.4.3 and A1.4.4, and if more than 2 projects exist in a technology category, averages and ranges across projects will be shared amongst L1 recipients using method N6.

Dissemination on L2

Dissemination on L2 will only be performed if more than 2 projects exist in a technology category or if an ad-hoc agreement on how to treat data has been negotiated between the Commission and the relevant project sponsor(s), as indicated in Section 2. Averages and ranges across projects will be calculated for all information submitted in A1.4 for dissemination on L2 using method N6.

4.2 Part A.2: Technical set-up and performance (L2)

The contents of part A.2 (technical set-up and performance) of the current WIN template is shown in Table 11. This part contains L2 knowledge only.

Table 11 RK Template RK/RES/WIN Part A.2

Section	Item
A2.1	Outline plant design and operating approach
A2.2	Average monthly performance (MWh) compared to target, including reliability and causes of downtime plus impacts of any changes to operating conditions
A2.3	Data acquisition methods
A2.4	Electricity produced (MWh/per annum)
A2.5	Energy used, produced and exported. If possible, estimate efficiency and losses of the system.
A2.6	Wind power quality compared to initial specifications, including reasons for any deviation. Frequency and voltage stability as well as any application to improve system reliability should be taken into consideration (e.g. reactive power compensation, static transfer switches, energy storage or variable-speed generations)
A2.7	Questions for further research. Describe also any limitations to the current innovative items or technologies, and how such innovations can be further developed

Dissemination on L1

For dissemination on L1, text information submitted in A2.1, A2.2, A2.3, A2.6, and A2.7 will be aggregated by removing and desensitising information for specific projects (method T1).

For A2.2, the data will be aggregated as time series data (N1, Section 3.1.1) for one project. All other numerical information (A2.4 and A2.5) will be aggregated using averages and ranges across projects (N6) if more than 2 projects exist in a technology category.

Dissemination on L2

For dissemination on L2, text information submitted in A2.1, A2.2, A2.3, A2.6, and A2.7 will be aggregated by summarising information across projects (method T2). For numerical data submitted under items A2.2, A2.4 and A2.5, averages and ranges across projects will be calculated and disseminated using methods N2 and N6.

Dissemination on L2 will only be performed if more than 2 projects exist in a technology category or if an ad-hoc agreement on how to treat data has been negotiated between the Commission and the relevant project sponsor(s), as indicated in Section 2.

4.3 Part B: Cost levels

Table 12 shows the contents of part B (cost levels) of the current WIN template. This part contains both L1 and L2 knowledge and the RK templates require reporting on a number of cost categories.

Table 12RK Template RK/RES/WIN Part B

Section	Item
B.1	Total investment costs to date [€]: a) capital equipment b) site infrastructure c) development costs d) installation and commissioning e) intangible assets (incl. technology license) f) grid connection g) other
B.2	Operating costs in the previous operative year [€]: a) operation and maintenance b) services c) staff costs d) overheads e) waste disposal f) local rates and taxes g) insurance h) knowledge sharing i) other
B.3	Incremental cost per unit of output (ICPUP) [€/MWh]. This should be calculated using the following formula: ICPUP = $(CAPEX_{RES} + NPV_{5years}(O\&M\ Costs))$ / total projected amount of energy produced in the first five years The individual elements above are defined in Appendix A8 of the due diligence Procedures Manual. However, this formula should use actual capital costs, operating costs and an updated projection of energy production based on measured performance. Any assumptions, for example the discount rate used, should be consistent with the project Financial Model of the application procedure and noted here.

According to the Award Decision, the following cost information is to be shared with any Level 1 Recipient (Level 1) and beyond Level 1 Recipients (Level 2):

- Investment costs (€);
- Operating costs (€, fixed and variable);
- Cost per unit of output (€ per unit).**Error! Bookmark not defined.**

Cost data might be commercial sensitive, thus, for the dissemination on Level 1 and Level 2, not all detailed figures will be disclosed.

4.3.1 Dissemination on L1

Cost breakdown in percent for investment costs and operating costs for a project will be distributed to L1 recipients (Table 13) using aggregation method N3. An example for a cost breakdown chart to be disseminated on L1 is shown in **Error! Reference source not found.**.

4.3.2 Dissemination on L2

The average and ranges of total investment costs, total operating costs, and cost per unit of output will be disseminated on L2 using methods N5 and N6. In addition, the average cost breakdown across projects (N4) will be disseminated (Table 13). An example for a cost breakdown chart to be disseminated on L2 is shown in Figure 7.

Dissemination on L2 will only be performed if more than 2 projects exist in a technology category or if an ad-hoc agreement on how to treat data has been negotiated between the Commission and the relevant project sponsor(s), as indicated in Section 2.

Table 13Example for RK submissions RES/WIN Part B (cost levels) and aggregation/anonymisation

Cost levels	Data from RK Submissions				Calculated data			
	A	B	C		A	B	C	Average (Range)
Investment costs [MEUR]	**550**	**580**	**470**					**533 (470-580)**
Capital equipment	200	150	120		36%	26%	26%	29%
Site infrastructure	90	120	55		16%	21%	12%	17%
Costs	70	90	120		13%	16%	26%	18%
Installation and commissioning	150	160	100		27%	28%	21%	26%
Intangible assets	20	30	50		4%	5%	11%	6%
Grid connection	15	20	5		3%	3%	1%	3%
Other	5	10	20		1%	2%	4%	2%
Operating costs [MEUR]	**125**	**81**	**249**					**152 (81-249**
Operation and maintenance	20	30	50		16%	37%	20%	22%
Services	30	10	80		24%	12%	32%	26%
Costs	50	10	30		40%	12%	12%	20%
Overheads	10	5	50		8%	6%	20%	14%
Waste disposal	5	10	2		4%	12%	1%	4%
Local rates and taxes	2	5	4		2%	6%	2%	2%
Insurance	1	2	3		1%	2%	1%	1%
Knowledge sharing	2	4	10		2%	5%	4%	4%
Other	5	5	20		4%	6%	8%	7%
Incremental costs per unit of output [EUR/MWh]	**60**	**70**	**100**					**77 (70-100)**

L1, cost breakdown for each project in %
L2, average cost breakdown in % (if more than 2 projects)
L2, average absolute numbers and range (if more than 2 projects)

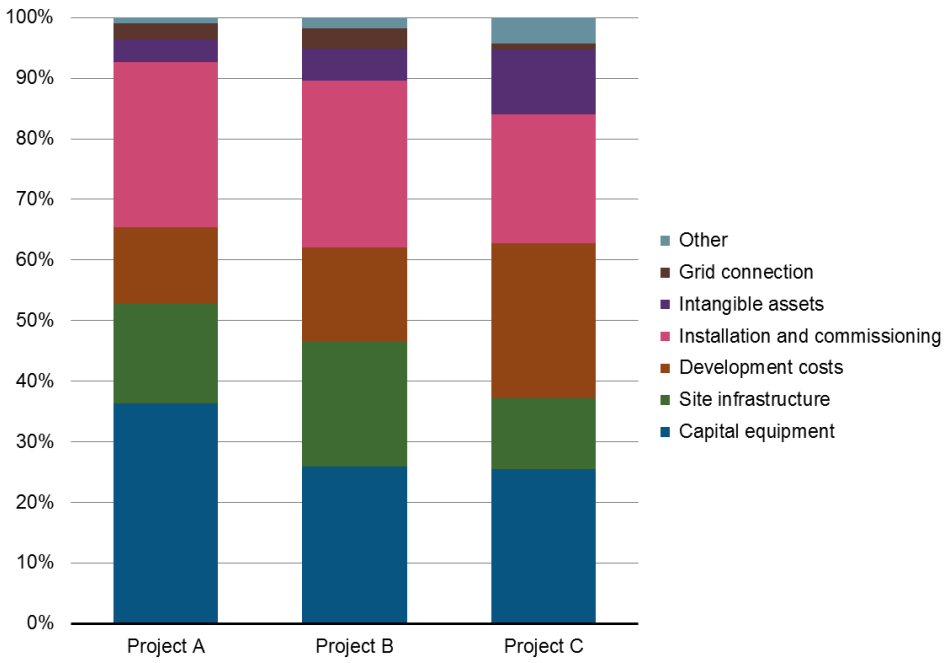

Figure 6 Example of breakdown of investment costs for L1 recipients

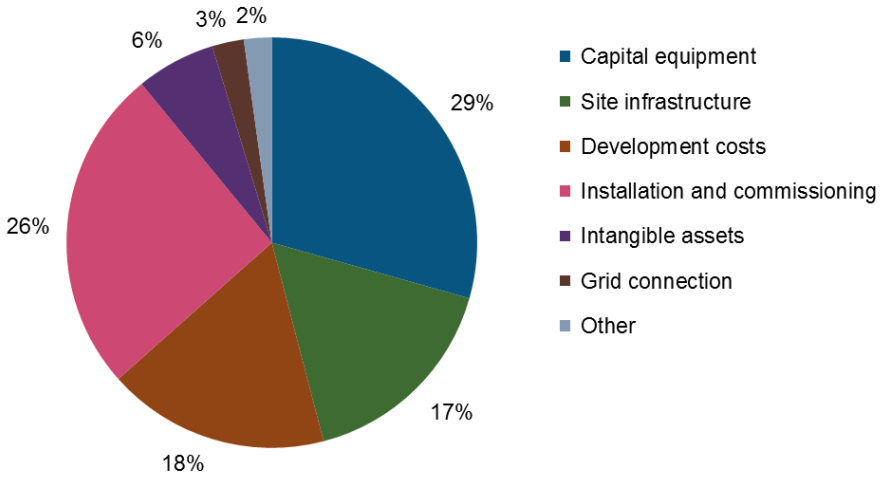

Figure 7 Example of average breakdown of investment costs for L2 recipients

4.4 Part C.1: Project Management (L1)

Table 14 shows the contents of part C.1 (project management) of the current WIN template. This part contains L1 knowledge (C.1).

Table 14RK Template RK/RES/WIN Part C.1

Section	Item
C.1.1	List and brief description of the permits and consents needed, the authorities involved, the documents that the project developer had to provide, and the lessons learned and experiences in obtaining planning permission and negotiating legislative considerations (steps, roles, time-frame)
C.1.2	Stakeholder engagement and public communication strategies, including: a) timing/frequency of stakeholder engagement b) methods of communication c) challenges faced and lessons learned d) target groups selected and estimation of number of stakeholders reached
C.1.3	Project planning issues, including progress against key milestones and their interdependencies
C.1.4	Risk management and allocation strategies (risk ranking, and statistical inputs)
C.1.5	Lessons learned and experiences in consortium management (roles and governance model)
C.1.6	Lessons learned and experiences in how to finance, insure and minimise risk for a full project or future projects

4.4.1 Dissemination on L1

All information submitted in C.1 will be shared amongst L1 recipients.

4.4.2 Dissemination on L2

For dissemination on L2, information submitted in C.1 will be aggregated by summarising L1 answers across projects if there are more than 2 projects per category (methods T1 and T2). The summary text shall make it impossible to ascribe the results to individual projects, organisations or persons, e.g. by simply listing the problems faced by project sponsors, without specifying to which project they belong. In addition, aggregated information on project management submitted by projects in C.2 will be used (Section 4.5).

4.5 Part C.2: Project Management (L2)

Table 15 shows the contents of part C.2 (project management) of the current WIN template. This part contains L2 knowledge only.

Table 15RK Template RK/RES/WIN Part C.2

Section	Item
C.2.1	Aggregated information on good practices in the above areas

For dissemination on L2, the aggregated information on project management submitted in C.2 will be used. In addition, information from section C.1 will be aggregated by summarising L1 answers across projects if there are more than 2 projects per category (T2). The summary text shall make it impossible to ascribe the results to individual projects, organisations or persons (T1).

4.6 Part D: Environmental Impact

Table 16 shows the contents of part D (environmental impact) of the current WIN template. This part contains both L1 and L2 knowledge.

Table 16RK Template RK/RES/WIN Part D

Section	Item
D.1	Methods of transport and the associated environmental impact
D.2	Visual impact on the landscape and associated issues, including installation of additional overhead cables (where applicable)
D.3	Impact on cultural heritage (where applicable)
D.4	Impact on communication networks (where applicable)
D.5	Impact on designated ecological and environmental receptors, in particular on birdlife
D.6	Impact on connecting to the national grid using under/over ground cables
D.7	Impact on geology, acquifers and water sources
D.8	Emissions to the environment (gaseous, liquid, solid) in both undisturbed and disturbed operation
D.9	Other significant environmental impacts (e.g. noise)
D.10	Reduction of CO_2 emissions (total and per unit of output) by comparison with reference plant or product
D.11	Questions for further research

According to the Award Decision, knowledge on environmental impact is to be shared with any Level 1 Recipient (Level 1) and beyond Level 1 Recipients (Level 2).[Error! Bookmark not defined.]

4.6.1 Dissemination on L1

For dissemination on L1, information submitted in part D will be aggregated by summarising answers for individual projects using method T1. Information will be removed or desensitised so results cannot be ascribed to individual projects, organisations or persons. For D.10, the average reduction of CO_2 emissions and the range of reductions will be disseminated only if there are more than 2 projects (using method N6).

4.6.2 Dissemination on L2

For dissemination on L2, information submitted in part D will be aggregated by summarising answers across projects using method T2. The summary text shall make it impossible to ascribe the results to individual projects, organisations or persons, e.g. by simply listing the problems faced by project sponsors, without specifying to which project they belong. For D.10, the average reduction of CO_2 emissions and the range of reductions will be disseminated only if there are more than 2 projects (using method N6).

4.7 Part E: Health and safety

Table 16 shows the contents of part E (health and safety) of the current WIN template. This part contains both L1 and L2 knowledge.

Table 17RK Template RK/RES/WIN Part E

Section	Item
E.1	Safety incidents in disturbed operation, including: a) Location; b) Output; c) Impact; d) environmental emissions (air, water, land); e) cause of incident; f) resolution measures taken; g) key lessons learned.
E.2	Health issues in regular/undisturbed operation compared to the levels before project implementation, if applicable, or to the levels recommended in European Regulations (e.g. REACH). Please comment on (where relevant): a) hazardous substances or situations and their potential impacts; b) exposure values related to relevant chemical agents at work; c) exposure to carcinogens or mutagens at work; d) exposure to physical hazards at work such as noise and vibration; e) other.
E.3	Near misses, including: a) location; b) output; c) cause; d) measures taken; e) key lessons learned.
E.4	Description of monitoring and resolution systems to track safety
E.5	Number of incidents per hour operated

According to the Award Decision, knowledge on environmental impact is to be shared with any Level 1 Recipient (Level 1) and beyond Level 1 Recipients (Level 2).[Error! Bookmark not defined.]

4.7.1 Dissemination on L1

For dissemination on L1, information submitted in part E will be aggregated by summarising answers for individual projects. Information will be removed or desensitised so results cannot be ascribed to individual projects, organisations or persons (method T1). For E.5, the average number of incidents per hour operated and the range will be disseminated only if there are more than 2 projects (using method N6).

4.7.2 Dissemination on L2

For dissemination on L2, information submitted in part E will be aggregated by summarising answers across projects (method T2). The summary text shall make it impossible to ascribe the results to individual projects, organisations or persons, e.g. by simply listing the problems faced by project sponsors, without specifying to which project they belong. For E.5, the average number of incidents per hour operated and the range will be disseminated only if there are more than 2 projects (using method N6).

4.9 Summary of methods used for RK/RES/WIN

A summary of the methods used to aggregate and desensitise knowledge for dissemination on L2 is shown in Table 18 for the RK/RES/WIN template for each item of the RK submission.

Table 18RK Template RK/RES/WIN: summary of aggregation methods used

Section	Subsection	L1	L2
A1.1.1	Overview of wind farm and infrastructure	n.a.[1)]	T1, T2
A1.2.1	Summary of the wind turbine design	T1, G	T1, T2, G
A1.2.2	Summary of remote communications	T1, G	T1, T2, G
A1.2.3	Details of the turbine installation process	T1, G	T1, T2, G
A1.2.4	Suitability for scale-up	n.a.	T1, T2
A1.3.1	Energy performance plot/curve	N1, T1	N2, T1, T2
A1.3.2	Accuracy of energy yield assessment	T1	T1, T2
A1.3.3	Final weight to power ratio and capacity factor	N2, T1	N2, T1, T2
A1.3.4	Extreme wind speeds and turbulence characteristics	T1	T1, T2
A1.4.1	Site visits and downtime for corrective maintenance	n.a. (sum of A1.4.1	N6
A1.4.2	Site visits and downtime for preventive maintenance	and A1.4.2)	N6
A1.4.3	Total number of maintenance and repair hours	N6	N6
A1.4.4	Vessel types and number of vessels	N6	N6
A2.1	Outline plant design and operating approach	T1	T2
A2.2	Average monthly performance	T1, N1	T2, N2
A2.3	Data acquisition methods	T1	T2
A2.4	Electricity produced	T1, N6	T2, N6
A2.5	Energy used, produced and exported	T1, N6	T2, N6
A2.6	Wind power quality	T1	T2
A2.7	Questions for further research	T1	T2
B.1	Total investment costs	N3	N4, N5
B.2	Operating costs	N3	N4, N5
B.3	Incremental cost per unit of output (ICPUP)	N6	N6
C.1.1	Permits and consents	n.a.	T1, T2
C.1.2	Stakeholder engagement	n.a.	T1, T2
C.1.3	Project planning issues	n.a.	T1, T2
C.1.4	Risk management	n.a.	T1, T2
C.1.5	Consortium management	n.a.	T1, T2
C.1.6	Finance, insure and minimise risk	n.a.	T1, T2
C.2.1	Aggregated information on good practices	n.a.	n.a.
D.1	Methods of transport	T1	T2
D.2	Visual impact on landscape	T1	T2
D.3	Impact on cultural heritage	T1	T2
D.4	Impact on communication networks	T1	T2
D.5	Impact on ecological and environmental receptors	T1	T2
D.6	Impact on connecting to the national grid	T1	T2
D.7	Impact on geology, acquifers and water sources	T1	T2
D.8	Emissions to the environment	T1	T2
D.9	Other significant environmental impacts	T1	T2
D.10	Reduction of CO2 emissions	N6	N6
D.11	Questions for further research	T1	T2
E.1	Safety incidents in disturbed operation	T1	T2
E.2	Health issues in regular/undisturbed operation	T1	T2
E.3	Near misses	T1	T2
E.4	Monitoring and resolution systems	T1	T2
E.5	Number of incidents per hour operated	N6	N6

1) n.a. means no aggregation method foreseen

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Abstract

NER 300 is an EU funding programme for the demonstration of carbon capture and storage (CCS) and innovative renewable energy (RES) technologies at the pre-commercial stage. Knowledge sharing requirements are built into the legal basis of the programme as a critical tool to lower risks in bridging the transition to large-scale production of innovative renewable energy and CCS deployment. Projects have to submit annually to the European Commission relevant knowledge gained. The European Commission assesses the relevant knowledge, aggregates and disseminates it. This report presents the methodology for the aggregation of relevant knowledge.

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