



swiss economics

**Asset and Output Reporting  
Guide  
(Call XY)  
E2GAS PROJECT**

**SUMICSID  
Swiss Economics**

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## Disclaimer

This is a cost reporting guide for the E<sup>2</sup>GAS project for benchmarking of gas transmission system operators, delivered by the authors, SUMICSID and Swiss Economics. The latest version of this document is always obtainable at the Worksmart platform.

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## Version history

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# 1. Introduction

## *Background*

- 1.01 This Asset and Output Reporting Guide is developed to support the e<sup>2</sup>GAS benchmarking for gas TSOs.
- 1.02 As far as appropriate, the guide builds on material and experience from the e<sup>3</sup>GRID 2012 benchmarking project for electricity TSOs, the German benchmarking of gas TSOs from 2010 onwards, and the feasibility study to this project, pe<sup>2</sup>GAS from 2014.

## *Overview*

- 1.03 According to the Project Plan, e<sup>2</sup>GAS involves a number of data calls for information
- 1) Operating cost, C  
Scope and decomposition of costs to be reported in the benchmarking, methodology and definitions.
  - 2) Asset data X and output indicators Y  
Asset data and technical characteristics, data related to system services performed.
  - 3) Operator Specific Conditions Z  
Guidelines for submission of cost drivers, costs and asset types that have been omitted in the other calls for some individual operator.
- 1.04 This guide and its associated reporting template constitute Call XY above as part of the deliverable G2 (final release of data collection material).
- 1.05 A guide in draft format is labelled X. When released, the revision number is labelled V. The data collection starts at the final release of V1.0. Any revisions of this document and/or data templates will be uploaded to the Worksmart platform and a notification will be issued to registered participants.

## *Principles*

- 1.06 The asset guide X (Sections 3-5) concerns the reporting of the grid assets from the TSO asset registers for use in the e<sup>2</sup>GAS benchmark. It does not specifically address planned or actual quality in grid operation.
- 1.07 The output guide Y (Section 6) concerns the listing of output indicators that come from two sources: (i) TSO output data reported by the TSOs and (ii) a number of country-related indicators collected from open

sources. The output parameters inform the selection of output variables for the efficiency model. Some output parameters may also be used in sensitivity analysis after the run. Public parameters used in the calculations will be referenced and reproduced in subsequent reports. This version does not contain variables collected for the correction of specific cost parameters nor output specifications for out-of scope activities, e.g. indexes related to labor cost corrections.

## 2. System description

2.00 The following section gives a brief overview over the system description for the asset base of a gas TSO.

### *Transmission system*

2.01 The fundamental objective of a transmission system operator is to transport gas to distribution networks and other connected clients.

2.02 The gas transmission system is composed of different network parts characterized by the type of gas transmitted. There are two types of natural gas:

- 1) a low calorific value ("L gas") with a High Heating Value (HHV) between 9.5 and 10.5 kWh/m<sub>n</sub><sup>3</sup> and,
- 2) a high calorific value ("H gas") with a High Heating Value (HHV) between 10.7 and 12.8 kWh/m<sub>n</sub><sup>3</sup>.

### *Services and scope*

2.03 Gas transmission systems can cover for both qualities the following ranges of services:

- 1) Domestic gas **transport** for redelivery at a delivery point in the country;
- 2) International gas **transit** services without domestic gas distribution or supply along a route from a transit entry point to a transit exit point;
- 3) **System services**;
- 4) **Gas storage** services;
- 5) **LNG** services.

2.04 Associated activities are described in the Cost guide C.

2.05 In this benchmarking only the services 1) and 2) are considered. Both assets and costs for other services are excluded from the calculation of cost efficiency measures.

### *Assets and outputs*

2.06 Assets relevant for this benchmarking include components that are relevant to transport and distribute gas, essentially a pipeline network with its control system as described in more detail in Section 3 below.

2.07 The associated outputs are described in Section 6.

### 3. Asset description

#### *Overview*

- 3.01 To describe a pipeline network, locations, pipes, controllers/compressors and connection points can be distinguished, as illustrated in Figure 1. There is one sheet for each category in the template.
- 3.02 A **location** is a geographical location, for example the location of a connection point.
- 3.03 A **pipe** (gas pipeline) connects two locations.
- 3.04 A **controller/compressor** is located at location between two locations of different nominal pressure or at a connection point.
- 3.05 A **connection point** marks entry or exit of gas from network, e.g. injection from upstream suppliers or delivery to downstream networks.

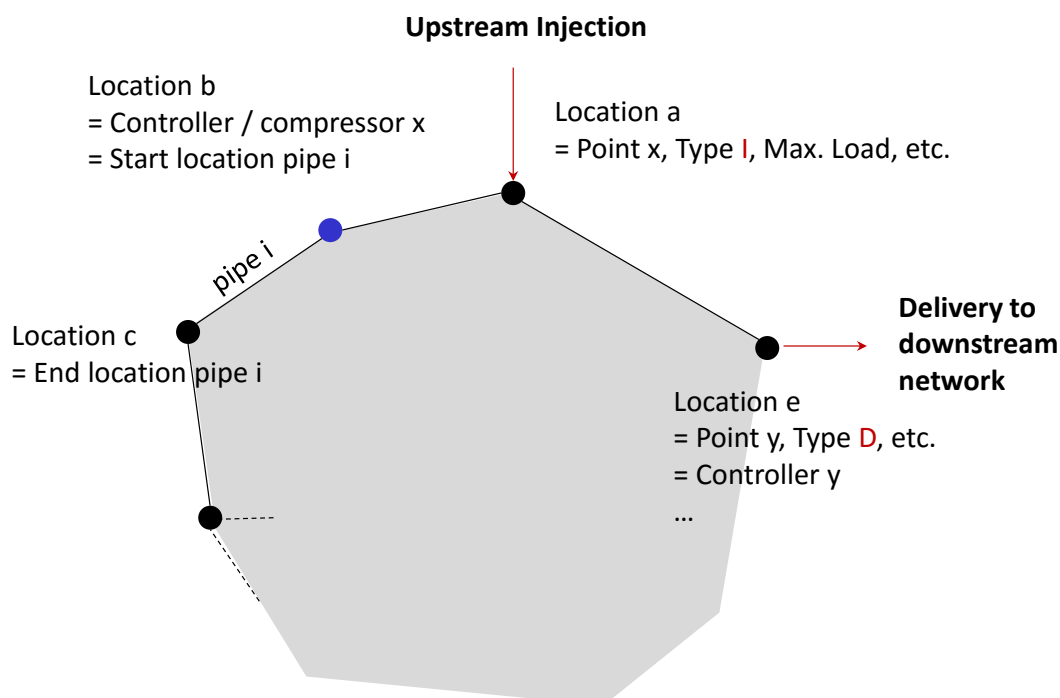


Figure 1 Scope and functions.

***Pipes***

- 3.06 The pipeline network transmits gas from the receiving points located at the borders of neighbouring TSOs and/or from LNG either to customers directly or through DSOs or for gas transit purposes to or from neighbouring TSO.
- 3.07 Pipelines / pipes are elementary sections of the pipelines system that are for example characterized by a nominal diameter or a specific Maximum Operating Pressure (MAOP). The network parts used for transport to (domestic) customers versus transit offtake often have different dimensioning. The pipeline is protected against external corrosion by an external coating and a cathodic protection system, alternatively through the use of other materials.
- 3.08 In-line stations (block valves and pig traps) are installed at regular intervals along the pipelines for safety and operational purposes. As they are correlated with network length, pressure levels and other factors for which data is collected for, such data are not collected in this call. Should local regulations be a cost driver in this regard (e.g. prescription of maximal distances between sectionalizing valves stations), this can be specified in Call Z.

***Pressure regulators/controllers and compressors***

- 3.09 Compressor stations are installed along the pipeline route in order to compensate pressure drops as the network develops. The pressure regulators are installations serving to regulate the gas flow in the system. There could also be metering stations with equipment for measuring, but not regulating, the flow through a given pipeline section.
- 3.10 Such assets are located at locations between two nodes of different nominal pressure or at a connection point where pressure is changed (e.g. in a delivery station where pressure is reduced).

***Connection points***

- 3.11 Connection points are entry and exit points where gas enters or leaves the network.
- 3.12 At connection points, metering stations are often located, e.g. at border metering stations used for commercial and fiscal purposes and at internal delivery stations located at the output of the transport system to measure the gas delivered and to reduce its pressure to the needs of the downstream distribution system.

- 3.13 When pressure is reduced for delivery, the exit point is also a controller/compressor location and to be listed twice in the asset database, once as an exit point and once as a controller/compressor.
- 3.14 The following types of connection points are distinguished:
- I: Injection from upstream net/production/injection from biogas plant
  - D: Delivery to downstream network
  - C: Delivery to customers, direct withdrawal
  - N: Delivery to neighbouring networks
  - S: Gas storage

## 4. Reporting Structure

4.01 Below, we give an overview of the item database structure and the common reporting categories. Whenever applicable, the default reporting option is stated and indicated with grey shading in tables.

4.02 For each category, the classes are defined with unit of measurement, definition of measure and limits  $(a,b)$  of the type  $a < x \leq b$ , i.e., the lower limit is exclusive.

### *Principles*

4.03 All values should be provided to normal temperature and pressure ( $T = 0^{\circ}\text{C}$ ,  $P = 1.01325 \text{ bar}$ ).

4.04 Data that are not available are to be calculated or estimated as exactly as possible. The determination of such data is to be documented and provided to the NRA together with the data.

4.05 Unless stated, the reporting here only concerns the state of assets in use Dec 31, 2014.

4.06 The data collection is separated for H gas (high calorific gas) and L gas (low calorific gas).

4.07 A more differentiated classification may be applied, maintaining the above ranges, see green fields on the left.

### *Geographical data*

4.08 The provision of geographical data for the used location IDs including names is voluntary and serves for validation purposes only, unless all operators provide geographically coded data.

4.09 If geographical coordinates are not supplied, you may attribute unique location IDs to denote assets for validation purposes.

### *Pressure range*

4.10 Assets such as pipes are to be attributed to pressure ranges. The attribution of assets to pressure ranges should be based on the assets nominal pressure.

4.11 There are six types of standard pressure ranges in Table 4-1:

Table 4-1 Pressure ranges.

<b>P</b>	<b>Limit L</b>	<b>Limit H</b>	<b>UoM</b>	<b>Definition</b>
LP	-	= 0.1	Bar	nominal
MP	>.1	= 1	Bar	nominal
HP1	>1	=5	Bar	nominal
HP2	>5	=16	Bar	nominal
HP3	>16	=70	Bar	nominal
HP4	>70	-	Bar	nominal

- 4.12 In case of missing, incomplete or incorrect report of the category, the lowest category is assumed by default.
- 4.13 Note: These pressure ranges relate also to DSOs, and the high pressure ranges may need a higher differentiation. You may further detail HP3 and HP4 in the templates, make sure to be consistent with the above ranges to ensure comparability.

***Code keys***

- 4.14 Code keys, fully identifying the type of asset are automatically generated and serve for internal purposes only.

## 5. Asset Category Definitions

5.01 Below, we introduce the asset categories in order, drawing if applicable on the previously defined classes of pressure range (P). The main attention is paid to the asset specific positions. Some comments are given to guide the reporting.

### *Pipeline system*

5.02 An item in pipes category (sheet "X pipes") is a pipe section that is appropriately described by the following characteristics.

5.03 **Pipe section length:** Length of pipe section (without house connections) in kilometers that is already in use for the transport of gas or the delivery of gas to clients. Also to be reflected are pipelines that have been put out of service short-, middle- or longterm. Not to be reflected are pipelines that are dismantled or that are now used for other services than gas transport. Pipeline kilometers that are shared with external parties are to be included and marked separately (see below).

5.04 **Pipe section volume:** Inner spatial volume  $V$  of pipe section  $i$  in  $m^3$ , to be calculated based on section length  $L$  and inner diameter of the pipe section  $D_{inner}$ . Spatial volume is therefore independent of the pressure level and calculates as follows:

$$V_i = \pi \cdot \left( \frac{D_{inner,i}}{2} \right)^2 \cdot L_i$$

Pipeline volumes that are shared with external parties are to be included and marked separately (see below).

5.05 **Share of external use of pipe kilometers or volumes in co-ownership:** The share of external use is the respective amount in km of pipelines in co-ownership that is used by other network operators (without house connections). The shares are determined based on capacities granted on a contractual basis, not on property shares.

### Example:

*Shared network length without house connections: 100km*

*Shared network volume without house connections: 100m<sup>3</sup>*

*Third-party share of capacity usage: 20%*

*=> 100km\*20% = 20km share of external use*

*=> 100m<sup>3</sup>\*20% = 20m<sup>3</sup> share of external use*

5.06 **Gas quality:** Indication whether the pipe operates for **H gas** (high calorific gas) or **L gas** (low calorific gas).

5.07 **Pressure range:** Options cf. art 4.10.

5.08 **Material class:** Steel pipes are protected against external corrosion by an external coating and a cathodic protection system, alternatively through the use of other materials. Options are as follows:

Table 5-1 Pipelines: material classes.

M	Definition
SteelPE-CC	Steel pipeline with PE (polypropylene) and cathodic corrosion protection
SteelPE	Steel pipeline with PE (polypropylene)
SteelB	Steel pipeline bituminous-treated
Iron	Cast iron pipeline
PE	Polypropylene pipeline
PVC	PVC pipeline

5.09 **Diameter class:** Distinction of pipelines according to the nominal diameter. Steel and iron pipes: DN for the inner diameter of the pipe. For PE pipes: DN for the outer diameter of the pipe. Pipes have to be separated according to the following classes A to G (PE from D on only).

Table 5-2 Pipeline: diameter classes.

D	Definition
A	Pipelines of nominal diameter DN $x \geq 1000$ .
B	Pipelines of nominal diameter DN $700 \leq x < 1000$ .
C	Pipelines of nominal diameter DN $500 \leq x < 700$ .
D	Pipelines of nominal diameter DN $350 \leq x < 500$ rsp. Da $355 \leq x < 500$ .
E	Pipelines of nominal diameter DN $200 \leq x < 350$ rsp. Da $225 \leq x < 355$ .
F	Pipelines of nominal diameter DN $100 \leq x < 200$ rsp. Da $110 \leq x < 225$ .
G	Pipelines of nominal diameter DN $x < 100$ rsp. Da $x < 110$ .

5.10 **Pipe section name and location of start and end:** Voluntary information.

***Pipe section environmental conditions:***

5.11 Considering that most TSOs will not be able to provide geographical information for specific assets and the access to comparable data sources for all countries involved, the Call X already includes a collection of environmental condition parameters for the pipeline system. In the case of proportions of a specific condition, e.g. 20% of a specific pipeline runs through a natural reserve, then the corresponding length (20% x total length) should be reported as a separate asset line in the sheet.

- 5.12 **Land use:** urban; rural (unproductive, =default); industrial; agricultural; environmental protected area
- 5.13 **Soil subsurface:** Loose or soft soils (=default); stony soils; rocky soils.
- 5.14 **Topographical:** Flat (=default); undulating (0 % < slope < 5 %); hilly (5 % < slope < 30 %); mountainous (30 % < slope). For slopes exceeding 40 % please add a comment.
- 5.15 **Soil humidity:** dry; occasionally wet (=default); permanently wet.
- 5.16 **Comment:** If the above categories do not appropriately describe the specific pipe laying difficulty conditions, please describe.

***Pressure regulator/controller stations and compressor stations***

- 5.17 A pressure controller or a compressor is either located at a location ID between two locations of different nominal pressure or at a connection point.
- 5.18 There is no need to report metering stations that are connection points as well, as it can be assumed that such connection points have a metering functionality depending of the nature of the connection point (I, D, C, N, S). If you consider that metering stations along the pipeline system that are not located at connection points are an important cost driver independent of pipeline length and other factors already asked for, you can list such metering stations in "x controllers and compressors" and urge in call Z why their reflection is necessary. The template will in this case not produce a controller/regulator ID (as these are not pressure controlled).
- 5.19 **Nominal pressure level** of pipelines connected to this location or that could be connected to this location in bar. If pipelines of different nominal pressure level are connected, the highest pressure level applies. Note that the nominal pressure level is not the effective pressure yielding from a load flow calculation.
- 5.20 **Pressure controlled:** Operating pressure in bar if held at a constant value (otherwise keep void).
- 5.21 **Upstream pressure:** Maximum operating pressure upstream (inlet) in bar.
- 5.22 **Downstream pressure:** Maximum operating pressure downstream (outlet) in bar.

- 5.23 **Flow rate:** Hourly nominal output in  $m_n^3/h$ . For stations, report nominal flow rate for an entire compressor station (i.e. not individual compressors within compressor station).
- 5.24 **Mechanical efficiency:** Overall mechanical efficiency in % (voluntary).
- 5.25 **Share of external usage:** Share of external usage is the respective share [%] of use of a third party of the controller or compressor in co-ownership. The shares are to be determined based on capacities granted on a contractual basis, not on property shares. It is the share in % of the pressure controller or compressor whose capacities are shared between one or more network operator and over whom the network operator can dispose only partially besides third parties.

### *Connection points*

- 5.26 Connection points are points in the system where gas enters or leaves the network. Use for every connection point a new line in sheet "X connection points". Pressure controllers that inject to downstream networks are seen as connection points as well (list here and under "X controllers and compressors").
- 5.27 **Location ID:** May provide location ID for connection point.
- 5.28 **Point also regulator?:** If the connection point is also a pressure regulator/controller/compressor, select the corresponding station ID (II.7 of sheet "X controllers and regulators").
- 5.29 **Pressure level:** Pressure level to which the connection point is connected to in bar.
- 5.30 **Type of connection point:** Type of injection or extraction/delivery:

Table 5-3 Pipelines: type of connection points.

T	Description
I	Injection from upstream net/production/injection from biogas plant/LNG terminals
D	Delivery to downstream network
C	Delivery to customers, direct withdrawal
N	Delivery to neighboring networks
S	Gas storage

If a connection point has both injection and delivery functionality, use two rows and provide specific values for each direction. Thereby,

change for the second entry the formula in II.13 (Connection point ID) by linking it to the first entry, so that both rows have the same connection point ID.

- 5.31 **Gas quality:** Gas quality of injection or delivery. H for H-gas and L for L-gas.
- 5.32 **Commercial settlement:** Commercial settlement of processing at the connection point:  
1) Bookable or orderable  
2) Nor
- 5.33 **Unique or shared use:** Indication whether the connection point is in unique (reporting TSO only) or shared (reporting TSO with other party) operation.
- 5.34 **Ownership of connection point:**  
1) Fully owned  
2) Partial ownership (joint venture)  
3) Rental (unique rental contractor)  
4) Shared rental (joint rental contract)
- 5.35 **Renter:** if applicable, renter of the connection point
- 5.36 **Pressure.max:** maximal pressure in bar that has to be reached at this connection point technically resp. contractually (Type D, C, N, S) or, respectively, that the upstream supplier is allowed to set (I). Applicable is the higher value.
- 5.37 **Pressure.min:** minimal pressure in bar that has to be reached at this connection point technically resp. contractually (Type D, C, N, S) or, respectively, that the upstream supplier is allowed to set (I). Applicable is the higher value.
- 5.38 **Capacity.injection.peak:** Highest measured hourly concurrent sum of capacities of all physical upstream injections at this connection point of the network operator that has occurred during the relevant year in  $\text{nm}^3/\text{h}$  ("concurrent peak load of the year").
- 5.39 **Capacity.delivery.peak:** Highest measured hourly concurrent sum of capacities of all physical downstream deliveries/withdrawals at this connection point of the network operator that has occurred during the relevant year in  $\text{nm}^3/\text{h}$  ("concurrent peak load of the year").
- 5.40 **Connection point or zonal value:** Indication, whether the following values are provided for the connection point (standard) or for the zone as a sum of the individual connection points.

- 5.41 **Capacity.injection.bookable/orderable:** Maximal hourly injection capacity bookable resp. orderable at the connection point resp. the zone in the relevant year in  $\text{nm}^3/\text{h}$ .
- 5.42 **Capacity.delivery.bookable/orderable:** Maximal hourly delivery/withdrawal capacity bookable resp. orderable at the connection point resp. the zone in the relevant year in  $\text{nm}^3/\text{h}$ .
- 5.43 **Capacity.injection.booked/ordered:** Yearly average hourly injection capacity booked resp. ordered at the connection point resp. the zone in the relevant year in  $\text{nm}^3/\text{h}$ .
- 5.44 **Capacity.delivery.booked/ordered:** Yearly average hourly delivery capacity booked resp. ordered at the connection point resp. the zone in the relevant year in  $\text{nm}^3/\text{h}$ .

## 6. Outputs

6.01 This data call for output indicators (Call Y) is developed to support the e<sup>2</sup>GAS benchmarking round for TSOs.

### 6.1 TSO-collected indicators

6.02 **Energy injected** is the sum of energy injected into the gas grid during the relevant year, to be provided in Normal cubic meters (nm<sup>3</sup>) and kilowatt hours (kWh).

Energy injected is required furthermore on a decomposed level as follows:

- 1) thereof from storage

6.03 **Energy delivered** is the sum of energy delivered / withdrawn from the gas grid during the relevant year, to be provided in Normal cubic meters (nm<sup>3</sup>) and kilowatt hours (kWh). To be included are also clients with individually negotiated terms. Self-consumption does not include linepack maintenance.

Energy delivered is required furthermore on a decomposed level as follows:

- 1) thereof to distributors
- 2) thereof to final customers (including industrial customers)
- 3) thereof to neighbouring market areas (TSO inside country)
- 4) thereof to neighbouring countries (TSOs outside country)
- 5) thereof to storage
- 6) thereof own consumption
- 7) thereof network losses

6.04 **Peak load of injections** is the highest sum of loads of simultaneous/concurrent injections into the gas grid, it occurs therefore in one particular moment during the year. Peak load is to be provided as hourly values measured in Normal cubic meters (nm<sup>3</sup>) and kilowatt hours (kWh). To be included are also clients with individually negotiated terms.<sup>1</sup> Values should be based on measurements.

6.05 **Peak load of deliveries** is the highest sum of loads of concurrent (simultaneous) deliveries (withdrawals) from the gas grid, it occurs

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<sup>1</sup> I.e. clients that obtain special conditions based on individual negotiations.

therefore in one particular moment during the year. Peak load is to be provided as hourly values measured in Normal cubic meters (nm<sup>3</sup>) and kilowatt hours (kWh). To be included are also clients with individually negotiated terms. Values should be based on measurements.

- 6.06 **yCompressors.num**: Total number of installed compressors
- 6.07 **yCompressors.power.sum**: Sum of power of installed compressors
- 6.08 **yCompressors.energy.used.sum**: Sum of energy used by compressors installed
- 6.09 Based on the asset data provided, a series of unweighted indicators are computed in the reporting sheet: **Total size of network** (unweighted) and the unweighted **sum of connection points**.

## 6.2 Public parameters

- 6.10 Call Y also includes two categories of data, which are summed up in 4 groups (A, B, C, D):
- **Transportation service (A)**
  - **Physical environment (B)** – these data will be used to identify further cost drivers and/or indicators from the physical environment having an impact on the cost level.
  - **Economic environment (C)**
  - **Macro-economics environment (D)** – these indicators can be useful for the standardization of the investment stream and labour cost corrections.
- 6.11 Whenever possible, only original indicators are listed, not composed ones such as “population per km<sup>2</sup>” etc.
- 6.12 Unless indicated otherwise, indicators are defined for the country as a proxy for service area. For the case of multiple operations in the same country, equivalent data are to be collected by region or corresponding.
- 6.13 Unless indicated otherwise, the indicators refer to annual values for the latest available data (2014).
- 6.14 The geographical variables are defined using an averaging technique that depends on available data. If only national data are available, such will be used. For regions, the same technique as for countries will be used.

- 6.15 The sources for general parameters are primarily EUROSTAT, ENTSO-G, national statistical bureaus and OECD. In the final release of the parameter values to each participant, the sources for all parameters will be indicated. Certain indicators may be composites (e.g. material price indexes), in such cases the original sources will be indicated as well as the exact calculation of such parameters.

### ***A - Transportation services***

Table 6-1 Indicators Transportation services

	Total Import of gas
	Total Export of gas
	Total gas consumption

- 6.16 The aggregate data are complements to the basis of validation for the TSO-reported data.

### ***B - Physical environment***

- 6.17 The physical environment may have an impact on the cost level, either for maintenance or investment. The list below tries to cover the main indicators to reflect the physical environment of a TSO from an aggregate (country) level.

Table 6-2 Indicators Physical environment

	Surface area (total)	km <sup>2</sup>
	Surface area (habitable)	km <sup>2</sup>
	Area for lakes, mashland and swamps	km <sup>2</sup>
	Forest area	km <sup>2</sup>
	Agricultural area	km <sup>2</sup>
	Area for road and rail infrastructure	km <sup>2</sup>
	Urban area (including city)	km <sup>2</sup>
	City area	km <sup>2</sup>
	Surface area above forestation level	km <sup>2</sup>
	Surface area above forestation level	km <sup>2</sup>

- 6.18 The aggregate data are complements to the basis of validation for the TSO-reported data.

### ***C - Economic environment***

- 6.19 Indicators of the economic environment can be useful for the standardization of the investment stream and/or corrections of labour costs.

Table 6-3 Indicators Economic environment

Labour productivity per hour worked	EUR
Labour productivity per person employed	EUR
Comparative price levels (EUROSTAT def)	-
Purchasing Power Parity	-
Market Integration – Trade integration of goods	-
Market Integration – Trade integration of services	-
Energy intensity of the economy (EUROSTAT def)	-
Hourly compensation costs for production workers manuf.	EUR
Social insurance expenditure and other taxes as % of salary	%

***D - Macro-economic environment***

6.20 Indicators of the macro-economic environment are candidates for use in the standardization of the investment stream and for deeper analyses of labour cost corrections.

Table 6-4 Indicators Macro-economic environment

Price convergence between EU member states	
Producer price index	
Consumer price index	
Retail price index	
Steel price index	
GDP per capita	EUR
Real GDP growth rate	%