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MEDEAS

MODELING THE RENEWABLE ENERGY TRANSITION IN EUROPE

Project Nr: 691287

Guiding European Policy toward a low-carbon economy. Modelling sustainable Energy system Development under Environmental And Socioeconomic constraints

Deliverable 2.3

Version 3.0.0

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Document info sheet

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MEDEAS
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Scope of the document

This document is Deliverable 2.3 of Work Package 2 (Data collection) in MEDEAS project. MEDEAS will develop four models: World, Europe, Austria and Bulgaria, thus input data is necessary to properly run the four models. Such collected data, as model input, must be accessible to the user in order to use or modify them. In this document, MEDEAS database is described, regarding different features. First, the design and structure of the database is described, both for the database itself and its corresponding metadata. Secondly, data collection and characteristics for each topic in the database are explained. Finally, we describe the structure and functionalities for users and managers of the MEDEAS Database Management System (DBMS).

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List of abbreviations and acronyms

BEV – Battery Electric Vehicle

CHP – Combined Heat and Power

CSP – Concentrated Solar Power

CTL – Coal To Liquids

DBMS- Database management System

DCMI - Dublin Core Metadata Initiative

EROI – Energy Return Of Investment

GDP – Gross Domestic Product

GHG – Green House Gases

GTL – Gas To Liquids

GVA – Gross Value Added

HEV – Hybrid Electric Vehicle

IEA – International Energy Agency

IOA – Input-Output Analysis

IOT – Input-Output Tables

LDV – Light Duty Vehicles

NGV – Natural Gas Vehicle

NR – Natural Resources

PAV – Partially aggregated variable

RES – Renewable Energy Sources

TPES – Total Primary Energy Supply

WIOD - World Input-Output Database

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Executive summary

MEDEAS database is a key and strategic part of the project, not only for the model implementation and design but also for the overall project. To have enough data in a flexible database is a key stone foundation also for evidence-based impact of Renewable Energy Sources (RES) transition evaluation and to construct a solid narrative for policy implementation in the RES transition in Europe, which is one of the main outcomes of MEDEAS. The database elaboration and their architecture must be reliable, transparent and public allowing a continuous update of all the data constituting the economic and energetic framework. Such database should also be manageable in terms of shared competences between the Regional and local level. Therefore, this deliverable describes the MEDEAS database and its Database Management System (DBMS). MEDEAS database consists of data collected from different sources and information associated with this data as metadata. The DBMS is the application constructed to manage, view and use MEDEAS database.

Most of the data are annual time series that correspond to the different model modules such as socioeconomic, environmental, energy, transport or material resources data used by the MEDEAS model. The main 'brick' on which the structure of the database is based is the Partially Aggregated Variable (PAV) and are organised by topics and disaggregated in a number of variables under different disaggregation levels. PAVs, disaggregation levels and variables generate the total entries in the databases. There are 158 PAVs, 161 disaggregation levels and 3188 variables. Not all PAVs are disaggregated in the same way (actually some of them are not at all) but this causes the total number of entries to increase up to 3507 variables in MEDEAS World database starting from only 158 PAVs. Europe, Austria and Bulgaria databases accounts with 5755 additional entries. Overall, MEDEAS database has 9262 entries. Annex I-IV summarises information, sources and comments on PAVs.

The web database management system (DBMS) allows partners to store, retrieve and manage the data collected, elaborated and generated within MEDEAS project. The DBMS has been designed, implemented and installed by CRES.

The design and development of the whole application consists of three components, namely the first layer, which is the database, the middle layer, which refers to the functionality of the management system and the front end, which is the user interface.

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The design and development of the database was based on the “entity - attribute – value” model. Within this context, the entity is one among "World", "EU", “Austria” or “Bulgaria” and the attribute is the specific entry. In this model, the entries are organized in a tree, whereas provisions are made, so that the history of changes for each entry is stored and readily available. Moreover, for each entry the relevant metadata are stored.

The DBMS selected to develop this application was MariaDB, a fork of the MySQL that intends to maintain high compatibility with MySQL and remain free under the GNU GPL. In terms of functionality, a J2EE library (.jar files) has been designed and developed to provide the expected functionalities, i.e., storage of the value of a specific entry; retrieval of value of a specific entry; creation of a new entry, and retrieval of data needed for report generation, for this purpose a Java API has been designed and implemented that, given one or more entries and some metadata, retrieves the relevant data.

Finally, we designed and developed a web application that exposes the layer 2, functionality to the web user, making MEDEAS database accessible through an authentication system with password. Emphasis has been given in the simplicity and robustness of the application.

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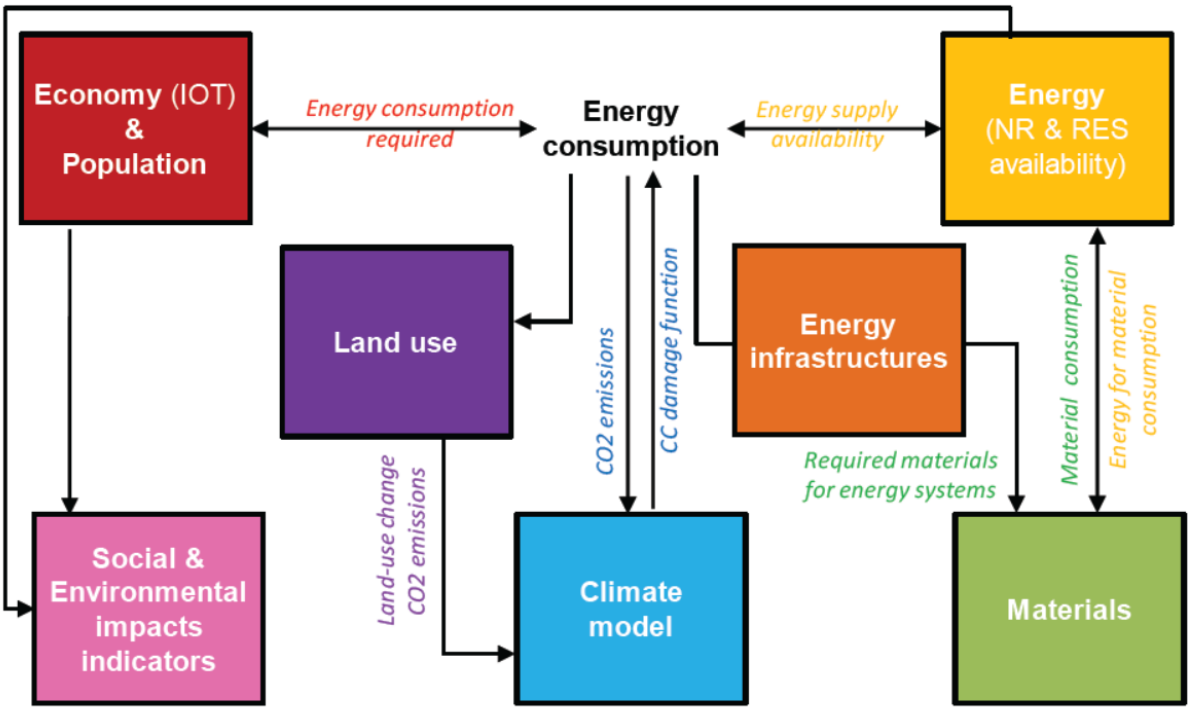
1. Introduction

The global aim of MEDEAS project is to provide policy makers and stakeholders with a new tool, to better assess the impacts and limitations of the EU energy production/consumption system transition to a low-carbon sustainable socio-economy. For this purpose, MEDEAS (World, Europe, Austria and Bulgaria) is a simulation model based on system dynamics that allows assessing complexity and dynamic interrelation of relevant variables. These models (one for each regional level) need to be fed by multidimensional data, regarding the different modules in the model. Although it has been taken into consideration other models' needs, the reference list of modules used for collecting data is that of MEDEAS World. These modules are the following: i/ Energy infrastructures, ii/ Economy and Population, iii/ Materials, iv/ Climate model, v/ Land use, vi/ Social and environmental impacts indicators, vii/ Energy (NR and RES availability). These modules and their fundamental intertwines are shown in Figure 1.

Figure 1. Overview of MEDEAS model modules and their fundamental intertwines.



MEDEAS database has two objectives. The first is to feed the models of MEDEAS. The second is to provide the user an easy, transparent tool in order to check our models and modify them. Accomplishing these objectives require not only a user-friendly DBMS, but a clear design and proper information of the data used. Thus, additionally to data collection, metadata have been

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collected for each entry. Annex I-IV summarizes metadata for all regional levels (World, Europe, Austria and Bulgaria) and entries. Partially Aggregated Variables (PAVs), disaggregation levels and variables generate the total entries in the database delivered. These PAVs are organised by topics and disaggregated in a number of variables under different disaggregation levels.

A large database collecting information about the historical trends or values of the PAVs, disaggregation levels and variables used in the model is necessary. Moreover, the evaluation of the results requires the assumption of values for these entries, which can change among scenarios. Thus, a key task in MEDEAS is collecting and organizing this data. In addition, as the project intends to be open to changes by the public, this information must be transparent, accessible and easy to modify. Thus, the construction of MEDEAS database is the main objective of this deliverable

The construction of the database has been split in two main sub-tasks: Data collection and Database Management System (DBMS). In order to coordinate the work, UVa designed and collected the data for the Database in spreadsheets files, then, this work was delivered to CRES, which used it to construct the DBMS. This Deliverable describes the process followed to construct the database, it is structured in two sections, one for each sub-task. Section 2 describes the process of database design and data collection. Section 3 describes the structure and functionalities of the DBMS.

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2. Metada and Data collection

Data collection encompasses three different steps. In the first step, data collected is explained according to topics. In a second step, the metadata of the database is provided, it gives information about the data and its sources. Finally, the data in the original source may have different units than those used in the models, so sometimes a change of units is necessary. This section explains the organization of MEDEAS database and the details of data collection, including its metadata. World, Europe, Austria and Bulgaria metadata information can be seen in Annex I-IV

Data have been collected in spreadsheets particularly designed with the objective to facilitate the transfer to the DBMS and make it easy to be managed by users. In addition, metadata have also been specifically designed to provide the user important and useful information about the data used by MEDEAS. Table 1 shows metadata categories.

Table 1. Categories in metadata from MEDEAS database

Category	Information
Region	Regional level
PAV	Name of PAV.
Id	Code of identification.
Topic	The different topics of database.
Type of variable	Exogenous or endogenous
Units	Units of each entry.
Source	The source of data.
Link	Link to the web's data source.
License	Public domain / Private domain.
Last source update	The date when the original data source updated its data for the last time.
Date collection	The date when data was collected from the sources.
Data period	Time period for which data was collected or calculated and to which the data refer
Reliability	Reliability index according to different criteria.
Comments	Clarifications and description necessary to properly understand the entries.
Type of value	Historical data series, parameter, constant, scenario parameter.

Next, we will describe all the categories in metadata. In this way we show which data is in the database, how is related with the MEDEAS models and how is collected.

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2.1 Region

MEDEAS database is structured in 3 different regional levels: World, Europe and Country (Austria and Bulgaria). Although models for Europe, Austria and Bulgaria have not been developed yet, its future needs have been taken into consideration.

This Deliverable mainly describes the World MEDEAS database; the data for other regional levels (Europe, Austria and Bulgaria) has the same characteristics than the World level, but also includes data on trade with other regions. For the World regional level there are no commercial relationships because it is a closed system from the point of view of trade.

Europe, Austria and Bulgaria databases accounts with 5755 additional entries to the World database. Thus, MEDEAS databases (at three geographical levels) have in total 9262 entries.

As one of the MEDEAS database's objectives is feeding the models, Europe, Austria and Bulgaria level will probably be extended in the future throughout the DBMS. Currently such three geographical domains only have topics: Socioeconomic, Resources-Economy, Land Use, Energy consumption by sectors, Commerce and Energy (energy trade). There are 1911 entries for Europe, and 1922 for Austria and Bulgaria, with the same structure (for metadata fields) as in World level.

2.2 PAV

Originally the World MEDEAS database sent in December 2016 contained 2590 entries. In this final version, 782 of these entries have been eliminated. Some because they are outputs that the model obtains and others are not used in the model. Of the 1808 remaining entries, the data or its metadata have been modified in a large number of them. As a result, the new World MEDEAS database has 3188 variables, plus 158 PAVs and 161 disaggregation levels. Thus, in total, MEDEAS World database accounts 3507 entries. Table 2 shows the list of PAVs in World MEDEAS database. As mentioned before, the databases 'entries' column collects three types of information: PAVs, disaggregation levels and variables; the number of each of them for each PAV can be seen in table 2.

Table 2. List of PAVs in MEDEAS database with their assigned identification code and grouped by topics

Topic	id	PAV	PAV + disaggregation levels + variables
Socioeconomic	1.00.00	GDP (Final demand)	1 + 0 + 35

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Topic	id	PAV	PAV + disaggregation levels + variables
Socioeconomic	2.00.00	Production	1 + 0 + 35
Socioeconomic	3.00.00	Inequality indicators	1 + 0 + 2
Socioeconomic	4.00.00	Income	1 + 0 + 2
Socioeconomic	5.00.00	Population	1 + 0 + 0
Socioeconomic	6.00.00	Life expectancy at birth	1 + 0 + 0
Socioeconomic	7.00.00	Urban population	1 + 0 + 0
Socioeconomic	8.00.00	Rural population	1 + 0 + 0
Socioeconomic	9.00.00	Unemployment rate	1 + 0 + 0
Socioeconomic	10.00.00	Energy dependency	1 + 0 + 0
Socioeconomic	11.00.00	Technical coefficients	1 + 35 + 1225
Resources-Economy	12.00.00	Final energy consumption per capita	1 + 0 + 0
Resources-Economy	13.00.00	Water consumption	1 + 0 + 3
Resources-Economy	14.00.00	Water intensity	1 + 3 +18
Resources-Economy	15.00.00	Material consumption	1 + 0 + 0
Resources-Economy	16.00.00	Primary energy intensity	1 + 4 + 144
Resources-Economy	17.00.00	Final energy intensity	1 + 5 + 180
Land use	18.00.00	Food land	1 + 0 + 0
Land use	19.00.00	Forest land	1 + 0 + 0
Land use	20.00.00	Biodiversity protection land	1 + 0 + 0
Land use	21.00.00	Urban land area	1 + 0 + 0
Land use	22.00.00	Biofuel and bioelectricity land	1 + 0 + 0
Land use	23.00.00	Arable and cropland, % total land area	1 + 0 + 0
Land use	24.00.00	Pastures and meadows, % total land area	1 + 0 + 0
Land use	25.00.00	Forest, % total land area	1 + 0 + 0
Land use	26.00.00	Other land, % total land area	1 + 0 + 0
Energy consumption by sectors	27.00.00	Final Energy Consumption (FEC)	1 + 5 + 180
Materials	28.00.00	Mineral production	1 + 0 + 20
Materials	29.00.00	Kg material per new MW installed (construction phase)	1 + 7 + 406
Materials	30.00.00	Kg material per new MW installed (Operation and maintenance)	1 + 4 + 68
Materials	31.00.00	Initial energy consumption per unit of material consumption	1 + 2 + 116
Materials	32.00.00	Total reserves	1 + 0 + 58
Materials	33.00.00	Total resources	1 + 0 + 58
Emission and Climate	34.00.00	CO2 emissions from different activities	1 + 0 + 6
Emission and Climate	35.00.00	Nitrous oxide emissions	1 + 0 + 0
Emission and Climate	36.00.00	Increase in total radiative forcing in relation to pre-industrial levels	1 + 0 + 0
Emission and Climate	37.00.00	CH4 emissions	1 + 0 + 0
Emission and Climate	38.00.00	CO2 concentration levels	1 + 0 + 0

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Topic	id	PAV	PAV + disaggregation levels + variables
Emission and Climate	39.00.00	Global mean temperature increase	1 + 0 + 0
Emission and Climate	40.00.00	GHG emissions	1 + 0 + 15
Electricity transformation	41.00.00	Hydroelectricity pumped storage capacity	1 + 0 + 0
Electricity transformation	42.00.00	Hydroelectricity pumped storage energy production	1 + 0 + 0
Electricity generation from RES variables	43.00.00	Installed capacity of electrical RES	1 + 0 + 8
Electricity generation from RES variables	44.00.00	Electricity cost from RES	1 + 0 + 7
Electricity generation from RES variables	45.00.00	RES lifetime	1 + 0 + 9
Energy historical data	46.00.00	Percentage CHP plants vs total heat output	1 + 0 + 0
Energy historical data	47.00.00	Percentage gas in fossil CHP plants	1 + 0 + 0
Energy historical data	48.00.00	Percentage solids in fossil CHP plants	1 + 0 + 0
Energy historical data	49.00.00	Percentage liquids in fossil CHP plants	1 + 0 + 0
Energy historical data	50.00.00	Extraction resources	1 + 0 + 4
Energy historical data	51.00.00	Share resources by sector	1 + 0 + 2
Energy historical data	52.00.00	Alternative transport	1 + 0 + 2
Energy historical data	53.00.00	Annual generation liquids RES	1 + 0 + 1
Energy historical data	54.00.00	Capacity installed RES for non-commercial heat	1 + 0 + 3
Energy historical data	55.00.00	Capacity installed RES for commercial heat	1 + 0 + 3
Energy historical data	56.00.00	Nuclear generation TWh	1 + 0 + 0
Energy historical data	57.00.00	Efficiency gas for electricity	1 + 0 + 0
Energy historical data	58.00.00	Electricity consumption	1 + 0 + 0
Energy historical data	59.00.00	Share gas vs (coal + gas) heat	1 + 0 + 0
Energy historical data	60.00.00	Non energy use	1 + 0 + 4
Energy historical data	61.00.00	Losses	1 + 0 + 3
Energy historical data	62.00.00	Transformation losses	1 + 0 + 3
Energy historical data	63.00.00	TPES primary solids biofuels	1 + 0 + 0
Energy historical data	64.00.00	Waste	1 + 0 + 0
Energy historical data	65.00.00	Efficiencies	1 + 0 + 9
Energy historical data	66.00.00	Losses in Charcoal plants	1 + 0 + 0
Energy historical data	67.00.00	Peat	1 + 0 + 0
Energy historical data	68.00.00	Biogases	1 + 0 + 0
Historic constants	69.00.00	BEV/HEV past share growth	1 + 0 + 0
Historic constants	70.00.00	NGV past share growth	1 + 0 + 0
Historic constants	71.00.00	Biofuels past growth	1 + 0 + 0
Historic constants	72.00.00	Historical growth CTL	1 + 0 + 0
Historic constants	73.00.00	Historical growth GTL	1 + 0 + 0
Historic constants	74.00.00	Hydro past capacity growth	1 + 0 + 0
Historic constants	75.00.00	Geothermal past capacity growth	1 + 0 + 0
Historic constants	76.00.00	Solid bioE-elec	1 + 0 + 0

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Topic	id	PAV	PAV + disaggregation levels + variables
Historic constants	77.00.00	Oceanic past capacity growth	1 + 0 + 0
Historic constants	78.00.00	Wind onshore past capacity growth	1 + 0 + 0
Historic constants	79.00.00	Wind offshore past capacity growth	1 + 0 + 0
Historic constants	80.00.00	Solar PV past capacity growth	1 + 0 + 0
Historic constants	81.00.00	CSP past capacity growth	1 + 0 + 0
Historic constants	82.00.00	Cumulated conventional oil extraction to 1995	1 + 0 + 0
Historic constants	83.00.00	Cumulated unconventional oil extraction to 1995	1 + 0 + 0
Historic constants	84.00.00	Cumulated conv gas extraction to 1995	1 + 0 + 0
Historic constants	85.00.00	Cumulated unconventional gas extraction to 1995	1 + 0 + 0
Historic constants	86.00.00	Cumulated coal extraction to 1995	1 + 0 + 0
Historic constants	87.00.00	Cumulated uranium extraction to 1995	1 + 0 + 0
Historic constants	88.00.00	Past solar growth for heat-commercial	1 + 0 + 0
Historic constants	89.00.00	Past geothermal growth for heat-commercial	1 + 0 + 0
Historic constants	90.00.00	Past solid bioE-heat-commercial	1 + 0 + 0
Historic constants	91.00.00	Past solar growth for heat-no-commercial	1 + 0 + 0
Historic constants	92.00.00	Past geothermal growth for heat-no-commercial	1 + 0 + 0
Historic constants	93.00.00	Past solid bioE-heat-no-commercial	1 + 0 + 0
Historic constants	94.00.00	Cumulative emissions 1751-1995	1 + 0 + 0
Renewable & Nuclear Energy Parameters	95.00.00	Power density	1 + 0 + 6
Renewable & Nuclear Energy Parameters	96.00.00	Life time	1 + 0 + 12
Renewable & Nuclear Energy Parameters	97.00.00	Capacity factor initial	1 + 0 + 12
Renewable & Nuclear Energy Parameters	98.00.00	Investment cost	1 + 0 + 9
Renewable & Nuclear Energy Parameters	99.00.00	Time planification	1 + 0 + 9
Renewable & Nuclear Energy Parameters	100.00.00	Time construction	1 + 0 + 9
Renewable & Nuclear Energy Parameters	101.00.00	Min Cp (Coefficient of Power)	1 + 0 + 9
Renewable & Nuclear Energy Parameters	102.00.00	EROI initial	1 + 0 + 6
Renewable & Nuclear Energy Parameters	103.00.00	Employment factors RES	1 + 2 + 22
Other parameters	104.00.00	Energy shares by sector	1 + 0 + 2
Other parameters	105.00.00	Efficiencies	1 + 0 + 12
Other parameters	106.00.00	Energy losses	1 + 0 + 2
Other parameters	107.00.00	Bioenergy	1 + 0 + 6
Other parameters	108.00.00	Life time RES Thermal	1 + 0 + 0
Other parameters	109.00.00	Alternative transport	1 + 0 + 2
Other parameters	110.00.00	Grid reinforcement costs ref	1 + 0 + 0

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Topic	id	PAV	PAV + disaggregation levels + variables
Other parameters	111.00.00	Oil refinery gains share	1 + 0 + 0
Other parameters	112.00.00	Tpefpc threshold high development	1 + 0 + 0
Other parameters	113.00.00	TPED acceptable standard living	1 + 0 + 0
Other parameters	114.00.00	Prop heat distribution losses	1 + 0 + 0
Other parameters	115.00.00	Waste	1 + 0 + 8
Other parameters	116.00.00	Biogas	1 + 0 + 8
Other parameters	117.00.00	Climate parameters	1 + 0 + 11
Other parameters	118.00.00	Share traditional biomass vs solids in households	1 + 0 + 0
Other parameters	119.00.00	Efficiency solar panels for heat	1 + 0 + 0
Other parameters	120.00.00	Losses solar for heat	1 + 0 + 0
Other parameters	121.00.00	Efficiency geothermal for heat	1 + 0 + 0
Other parameters	122.00.00	EV batteries	1 + 0 + 4
Other parameters	123.00.00	Pumped hydro storage (PHS)	1 + 0 + 3
Other parameters	124.00.00	Materials	1 + 0 + 2
Other parameters	125.00.00	EROI NRE fuels	1 + 0 + 6
Other parameters	126.00.00	Heat demand	1 + 2 + 7
Other parameters	127.00.00	Lifetime CTL	1 + 0 + 0
Other parameters	128.00.00	Lifetime GTL	1 + 0 + 0
Transport	129.00.00	Household vehicles	1 + 2 + 6
Transport	130.00.00	Commercial vehicles	1 + 4 + 11
Transport	131.00.00	Share of household vehicles	1 + 2 + 6
Transport	132.00.00	Share of commercial vehicles	1 + 4 + 12
Transport	133.00.00	Energy used in Households vehicles	1 + 2 + 6
Transport	134.00.00	Energy used in commercial vehicles	1 + 4 + 13
Transport	135.00.00	Saving ratios of alternative HOUSEHOLDS vehicles relative to liquids vehicles	1 + 2 + 6
Transport	136.00.00	Saving ratios of alternative COMMERCIAL vehicles relative to liquids vehicles	1 + 4 + 13
Transport	137.00.00	Batteries ratio	1 + 5 + 4
Scenarios	138.00.00	Trend demand (all sectors)	1 + 2 + 10
Scenarios	139.00.00	Waste	1 + 2 + 10
Scenarios	140.00.00	Intensities	1 + 1 + 5
Scenarios	141.00.00	Minerals	1 + 2 + 10
Scenarios	142.00.00	Nuclear	1 + 1 + 5
Scenarios	143.00.00	Techno-ecological potential electric RES	1 + 7 + 35
Scenarios	144.00.00	Projection electric RES	1 + 8 + 40
Scenarios	145.00.00	Bioenergy	1 + 15 + 75
Scenarios	146.00.00	Techno-ecological potential RES for heat	1 + 2 + 10
Scenarios	147.00.00	Projection RES for heat	1 + 3 + 15
Scenarios	148.00.00	Alternative transport	1 + 3 + 15
Scenarios	149.00.00	Afforestation	1 + 1 + 5

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Topic	id	PAV	PAV + disaggregation levels + variables
Scenarios	150.00.00	Resources oil	1 + 4 + 20
Scenarios	151.00.00	Resources gas	1 + 4 + 20
Scenarios	152.00.00	Resources coal	1 + 1 + 5
Scenarios	153.00.00	Resources uranium	1 + 1 + 5
Scenarios	154.00.00	CTL	1 + 1 + 5
Scenarios	155.00.00	GTL	1 + 1 + 5
Scenarios	156.00.00	Climate	1 + 1 + 5
Scenarios	157.00.00	CC impacts	1 + 1 + 5
Scenarios	158.00.00	Policies to reduce oil contribution in heat and electricity following linear decreasing trend	1 + 2 + 10

2.3 Id

As mentioned before, MEDEAS database has a high disaggregation level in their PAVs. Some of them (there are PAVs which do not need any disaggregation) can have a disaggregation level which organises the variables amongst different types. All of them are the entries in database,+ which are translated into the DBMS. Several examples are provided in Table 3 and in this section.

Each entry has one identification code. There are no more than three levels for each PAV, which are identified (column id) by their respective identification code. The different disaggregation levels of the entries were encoded by numbers (00–99), thus this identification code will report these three levels following this structure: xx.xx.xx. The first level corresponds to the PAV, and the second and third level corresponds to the different levels of disaggregation because each PAV can be disaggregated in a number of variables. Second level can be a disaggregation level when there is no data in it, but also a variable when there is data. Third level is always a variable including data.

For instance, the PAV with identification code 1.00.00 and called 'GDP (Final Demand)' has been disaggregated by economic sectors (Table 5) into 35 new variables from 1.01.00 to 1.35.00; and the PAV with identification code 29.00.00 and called 'Kg material per new MW installed (construction phase)' has been disaggregated by 7 energy technologies from 29.01.XX to 29.07.XX and by 58 materials (Table 7) from 29.XX.01 to 29.XX.58 resulting in 7 disaggregation levels plus 406 (58x7) variables.

Table 3 shows examples on how entries are assigned a with three level identification code. 'Id' column shows the identification code. 'Entries' is the column with the name of the entry. 'Type of

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entry' column shows if the entry is a PAV, a disaggregation level or a variable. The column 'Data provided' explains the information of each entry, this information will be provided by DBMS.

Table 3. Examples of disaggregation levels of entries in MEDEAS database and their identification codes.

Id	Entries	Type of entry	Data provided
17.00.00	Final Energy Intensity	PAV	Final energy intensity (Total)
17.01.00	Final Energy Intensity _Electricity	Disaggregation level. Second disaggregation level. More levels.	Final energy intensity by source (Electricity)
17.01.01	Agriculture, Hunting, Forestry and Fishing	Variable. Third disaggregation level. Includes data. No more levels.	Final energy intensity by source (Electricity) and sector (Agriculture, Hunting, Forestry and Fishing)
17.01.02	Mining and Quarrying	Variable. Third disaggregation level. Includes data. No more levels.	Final energy intensity by source (Electricity) and sector (Mining and Quarrying)
17.02.00	Final Energy intensity_Heat	Disaggregation level. Second disaggregation level. More levels.	Final energy intensity by source (Heat)
17.02.03	Food, Beverages and Tobacco	Variable. Third disaggregation level. Includes data. No more levels.	Final energy intensity by source (Heat) and sector (Food, Beverages and Tobacco)
17.03.04	Textiles and Textile Products	Variable. Third disaggregation level. Includes data. No more levels.	Final energy intensity by source (Liquids) and sector (Textiles and Textile Products)
28.00.00	Mineral production	PAV	Mineral production (Total)
28.01.00	Silver (Ag)	Variable. Second disaggregation level. Includes data. No more levels	Mineral production by mineral (Silver)

Disaggregation levels not always include data when their only utility is labelling the disaggregated data under its title, then the variables are included under these disaggregation levels or PAVs (when there is no need to use disaggregation levels).

In some cases, the PAV is enough to provide the data, as there is no disaggregation in it. For instance, PAV 29.00.00, 'Kg material per new MW installed (construction phase)' in Materials topic has 7 disaggregation levels according different energy technologies and 58 materials in each disaggregation level. Their commitment is separating the materials used in energy infrastructures construction by technologies. However, there is no data nor in the PAV, neither in the 7 disaggregation levels, but in the 406 variables.

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2.4 Topic

MEDEAS database (both data and metadata) is organized by Topics. These topics (Table 4) are related to the modules in MEDEAS model showed in Figure1 (i/ Energy infrastructures, ii/ Economy and Population, iii/ Materials, iv/ Climate model, v/ Land use, vi/ Social and environmental impacts indicators, vii/ Energy (NR and RES availability)).

Each topic has a number of PAVs collected (Table 2) regarding the model needs. The topics put together all the entries that feed each module of the model. In each topic, PAVS are collected in addition to their levels of disaggregation and variables.

Table 4. Topics in MEDEAS Database and its number of entries.

Topic	Information	Number of entries
Socioeconomic	Data for the economy module, mainly in monetary units	1345
Resources-Economy	Hybrid variables such as resources intensities related to GDP	363
Land use	Data for the land-use module	9
Energy consumption by sectors	Final and primary energy consumption by sources and industrial sectors. Data for the economy module	186
Materials	Material resources. Data for the materials module	745
Emissions and climate	Data for the climate module	28
Electricity transformation	Data for the energy infrastructures module	2
Electricity generation from RES variables	Data for the energy (NR and RES availability) module	27
Energy historical data	Data for the energy infrastructures module and for the energy (NR and RES availability) module	57
Historic constants	Constants needed in the models	26
Renewable & Nuclear Energy Parameters	Parameters for the energy (NR and RES availability) module	105
Other parameters	Parameters needed in the models	100
Transport	Data for the economy module related with transport	115
Scenarios	Scenarios data considered in the models	399

Details on the different entries contained in each topic will be discussed below.

Socioeconomic: Here we can find data related with final demand, production, primary income distribution or the values for the coefficient matrix of the Input-Output tables (IOTs). Final demand and GDP are disaggregated by 35 economic sectors (Table 5). Inequality indicators refer to the

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income share over GDP of labour and capital. Thus, PAV Income collects labour and capital income.

Collection of a large share of socioeconomic data depends on working with the World Input-Output Database WIOD. One of the main strengths of MEDEAS is its sectorial disaggregation and Input-Output Analysis (IOA). For this purpose, the WIOD was chosen because it met all these requirements: public database, available at world level and inclusion of environmental (Genty 2012) and societal (Timmer et al. 2015) satellite accounts. WIOD provides interregional IOTs in current and in previous year prices. The process to obtain a world IOT as if it was just one country has involved two tasks:

- Deflate interregional IOTs using value chains with a common base year (1995).
- Compile deflated interregional IOTs into a one region with no external trade.

Hence, firstly, interregional IOTs were deflated using value chains methodology. Then, in collaboration with Masaryk University (MU), interregional IOTs (see Figure 2) had to be translated to one region IOT.

Figure 2. National and Interregional IOTs to construct World MEDEAS IOTs.

National IOT

Industry demand	Final demand		Total
IC^N	FD^N	FD^{FN}	X^N
IC^F	FD^{NF}		
VA^N			
X^N			

Interregional IOT

Industry demand			Final demand			Total
$IC^{1,1}$	$IC^{1,\cdots}$	$IC^{1,n}$	$FD^{1,\cdots}$	$FD^{1,1}$	$FD^{1,n}$	X^1
$IC^{\cdots,1}$	$IC^{\cdots,\cdots}$	$IC^{\cdots,n}$	$FD^{\cdots,1}$	$FD^{\cdots,\cdots}$	$FD^{\cdots,n}$	$X^{\cdots}$
$IC^{n,1}$	$IC^{n,\cdots}$	$IC^{n,n}$	$FD^{n,1}$	$FD^{n,\cdots}$	$FD^{n,n}$	X^n
VA^1	$VA^{\cdots}$	VA^n				
X^1	$X^{\cdots}$	X^n				

IC: Intermediate consumption; FD: Final demand; VA: Value added; X: Production. National IOT superscripts: N: National; FN: foreign in national; NF: National in foreign.

In order to fit with the world model, this interregional IOT needs to be converted into a one region IOT without external trade, like in Figure 3. As well, for the Europe database, from the interregional IOT there has been necessary to convert it into a 2 regions IOT. These 2 regions IOT consists on an interregional IOT with just 2 regions: Europe and Rest of the world (collecting external trade). For country level, conversely, it has been constructed a national IOT. All these

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structural changes imply different accounting systems in the IOTs, which has required an additional work to collect the data needed in the model.

Figure 3. World IOT used in MEDEAS.

Industry demand	Final demand	Total
IC^W	FD^W	X^W
VA^W		
X^W		

IC: Intermediate consumption; FD: Final demand; VA: Value added; X: Production.

Using this source has conditioned the election of the sectorial disaggregation. Besides, additional work has been needed in order to compile WIOD energy sources into those needed in the model. The 35 sectors that can be seen along the database are collected in Table 5.

Table 5. Sectorial distribution in MEDEAS database

Sectors			
1	Agriculture, Hunting, Forestry and Fishing	18	Construction
2	Mining and Quarrying	19	Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel
3	Food, Beverages and Tobacco	20	Wholesale Trade and Commission Trade, Except of Motor Vehicles
4	Textiles and Textile Products	21	Retail Trade, Except of Motor Vehicles ; Repair of Household Good
5	Leather, Leather and Footwear	22	Hotels and Restaurants
6	Wood and Products of Wood and Cork	23	Inland Transport
7	Pulp, Paper, Paper , Printing and Publishing	24	Water Transport
8	Coke, Refined Petroleum and Nuclear Fuel	25	Air Transport
9	Chemicals and Chemical Products	26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
10	Rubber and Plastics	27	Post and Telecommunications
11	Other Non-Metallic Mineral	28	Financial Intermediation
12	Basic Metals and Fabricated Metal	29	Real Estate Activities
13	Machinery, Nec	30	Renting of M&Eq and Other Business Activities
14	Electrical and Optical Equipment	31	Public Admin and Defence; Compulsory Social Security
15	Transport Equipment	32	Education
16	Manufacturing, Nec; Recycling	33	Health and Social Work
17	Electricity, Gas and Water Supply	34	Other Community, Social and Personal Services
		35	Private Households with Employed Persons

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The PAV corresponding to Technical Coefficients (PAV 11.00.00) has the largest set of entries in MEDEAS. It is usually given as panel data, as it reflects commercial transactions between these 35 industrial sectors (a 35x35 matrix) repeated for the entire time sample. As it is collected as time series, each sector's relation with the other 34 is one variable. Therefore, PAV 11.00.00 has 25 disaggregation levels and 1225 (35x35) variables. For the sake of simplicity, sectorial data with equal metadata than its root PAV, it is not included in the metadata. Socioeconomic topic includes 1345 entries at world level.

Resources-Economy: Includes hybrid indicators, as the efficiencies in primary and final energy consumption regarding each sector production. Efficiencies are disaggregated by industrial sectors and types. For instance, energy intensities are unbundled according to energy sources. Final energy sources are: i/ electricity; ii/ heat; iii/ liquids; iv/ gases; v/ solids. Primary energy is disaggregated in: i/ coal; ii/ oil; iii/ natural gas; iv/ other. This topic encompasses 363 entries.

Land use: we have registered the land area and share of land use: food land, forest, biodiversity protection land, pastures, biofuels land, arable land and others as energy infrastructures for the spread of renewable technologies. There is the same number of entries than PAVs because there is no disaggregation, this is 9 entries.

Energy consumption by sectors: due to its especial relevance, in this section we include data about the final energy consumption within different sources and economy sectors. As mentioned before regarding energy intensities, final energy consumption is disaggregated by 5 final energy sources and 35 industrial sectors plus household consumption, resulting in 186 entries. Aggregated energy sources used in MEDEAS and their original disaggregation are shown in Table 6.

Finally, in order to aggregate energy data in a proper way to fit in MEDEAS model, WIOD sources have been contrasted with IEA sources to compile new types of final energy. Table 6 shows Final energy sources. MEDEAS column show the energy source in MEDEAS, which has been constructed aggregating WIOD energy sources. WIOD energy sources, in turn, need to be contrasted with IEA balances.

Table 6. Conversion of WIOD final energy sources to MEDEAS

MEDEAS	WIOD CODE	IEA
ELECTRICITY	ELECTRICITY	Electricity
HEAT	HEAT	Heat

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LIQUIDS	CRUDE	Crude oil - Natural gas liquids - Refinery feedstocks - Additives/blending components - Other hydrocarbons
	DIESEL	Gas/Diesel oil exc. Biofuels
	GASOLINE	Motor gasoline excl. Biofuels
	JETFUEL	Aviation gasoline - Gasoline type jet fuel -Kerosene type jet fuel excl. Biofuels
	LFO	Gas/Diesel oil
	HFO	Fuel oil
	NAPHTA	Naphtha
	OTHPETRO	Bitumen - Ethane -Liquefied petroleum gases (LPG) - Lubricants -Other oil products -Other kerosene -Paraffin waxes -Petroleum coke -Refinery gas -White spirit & SBP
	BIOGASOL	Bio-gasoline -Other liquid biofuels
	BIODIESEL	Biodiesels
GASES	NATGAS	Natural gas
	OTHGAS	Blast furnace gas -Coke oven gas -Gas works gas -Coal gases non-specified -Other recovered gases
	BIOGAS	Biogases
SOLIDS	HCOAL	Anthracite - Other bituminous coal - Coking coal - Patent fuel - Sub-bituminous coal
	BCOAL	BKB - Coal tar - Lignite - Peat - Peat products
	COKE	Gas coke - Coke oven coke
	WASTE	Industrial waste - Municipal waste (renewable) - Municipal waste (non-renewable)
	OTHRENEW	Charcoal - Non-specified primary biomass and waste - Primary solid biomass

Materials: We include here the extraction of critical materials from the point of view of renewable energy generation, as well as the reserves, the recycling rates and the extraction costs in monetary and energy terms. The list of 58 materials in which are disaggregated the PAVs are collected in Table 7. This Topic contains 745 entries.

Table 7. List of 58 materials

MATERIALS		
Adhesive	Lime	Silicon sand
Aluminium (Al)	Limestone	Silicon wafer modules
Aluminium mirrors	Lithium (Li)	Silver (Ag)
Cadmium (Cd)	Lubricant	Tin (Sn)
Carbon fibre	Magnesium (Mg)	Soda ash
Cement	Manganese (Mn)	Steel
Chromium (Cr)	Heavy machinery (depreciation	Synthetic oil

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	and reposition)	
Copper (Cu)	Concrete	Tellurium (Te)
Diesel	Molybdenum (Mo)	Titanium (Ti)
Dy	NaNO3 mined	Titanium dioxide
Electric/electronic components	NaNO3 synthetic	Vanadium (V)
Evacuation lines (KM)	Neodymium (Nd)	Wires
Fiberglass	Nickel (Ni)	Zinc (Zn)
Foam glass	Over grid (15%)	
Gallium (Ga)	Over grid (5%)	
Glass	Paint	
Glass reinforcing plastic (GRP)	Lead (Pb)	
Gravel (roads, protection…)	Plastics	
Indium (In)	Polypropylene	
Iron (Fe)	Rock	
KNO3 mined	Rock wool	
Asphalt	Sand	

Emissions and climate: Includes data concerning to greenhouse gases emissions. These are entries in terms of CO_2 and other gases as CH_4. It includes both atmospheric concentrations and temperature increases. Emissions are disaggregated by sources: oil, unconventional oil, coal, gas and unconventional gas. This topic has 28 entries.

Electricity transformation: Collects storage capacities in only two entries, the same number than PAVs.

Electricity generation from RES variables: Unlike primary energy sources, these are final energy sources. There is data of installed capacity, costs and lifetime for 7 technologies: i/ Wind power (on shore); ii/ Wind power (off shore); iii/ Solar photovoltaic (land); iv/ Hydro power; v/ Solar thermal power; vi/ Geothermal power; vii/ Biomass and waste power; viii/ Solar photovoltaic (rooftop); ix/ Solid bioenergy for electricity; x/ Oceanic. There are 27 entries in this topic.

'Energy historical data', 'Historic constants', 'Renewable & Nuclear Energy Parameters' and 'Other parameters': They are used among all the modules of MEDEAS. There are historical data required to establish trends and other historic constants as well. Then, parameters regarding Renewable & Nuclear Energy and other parameters required for the entries in the model. There are 288 entries in these topics.

Transport: Data about the energy use by each type of vehicle, number of electric and hybrid vehicles, number of batteries, etc. Types of vehicles are disaggregated related to their energy needs: i/ liquids; ii/ gas; iii/ hybrid; iv/ electric vehicle. In order to take into consideration efficiency

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we included information about saving and batteries ratios by type of vehicle. There are 2 and 4 wheels' vehicles, from households and commercial, heavy and light duty, cargos, bus and train. In this topic there are 115 entries.

Scenarios: Collects the data for running the models with the 4 default scenarios. In this topic there are 399 entries.

2.5 Type of Variable

The entries are classified regarding their role in MEDEAS as exogenous or endogenous. The entries that simply feed the model and do not evolve as a result of modeling, are exogenous. Conversely, endogenous are those that vary depending on the evolution of the model. For instance, constants like the rate of recycling does not evolve as consequence of the evolution of other entries in the model. It can be modified among scenarios or through policies, but this modifications are exogenous to the model. On the contrary, Final Energy consumption is a result of the evolution of other entries in the model such as energy availability. Thus, it is endogenous to the model. Finally, 'not clear' are those that play both roles, as historical trends do.

2.6 Units

Units in MEDEAS database have been chosen regarding availability and those that better fit with the model needs. Moreover, units need to be consistent between each other. For instance, monetary units that interact with entries relying on monetary units need to have the same base. WIOD, as one of the main sources of MEDEAS database provide not only entries in monetary units (such as production or final demand), but is used to calculate intensities (final energy intensity, primary energy intensity or water intensity). WIOD database is provided in current and in previous year prices. Deflating this data has been a large process, managing data sources with a sample with a size of 49000 for each year and, thus, a total size of the sample of 735000. Finally, the results obtained where monetary units in 1995 $. The simplified process to obtain monetary time series in the same base unit was the following:

1- From current prices to linkers.

$$L_t = \left(\frac{Curr_{t,t-1}}{Curr_{t-1}}\right) * 100$$

2- From linkers to volume chains.

$$Base\ Year\ (BY) = 100;\ BY_{+1} = linkers; Then: V_t = \frac{V_{t-1} * L_t}{100}$$

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3- From volume chains to constant values.

$$CV_t = \frac{Curr_{BY} * V_t}{100}$$

Where:

$Curr_t$: Value in current prices at year t.
$Curr_{t,t-1}$: Value in previous year prices.
L_t: Linker at year t.
V_t: Volume chain at year t.
CV_t: Constant value at year t.

The database units are collected in Table 8. Unit Title is de name of the unit which is shown for the user when selected in the database and metadata. Each unit title belongs to a quantity title, because each entry can be converted into other units. For instance, Quantity 'Area' is shown in km^2, Mha and kHa. Base unit is the reference unit for the others in each quantity title. Thus, base unit are shown by default. Multipliers for each unit title have been added to the base units in order to make the conversions.

Table 8. List of units in MEDEAS database

UNIT TITLE	QUANTITY	BASE UNIT
Annual growth%	**Annual growth**	**annual growth %**
kHa	Area	km^2
MHa	Area	km^2
km^2	Area	km^2
Mha/EJ	Area per energy	Mha/EJ
TW	Capacity	TW
MW	Capacity	TW
W/m^3	Capacity per area	W/m^2
ºC*m*m/(W*yr)	Climate parameter	ºC*m*m/(W*yr)
ppm	CO2 concentration	ppm
$tonCO_2$	CO_2 Emissions	$GtonCO_2$
$GtonCO_2$	CO_2 Emissions	$GtonCO_2$
$MtonCO_2$	CO_2 Emissions	$GtonCO_2$
GtonCO2/MJ	CO2 Emissions per energy	GtonCO2/MJ
Chained linked volumes, million€(2010)	Commerce volume	Chained linked volumes, million€(2010)
€/kWh	Cost per energy	€/kWh
Dmnl	Dimensionless	Dmnl

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UNIT TITLE	QUANTITY	BASE UNIT
TWe/Mha	Electric TW per area	TWe/Mha
TWe	Electrical Capacity	TWe
jobs/MW	Employment per energy	jobs/MW
EJ	Energy	EJ
TWh	Energy	EJ
TJ	Energy	EJ
TJ/$(1995)	Energy intensity	EJ/$(1995)
EJ/$(1995)	Energy intensity	EJ/$(1995)
kWh/$(1995)	Energy intensity	EJ/$(1995)
TJ/million$(1995)	Energy intensity	EJ/$(1995)
MWh/ha	Energy per area	MWh/ha
EJ/Mha	Energy per area	MWh/ha
kgoe/capita	Energy per capita	kgoe/capita
GJ/capita	Energy per capita	kgoe/capita
MJ/Kg	Energy per mass	MJ/Kg
W/(m2*ºC)	Heat capacity	W/(m2*ºC)
$(1995)/kW	Investment cost	$(1995)/kW
thousand$(1995)/TW	Investment cost	$(1995)/kW
% of total labor force	Labor Force	% of total labor force
Mton	Mass	Mton
ton	Mass	Mton
kton	Mass	Mton
kg/new MW	Mass per capacity	kg/new MW
ton/capita	Mass per capita	ton/capita
GtonCH4/MJ	Methane per energy	GtonCH4/MJ
million$(1995)	Money	million$(1995)
ktonCO$_2$eq	Other gases Emissions	GtonCO$_2$eq
GtonCO$_2$eq	Other gases Emissions	GtonCO$_2$eq
GtonCO$_2$eq/MToe	Other gases Emissions per energy	GtonCO$_2$eq/MToe
%	Percent	%
inhabitants	Population	inhabitants
W/m2	Radiative force	W/m2
ratio input($)/output($)	Technical coefficients	ratio input($)/output($)
ºC	Temperature	ºC
TWth	Thermal Capacity	TWth
vs past trends	Values	vs past trends
million vehicles	Vehicles	ºC

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UNIT TITLE	QUANTITY	BASE UNIT
m^3	Volume	TWth
1000m^3	Volume	vs past trends
m^3/$(1995)	Water intensity	million vehicles
1000m3/million$(1995)	Water intensity	m^3
1000m3/$(1995)	Water intensity	m^3
kW/battery	Watts per battery EV	m^3/$(1995)
yr	Years	m3/$(1995)

2.6 Sources, Link and License

In Table 9 are collected the 48 sources used for the MEDEAS database. Data used in MEDEAS must be of public domain, therefore data sources with copyright protection had required own elaborations and estimations. As one of MEDEAS main requirements is the public availability of all data used, the public domain is expressed explicitly in metadata, the category **license** can be public domain or private domain.

The most important data source by number of data is WIOD (Dietzenbacher et al. 2013), but also World Bank, IEA, OECD, CDIAC, BP, IRENA, etc. Some of the data sources are easy to collect data like 'British Petroleum (BP)', but others require hard work like USGS source for materials because data is provided in yearly independent reports from 1994 to 2016; and some are free and in the public domain (in the sense of intellectual property) like WIOD and some are non-free and have copyright protection like International Energy Agency.

The category **'sources'** explains also the procedure of retrieval, focusing on the institution or the author/s if it is from a paper, report or book. When possible, a **link** to the source where the data was collected is given. The URL given is always the closest to the final data, particularly for cases where is not possible to link them directly.

Table 9. List of sources in MEDEAS database

Source	Link
World Input-Output Database (WIOD)	www.wiod.org
World Bank Group	http://data.worldbank.org/
International Energy Agency	http://www.iea.org/statistics/
Friends Of The Earth	https://www.foe.co.uk/
Food and Agriculture Organization of the United Nations (FAO) -- Statistics Division (ESS),	http://www.fao.org/economic/ess/ess-home/en/

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Source	Link
Environment Statistics team	
Capellán et al. Deliverable D2.2.e.4 (annex 12)	Alfresco (internal server at ICM-CSIC). : https://alf.cmima.csic.es/share/page/
OECD. Green growth indicators	http://www.oecd.org/env/indicators-modelling-outlooks/green-growth-indicators/
United States Geological Survey (USGS)	https://www.usgs.gov/
Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc.ch/
Carbon Dioxide Information Analysis Center (CDIAC)	http://cdiac.ornl.gov/
Global Carbon Project	http://www.globalcarbonproject.org/
NOAA Earth System Research Laboratory	https://www.esrl.noaa.gov/
NASA. Global Climate Change	https://climate.nasa.gov/
Baseline scenario from DICE-2013R	http://www.econ.yale.edu/~nordhaus/homepage/documents/DICE_Manual_100413r1.pdf
Brandt and Farrell (2007)	http://rdcu.be/r5QG
British Petroleum (BP)	http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html
Howarth (2015)	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf
U.S. Energy Information Administration	https://www.eia.gov/
The International Renewable Energy Agency (IRENA)	http://www.irena.org
Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254
Electric Vehicles Initiative (EVI) IEA	http://www.cleanenergyministerial.org/Our-Work/Initiatives/Electric-Vehicles
International Association for Natural Gas Vehicles (IANGV)	http://www.iangv.org/
Lund&Boyer (2015)	Lund, John W., and Tonya L. Boyd. “Direct Utilization of Geothermal Energy 2015 Worldwide Review.” In Proceedings World Geothermal Congress 2015, 31. Melbourne, Australia, 2015.
SolarPACES data	https://www.nrel.gov/csp/solarpaces/
Environmental Working Group (EWG)	http://www.ewg.org
Capellán-Pérez et al. (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720
de Castro et al. (2013)	http://www.sciencedirect.com/science/article/pii/S1364032113005807
REN21 2016	http://www.ren21.net
Boccard (2009)	http://www.sciencedirect.com/science/article/pii/S030142150900144X
Teske et al. (2011)	Teske, Sven, Thomas Pregger, Sonja Simon, Tobias Naegler, Wina Graus, and Christine Lins. 2011. “Energy [R]evolution 2010—a Sustainable World Energy Outlook.” Energy Efficiency 4 (3): 409–33. doi:10.1007/s12053-010-9098-y.
Schneider and Froggatt (2014)	https://www.worldnuclearreport.org/-2014-.html
Annex 3 from MEDEAS D2.1	Alfresco (internal server at ICM-CSIC) : https://alf.cmima.csic.es/share/page/

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Source	Link
Deliverable 4.1	Alfresco (internal server at ICM-CSIC) : https://alf.cmima.csic.es/share/page/
WEO 2010	http://www.worldenergyoutlook.org/media/weo2010.pdf
Mediavilla2013; de Castro et al (2014) and MEDEAS D2.2 Task 2.2.e.4	Alfresco. (internal server at ICM-CSIC) : https://alf.cmima.csic.es/share/page/
Field et al. 2008	https://www.ncbi.nlm.nih.gov/pubmed/18215439
de Castro & Carpintero (2014)	http://www.sciencedirect.com/science/article/pii/S0360544213009018
Mills et al. (2012)	http://escholarship.org/uc/item/1tk2f2mc
Arto et al. (2016)	http://www.sciencedirect.com/science/article/pii/S0973082616301892?via%3Dihub
Goldemberg (2011)	http://econpapers.repec.org/paper/hdrhdocpa/hdocpa-2001-02.htm
DICE model	http://www.econ.yale.edu/~nordhaus/homepage/documents/DICE_Manual_100413r1.pdf
Nielsen & WoLiM 1.5	https://www.researchgate.net/publication/313823551_WoLiM_15_Model_Documentation
Dale & Barnhart (2013)	http://pubs.rsc.org/en/content/articlelanding/2013/ee/c3ee41973h
Denholm and Margolis (2008)	https://inis.iaea.org/search/search.aspx?orig_q=RN:40019299
Ragnarsdóttir et al. (2012)	Ragnarsdóttir, K.V., Sverdrup, H., Koca, D., 2012. Assessing long term sustainability of global supply of natural resources and materials, in: Sustainable Development-Energy, Engineering and Technologies-Manufacturing and Environment. InTech.
Hall et al. (2014)	http://science-and-energy.org/wp-content/uploads/2016/03/Hall-Lambert-and-Balogh-2014-EROI-of-different-fuels-and-the-implications-for-society.pdf
Rao et al. 2014	http://www.nature.com/nclimate/journal/v4/n9/full/nclimate2340.html?foxtrotcallback=true
WBGU 2003	www.wbgu.de/

2.7 Last source update, Date collection and Data period

The category **'last source update'** provides the last update time provided for the original data source collected.

Date collection refers to the date when the data was collected by UVa. If there are further developments, this category will have to be updated.

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A **data period** is the time period for which data was collected or calculated and to which the data refer.

2.8 Reliability index

Reliability index has been calculated according to the algorithm proposed in Table 10. The rationale of the reliability index is to provide a relatively objective criterion to choose a source. Length of the time series, continuity of them, number of sources used and variation of data sources are objective indicators. Variation of data sources (Table 10) refers, in case that more than one source has been used, to the variation between them. Finally, there is a subjective indicator 'reliability of data sources', depending on the institution, paper, or database where the data was collected. This concept has been introduced by AEA (M. Baumann) to harmonize the metadata definition with the concepts already in use in TIMES-Austria model.

Table 10. Reliability algorithm

Category	Possible answers	Scores
1. Length of the time series	1-5 5-10 More than 10	0.7 0.85 1
2. Obvious discontinuities in the time series without obvious explanation	YES NO	0.7 1
3. Number of data sources	1 Several	0.7 1
4. Variations of data sources	0 - 20% 21 – 50% > 50%	1 0.85 0.70
5. Reliability of data sources	Low Medium High	0.7 0.85 1

2.9 Comments and Type of value

Comments: Finally, some clarifications and descriptions are gathered in category comments, in order to make data more comprehensively. For instance, we detail here the estimated and elaborated data for MEDEAS in order to maintain its public domain nature.

Type of value relates to its condition as time series, constant or parameter. Data is organized in time series. Some data, as technical coefficients are usually provided as panel data. However,

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because of the need for homogeneity in the database, it was decided to provide them as time series. In addition, there are some constants or parameters that only require a data entry, with no time dimension. These kind of data has been delivered as just one value in 2015 or, alternatively, repeated throughout all the time sample. Data maximum sample if from 1960 to 2016, but depends on the entry, according mainly to the availability of long series.

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3. Web Database Management System (CRES)

A web database management system that allows partners to store, retrieve and manage the data collected, elaborated and generated within MEDEAS project was designed, implemented and installed in the framework of Deliverable 2.3. The exact work plan and actions for the development of the application are described in the following sections. It is noted that the data center hosting the application will provide infrastructure for running MariaDB along with an application server (Tomcat).

3.1 Work plan

CRES was the responsible partner for designing and developing the whole application, which consisted of three parts, described in the following.

Layer 1 - Database: The design and development of the database was based on the “entity - attribute – value” model. Within this context, the entity is one among "World", "EU", “Austria” or “Bulgaria” and the attribute is the specific entry. In this model, the entries are organized in a tree, whereas provisions were made, so that the history of changes for each entry is stored and readily available. Moreover, for each entry the relevant metadata are stored.

The DBMS selected to develop this application is MariaDB.

Layer 2 - Middle Layer: In terms of functionality, CRES has designed and developed a J2EE library (.jar files) that provides the following functionality, in the form of JSF post-backs:

- Store the value of a specific entry.
- Retrieve the value of a specific entry.
- Create a new entry.
- Retrieve the data needed for report generation. For this purpose a Java API has been designed and implemented, that, given one or more entries and one or more entities (see above) has retrieved the relevant data.

Layer 3 - Front end: CRES has designed and developed a web application that exposes the ‘layer 2’ functionality to the web user. Emphasis has been given in the simplicity and robustness of the application. A user authentication system is also provided at specific application sections, with the initial passwords sent to application users by a separate, secure medium.

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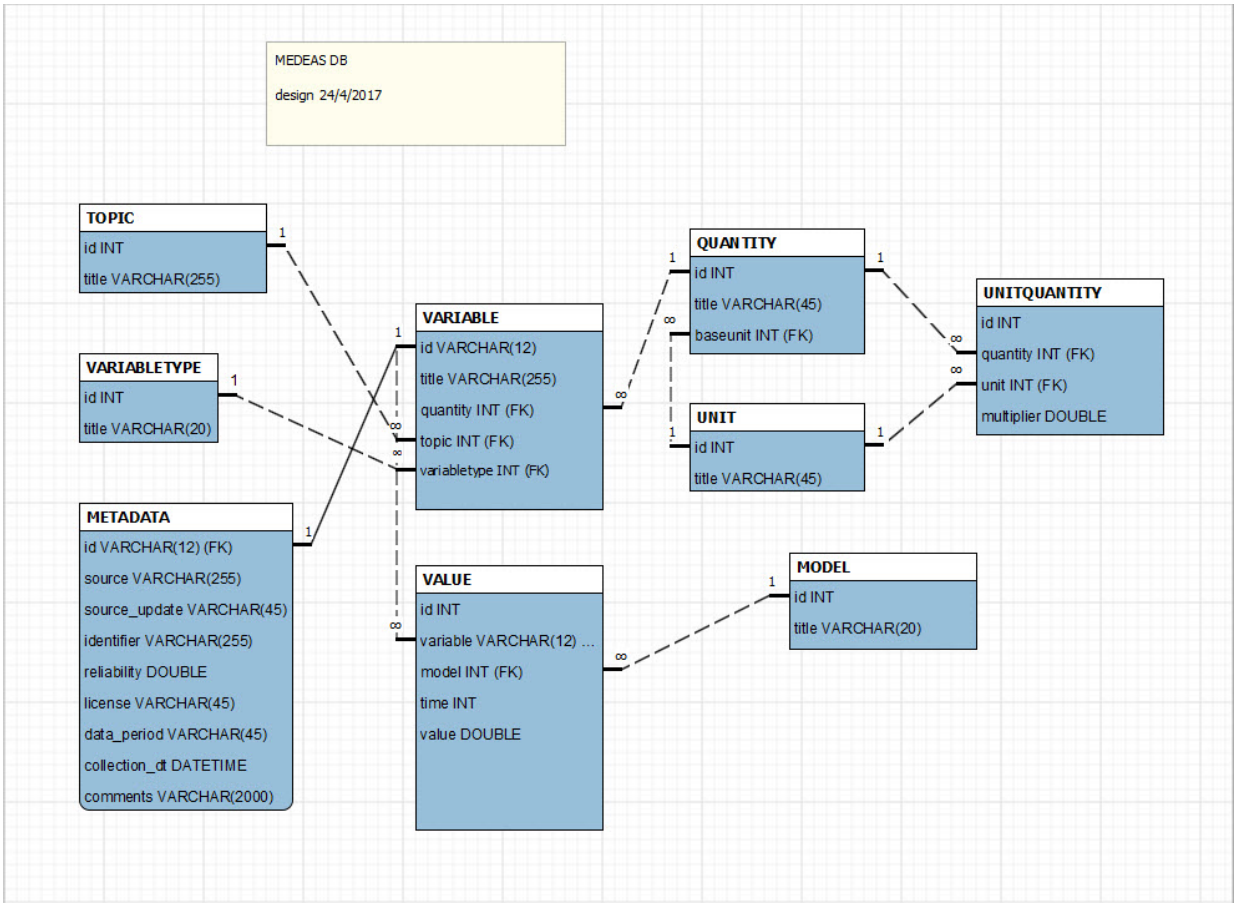
3.2 Database application description

This section describes the first layer of the DBMS, namely the database.

Figure 4 shows the schema of the database structure, which was designed based on an a set of initial sample data and following some discussions with the MEDEAS model developers.

Figure 4. Database Structure



As seen in Figure 4, the database consists of two main entities: Variable and Value. The Variable entity holds the basic characteristics of the entries of the MEDEAS project (Id code, entry title, etc.). It is connected with the Metadata entity, which holds additional characteristics of the entries. The Value entity holds the data collected, elaborated and generated within the MEDEAS project. Each Value entity record contains the Id code, the level to which the data refer (i.e. model: World, European etc.), the year to which the data refer (time) and the actual numerical value of the data.

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The other entities, which are shown in the schema above, are sets of predefined values that are used to fill certain fields of the main entities. Therefore, every value of a entry refers to a model (World, European etc.), which is retrieved from the Model entity. In the same way, every entry belongs to a Topic (e.g. socioeconomic, etc.) and has a Variable Type (endogenous, exogenous etc.). Moreover, every entry expresses a physical quantity (e.g. Energy). Every quantity has a base unit (e.g. kWh for Energy). Every unit (e.g. Joule) belongs to a certain quantity (in our example, Energy) and it is transformed to the base unit of a specific quantity according to a certain mathematical formula (in the aforementioned example, it is multiplied by 1/3600000, since 1J = 1/3600000 kWh).

3.2.1 Tables description

Each of the above mentioned entities is described below in detail through its corresponding database table.

Table 11. VARIABLE

Column name	Type	Description
id	String	Identification code. This is unique.
title	String	Title of the entry
quantity	Integer	Which physical quantity the entry refers to (e.g. Energy)
topic	Integer	Which topic the entry belongs to. It refers to the column 'id' of table TOPIC
variabletype	Integer	Type of the entry (endogenous or exogenous). It refers to the column 'id' of table VARIABLETYPE.

Note: Each entry must be either endogenous or exogenous (or not clear). If a certain entry is considered exogenous (i.e. it comes from an external source) and a new value for this entry is calculated through the model (produced by the model), a new entry must be created (meaning an entry with a new ID), which will have the same characteristics as the first one, but its 'variabletype' will be 'endogenous' and its title will probably need to be modified for the two entries to be distinguished.

Table 12. TOPIC

Column name	Type	Description
id	Integer	Identification code
title	String	Title of the topic

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The Topic entity concerns one of the main database topics, such as “Electricity Transformation”, “Emissions and Climate”, “Energy Consumption by sector”, “Socioeconomic”, etc. This table consists only of the topic’s ID and its title.

Table 13. VARIABLETYPE

Column name	Type	Description
id	Integer	Identification code
title	String	Title of type (endogenous, exogenous or not clear)

The Variabletype Entity concerns the type of each entry and in specific, whether it is comes from an external source (exogenous), whether it is produced by MEDEAS model (endogenous), or whether this is not clear. This table consists only of the variabletype’s ID and its title.

Table 14. QUANTITY

Column name	Type	Description
id	Integer	Identification code
title	String	Title of the quantity (e.g. Energy)
baseunit	Integer	The unit that we consider as default for this physical quantity (e.g. kWh for energy). It refers to column ‘id’ of table UNIT.

The Quantity Entity concerns the physical group into which each entry belongs. That is, each entry in the database belongs to a group, which has some specific characteristics, mainly referring to the measurement units. For example, “Final Energy Consumption” entry belongs to the Quantity Entity “Energy”. Each Quantity consists of an ID, its title, as well as a base unit. The base unit is the unit characterizing this quantity. All entries belonging in the same quantity can be transformed to the Quantity’s base unit, through a specified conversion factor.

Table 15. UNIT

Column name	Type	Description
id	Integer	Identification code
title	String	Title of the unit (e.g. kWh)

The Unit Entity concerns all units available in the database, whether they are base units or not. This table consists of the unit’s ID and its title.

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Table 16. UNITQUANTITY

Column name	Type	Description
id	Integer	Identification code
quantity	Integer	It refers to column 'id' of table QUANTITY.
unit	Integer	It refers to column 'id' of table UNIT.
multiplier	Double	The number with which we must multiply a value given in a unit represented by the 'unit' column, so that we have a value expressed in the base unit of the quantity represented by the 'quantity' column.

The Unitquantity Entity practically corresponds each unit to a quantity, through a transformation equation (or conversion factor). That is, all units available in the database belong to a specific quantity and they can be converted to the quantity's base unit through a multiplier. This table consists of the Unitquantity's ID, the unit table, the quantity table and the conversion factor (multiplier) between the specific unit and the quantity's base unit.

Table 17. MODEL

Column name	Type	Description
id	Integer	Identification code
title	String	Title of the model(World, European, Austria or Bulgaria)

The Model Entity concerns the actual model and consists of an ID and the model title (World, European, Austria and Bulgaria).

Table 18. METADATA

Column name	Type	Description
id	String	Variable code. This is unique and refers to column 'id' of table VARIABLE.
source	String	As defined in Section 2.
source_update	String	
identifier	String	
reliability	Double	
license	String	
data_period	String	
collection_dt	Date	
comments	String	

Each entry must have a unique row of metadata. If, for example, there are two different sources for an entry, then they should either both be included in the same metadata row or a new entry

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must be created (meaning a entry with a new id), which differs from the first in the 'source' column of the 'METADATA' table, and probably has a title that distinguishes the two entries.

Table 19. VALUE

Column name	Type	Description
id	Integer	Identification code
variable	String	Entry identification code. It refers to column 'id' of table VARIABLE.
model	Integer	Which level (World, European, Austria or Bulgaria) the value of the entry refers to. It refers to the column 'id' of table MODEL.
time	Integer	Which year the value of the entry refers to.
value	Double	The value of the entry for the given model and year.

The combination of fields "variable", "model", "time" is unique. This means that there can be only one value for a certain entry in a specific model (World, European, etc.) and in a certain year. If there is a second value for the same entry, same model and same year, a new entry must be created (meaning a entry with a new id), which will hold the second value.

The SQL scripts used to create the above described database schema can be found in Annex V.

3.3 Middle Layer Description

This section describes in more detail the middle layer of the DBMS, i.e. the functionality which will manage the database that will hold the data collected, elaborated and generated within MEDEAS project. Functionality is accomplished by certain procedures, in the form of JSF postbacks and through the use of the Java Persistence API (JPA) for the management of data. Details can be found in 3.5 Technical Description below.

Below, there is a short description of the above-mentioned functionality.

Two main types of users will be able to use the web application, the public users and the administrators. The specific functionalities for each user type will be described separately in the following sections.

3.3.4 Public Functionality

Public users have the ability to retrieve data from the MEDEAS database in two different ways, as described below:

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First, if the user wants to view or download all data contained in a specific model, the he can select a model (World, EU, Austria or a Bulgaria) and retrieve the data needed for report generation. The data will come in the form of a table shown in the web application and will be downloadable in the form of Excel, csv or xml.

Second, if the user only wants to view or download a certain part of the database, then he can select one or more entries (by defining search criteria on the entries or by clicking on certain entries) and retrieve the data for these entries. The data will come either in the form of a table (shown in the web application or downloadable as above), or in the form of graphs showing the time series of the values for each selected entry.

3.3.5 Administrator Functionality

Administrators have additional abilities to the above considering the management of all information included in MEDEAS database. In specific, an administrator is able to:

- See a list of the data for all the entities of the database.
- Edit the data for all the entities of the database.
- Create new records for all the entities of the database.
- Specifically, create new entries. In this case, the user inserts data for the new entry (title, topic, type, quantity) and defines the position of the new entry in the entry tree (defining the father or the grandfather of the entry, if it exists). The application, then, produces automatically an ID for the new entry and stores it in the database.
- Insert the main data, meaning the value of a certain entry for a certain model and a certain year. This can be accomplished by two different methods. First, the user is able to insert data by using a specific form. By this way, the user is able to insert data only for one entry and one year each time. If the user wants to insert batch data, he can do so by uploading an excel file. The application will read this file and store all relevant data in the database. In order to do that, without the risk of mistakes, an excel template must be downloaded from the application in advance on which the user will be based to upload new data.

The administrators will have authorized access (usernames and passwords that will be provided) in certain parts of the application (the ones related to the extra functionalities described above).

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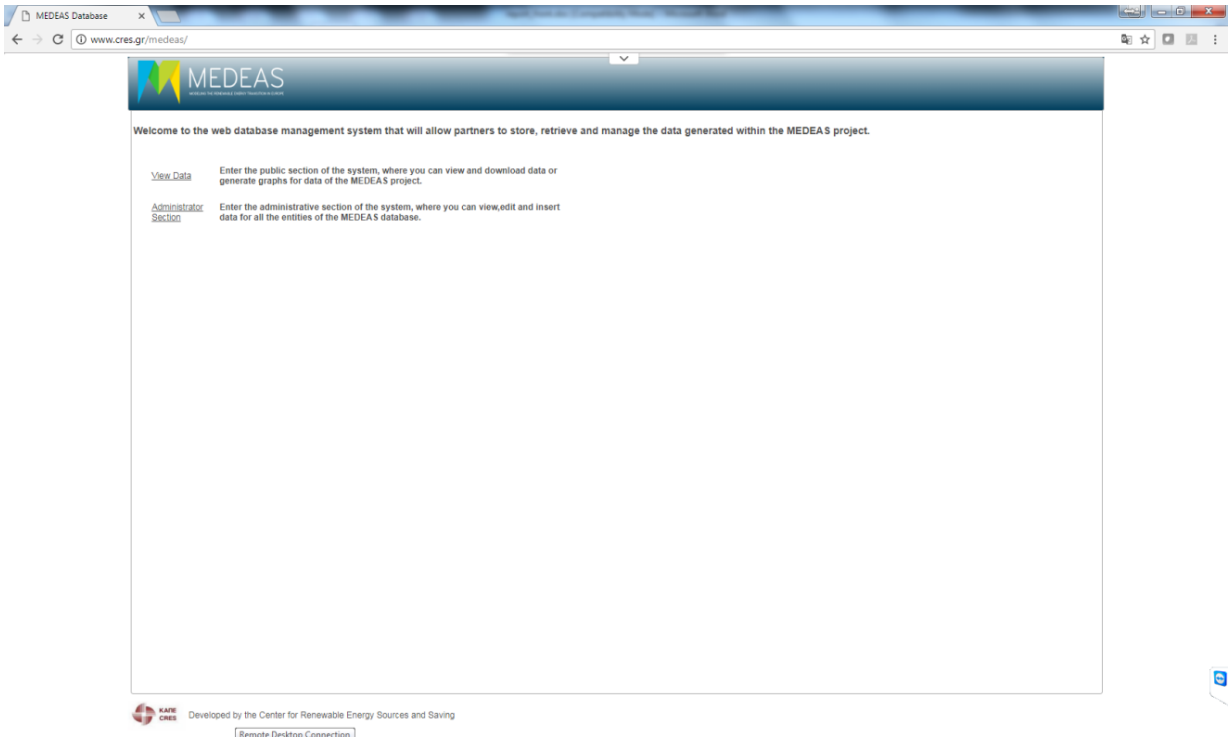
3.4 Front end Description

This section describes in detail the final action of the Web Database Management System and in specific the development of the front end, i.e. the web interface for the application that CRES developed to manage the database that will hold the data collected, elaborated and generated within the MEDEAS project. The interface was developed with the Java Server Pages package and more specifically, using the Prime Faces library.

3.4.1 Index Page

The first page of the application is the index page, which holds two links (Figure 5).

Figure 5. Index page



Each one of them, leads the user to one of the two sections (public or administrator) described below.

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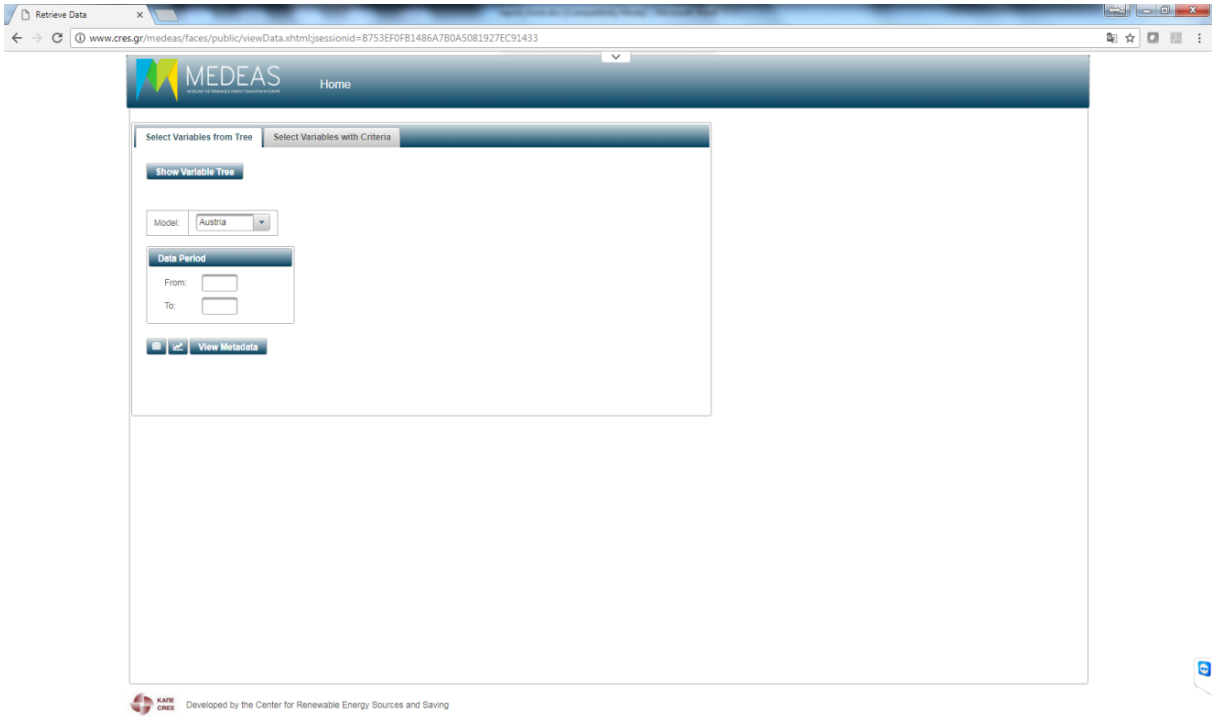
3.4.2 Public Section

The public section of the web application will be open to any user that registers in MEDEAS website and consists of one page that is called View Data. Here, the user can retrieve data from the database and view them in different forms (Figure 6).

Figure 6. Public Section



There are two tabs in this page, representing the two different ways that a user can use to search for entries.

3.4.2.1 Select Entries from Tree option

The first tab is used to choose an entry from the entries tree. As already mentioned previously, entries are stored in the database in the form of a tree, meaning that an entry can have children and a child can have children of its own (there are up to three levels in the tree). Therefore, after the user chooses one or more entries from the tree (multiple selections can be done using the Ctrl key), he must select a model (World, Europe etc.) and a data period for which he wants to view the data (Figure 7).

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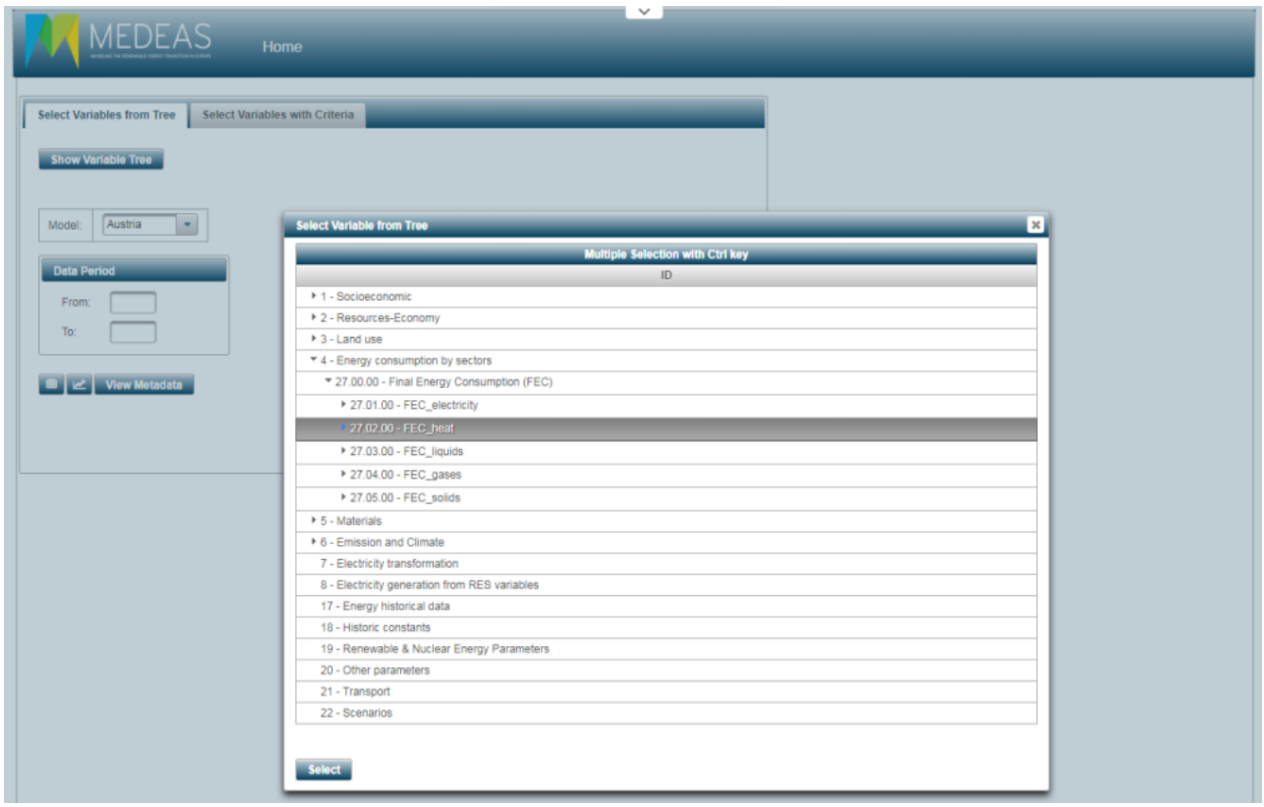
Figure 7. Select an entry from Tree view



Finally, the user can click on one of the three buttons in the bottom. The first one is for showing the data in tabular form (Figure 8), the second one is for showing data in a line graph and the third one is for showing the metadata for the selected entries.

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Figure 8. Select an entry from Tree results

3.4.2.2 Select Entries with Criteria option

The second tab is used to select entries based on certain criteria (Figure 9). The user can insert criteria for the model and the topic, or search for an entry with the entry Id or a part of the entry title. Finally, he can search for data within a certain data period. None of the above criteria is mandatory. If the user leaves a criterion blank, the search is performed ignoring this type of criteria. That is, if all criteria are left blank, the application will show all the data of the database. In this tab, the user can choose to view the selected data in a tabular form or view metadata for the selected entries.

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Figure 9. Select an entry with Criteria view

All the tabular views of data or metadata allow the user to download the data that they are currently viewing to three different forms: XLSX, XML and CSV, by clicking on the corresponding icons.

3.4.3 Administrator Section

The administrator section of the web application consists of a main page and several other pages, as well as a menu. In order to view the main page and the menu, the application will ask the user for a valid username and password.

In the main page, the user sees three links and a button (Figure 10), namely “Manage Entries”, “Manage Data”, “Upload Excel” and “Download Excel Template”.

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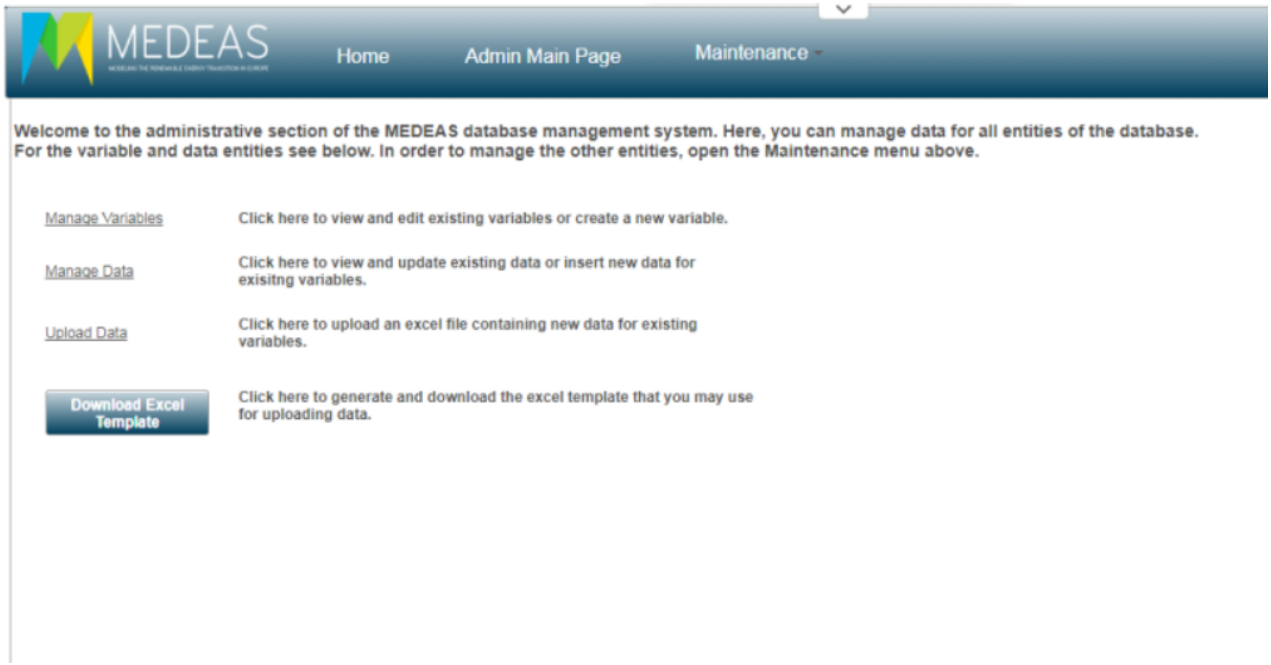
Figure 10. Administrator main page



3.4.3.1 Managing Data

There are two ways for a user to insert data (i.e. values for certain entries) in the database. The first way is described in the following. When the button "Download Excel Template" is clicked, the application reads the database and exports data in an excel file with a certain structure, called the Excel Template. This template in each sheet contains all the Topics, the Regions, the Variable Types, the Units and the Entries of the database, at the moment that the user downloaded it. Moreover, it includes two blank sheets, for the data and the metadata. The user can use this template to upload data and store them in the database. This can be achieved, by clicking the 'Upload Excel' link of the main admin page. The application opens another page, which allows the user to upload an Excel file and submit the contained data to the database.

The second way for a user to insert data is manually through the "Manage data" link. By clicking this link, the application opens a list of all the values (i.e. all the data) stored in the database. In this page, the user, except for viewing data using proper filters, can also create a new value (i.e. insert new data) or edit an existing value (i.e. update data) (Figure 11).

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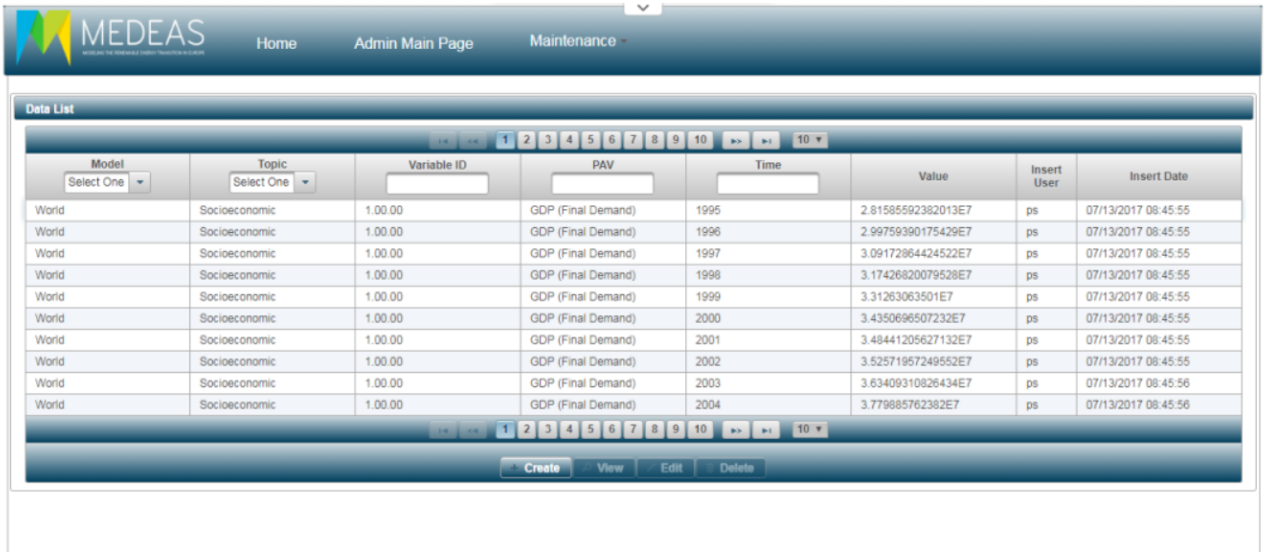
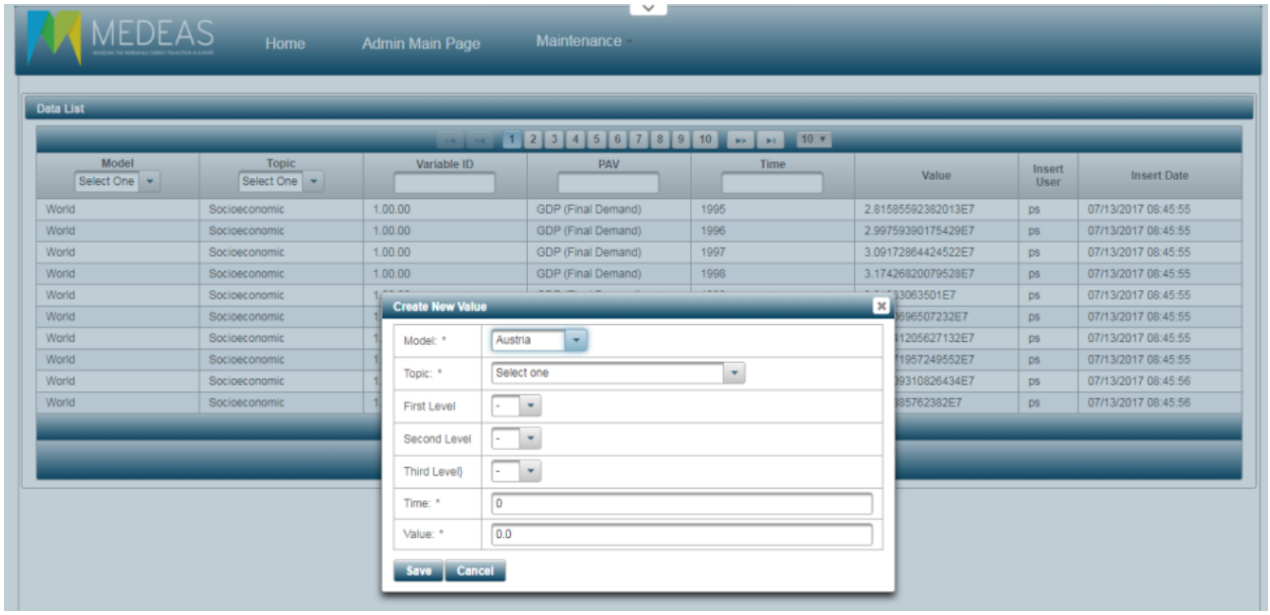
Figure 11 . Manage Data page



In order to create a new value, the user must select an entry and a model, insert the year for which the data will be stored and finally, insert the desired value (Figure 12).

Figure 12. Create New Value form



In order to update data, the user must select a record from the list and press the Edit button. In the opened form, he can only change the value for the certain model, entry and year. The old value is stored in a history table for historical purposes (Figure 13).

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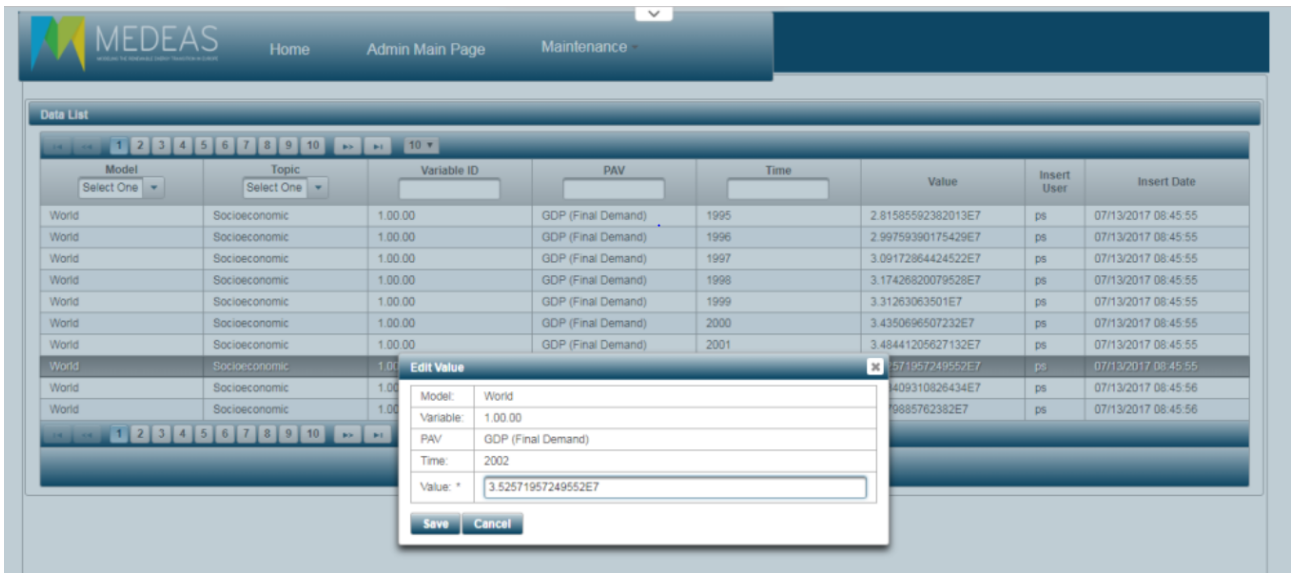
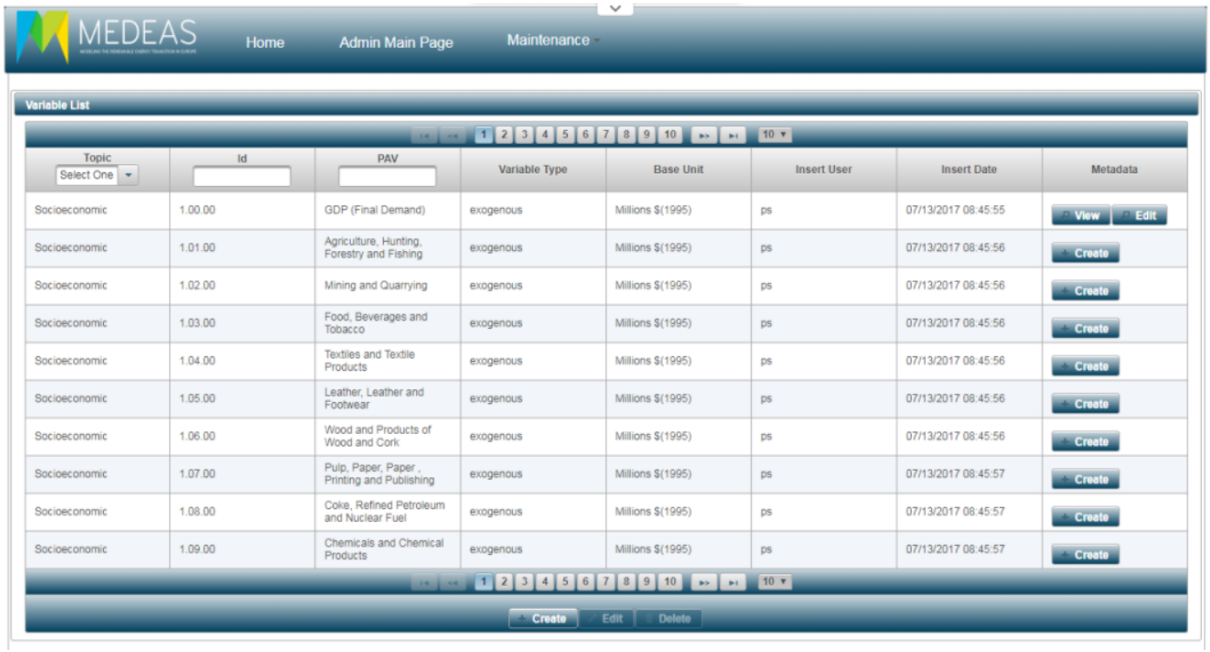
Figure 13. Edit Value form



3.4.3.2 Managing Entries

Similarly to data, the user can also manage entries. When the 'Manage Entries' link is clicked, the application opens a list with all the entries stored in the database. There, the user can view entries (with filters), create a new entry or edit an existing one (Figure 14).

Figure 14. Manage Entries page



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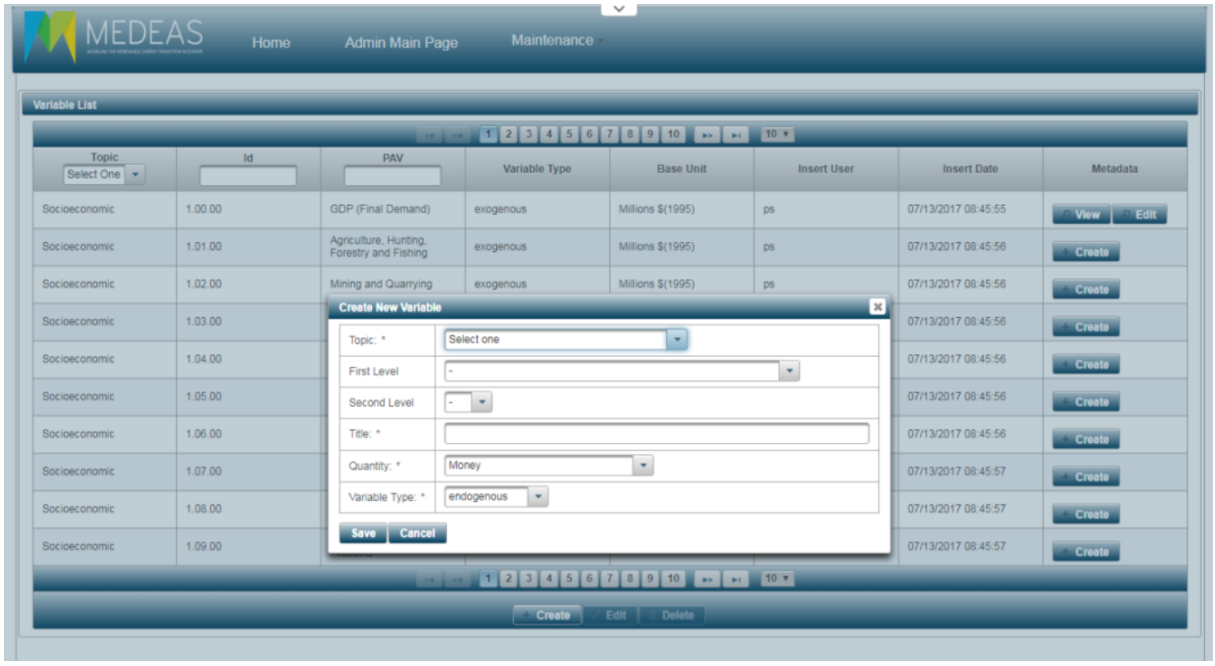
Special reference must be made to the Create Entry form. In this form, the user can insert the title of the new entry and select the level of the new entry in the entry tree, by selecting its parent or grandparent (Figure 15). So, if the first and the second level drop down menus of the form are not filled, the new entry will be of first level (meaning that it does not have any parent or grandparent). If the user selects a entry from the first level drop down menu, then the new entry will have the selected entry as parent. Similarly, if the user selects a entry from the first level drop down menu and another one from the second level drop down menu, then the new entry will have the first entry as grandparent and the second one as parent. When the user presses 'Save', the application automatically gives a new ID to the created entry. The ID is constructed in such manner that reflects the place of the entry in the tree. For example, if the new entry is a child of a entry with ID 29.00.00 and this parent has three other children with IDs 29.01.00, 29.02.00, 29.03.00, then the new entry will obtain the ID 29.04.00.

Figure 15. Create New Entry form



3.4.3.3 Maintenance

Finally, the administrator users can see a drop down menu at the top of the page, called Maintenance, which contains links to lists of the records of the remaining tables of the database (Figure 16). From there, the user can view, update or create new records in the Topic, Model, Variable Type, Unit, Quantity and Unit-Quantity tables (the structure and fields of these tables are described in 3.2.1 Tables description).

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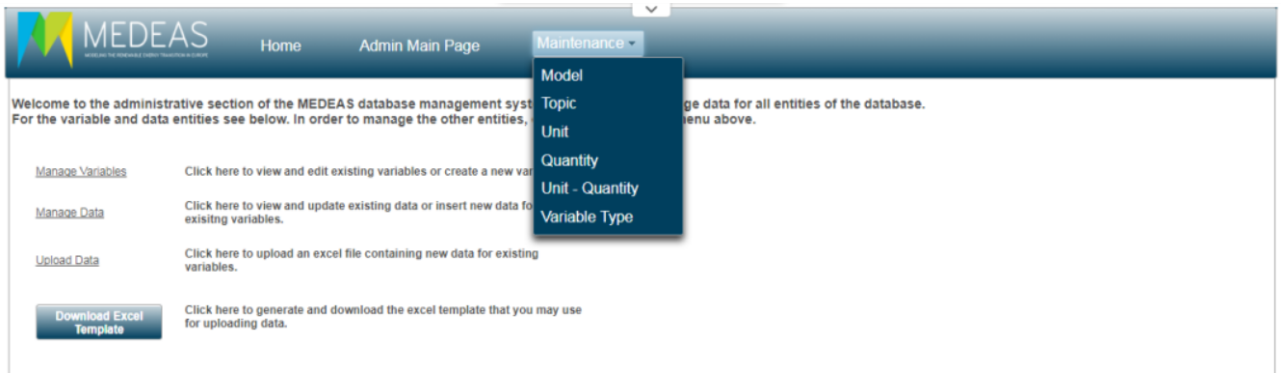
Therefore, if the user wants to view the Topics of the database, he selects 'Topic' from the Maintenance menu. The application opens the Topic list form. There, the user can create a new topic, edit the title of an existing topic or delete a topic. The same functionality applies to the remaining items of the Maintenance menu.

Figure 16. Maintenance drop-down menu



3.4.5 Data Update Procedure

The standard procedure that must be followed, in order to insert new data in the database, is described in the following.

If the new data refer to an existing entry, then the user can insert them either by the Create Value form or by uploading an excel file.

If the new data do not refer to an existing entry, then the user must first create the new entry using the Create Entry form of the application. Then he must download the new Excel Template that contains the new entry, fill it with data and upload it as described above.

During the creation of a new entry, the user must select a topic, a type and a quantity for the new entry. In order to do so, the corresponding entity must be already available in the database. That is, if, for example, the topic of the new entry doesn't exist, the user must first create it by using the Create Topic form of the application.

3.4.6 Super User Role

As mentioned previously, administrators have extra abilities regarding the management of data of MEDEAS database. The application defines one more type of user role, the super user. When someone enters the administrator section with super user credentials, he can also see a link to pages used to view, create and edit the existing users of the database.

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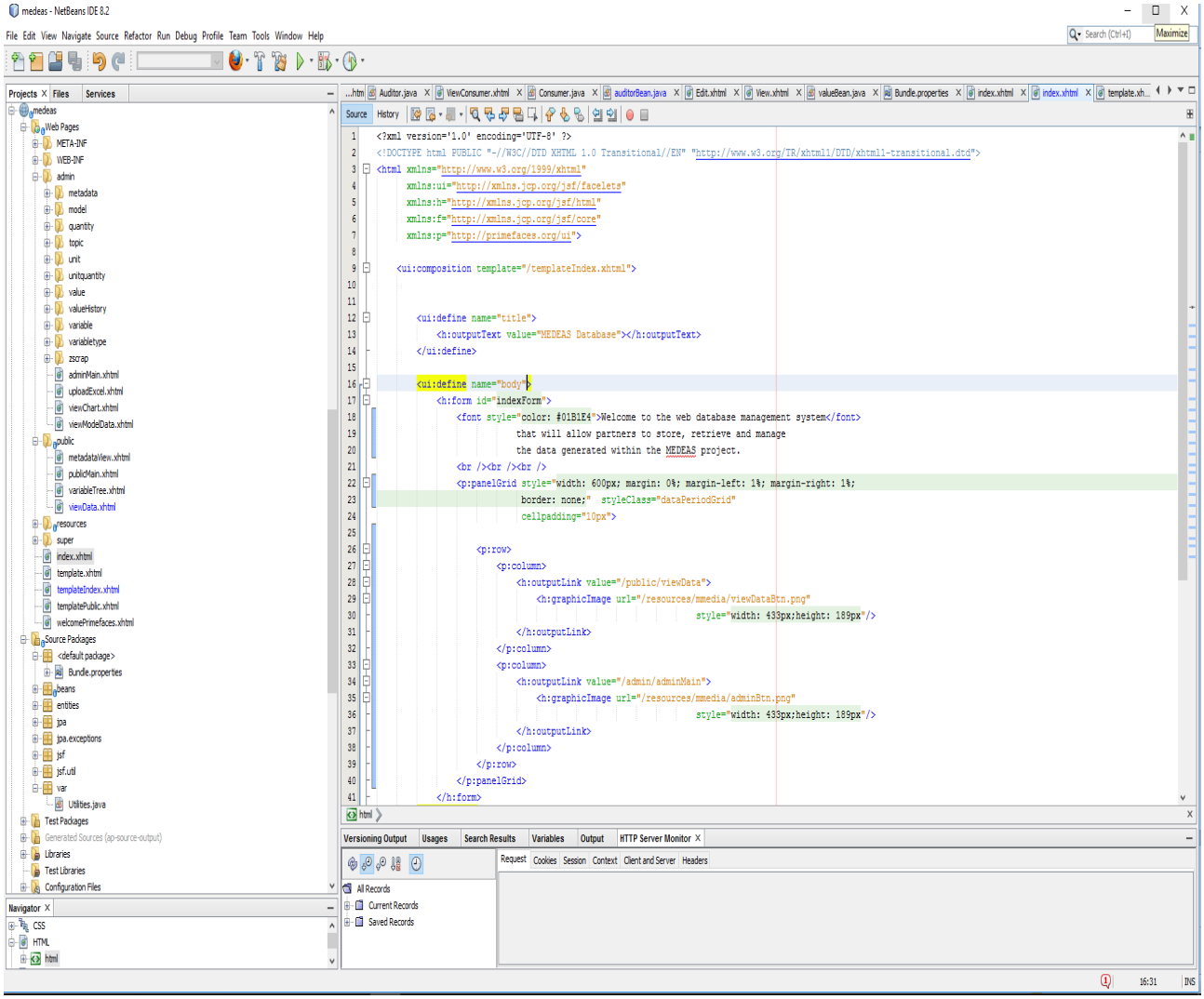
3.5 Technical Description

The MEDEAS Database Management System was implemented using various tools and technologies.

First of all, the database itself is running on a Maria DB database server. The Application Server of the web application is Apache Tomcat 8, which is running on an Apache web server.

The web application (middle and front layer) were developed under the NetBeans 8.2 IDE using the JPA and JSF technologies. The Netbeans project structure can be seen in Figure 17 below.

Figure 17. Netbeans project structure



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The Java Persistence API (JPA) is a Java application programming interface specification that describes the management of relational data in applications using Java Platform, Standard Edition and Java Platform, Enterprise Edition.

Persistence in this context covers three areas:

- the API itself, defined in the javax.persistence package;
- the Java Persistence Query Language (JPQL);
- object/relational metadata.

The reference implementation for JPA is EclipseLink. EclipseLink is an open-source mapping and persistence framework for use in a Java environment.

JPA is the Java API for object/relational mapping (ORM), where Java objects are mapped to database artifacts, for the purpose of managing relational data in Java applications. JPA includes Java Persistence Query Language (JPQL), the Java Persistence Criteria API and the Java API and XML schema for defining object/relational mapping metadata.

Java Server Faces (**JSF**) is a Java specification for building component-based user interfaces for web applications

JSF simplifies the creation of Web applications by providing a standard set of tools (or an API) for building user interfaces. For example, instead of coding a Web form in HTML, a developer can instead call a simple JSF function that generates the form. Another JSF function may be used to process the data entered by the user. These functions are processed on the server and the resulting data is output to the client's browser. JSF benefits developers by providing reusable objects that can easily be inserted into webpages. However, these components are also beneficial to website visitors since they produce standardized interface elements. Since the Java code is processed on the server, the appearance of the generated Web objects is consistent across multiple websites. Additionally, JSF components are tested on multiple platforms, so they work well in all major browsers. While JSF is often used to create basic webpage elements, it also supports advanced features, such as database access, Ajax interaction, and JavaScript page actions. These capabilities are useful for building dynamic websites that generate pages on-the-fly. For the MEDEAS application front end, a special JSF library, called PrimeFaces, was used. The following diagram in Figure 18 schematically represents the architecture used for implementing the MEDEAS Database Management System with the abovementioned tools.

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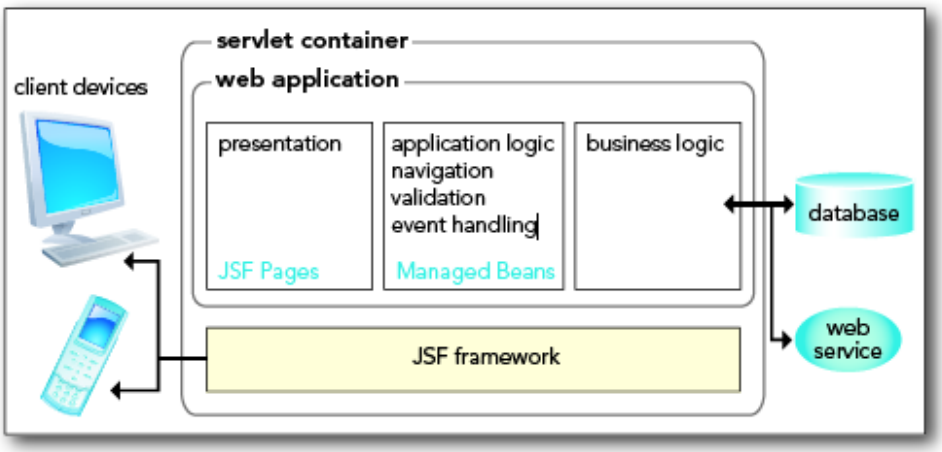
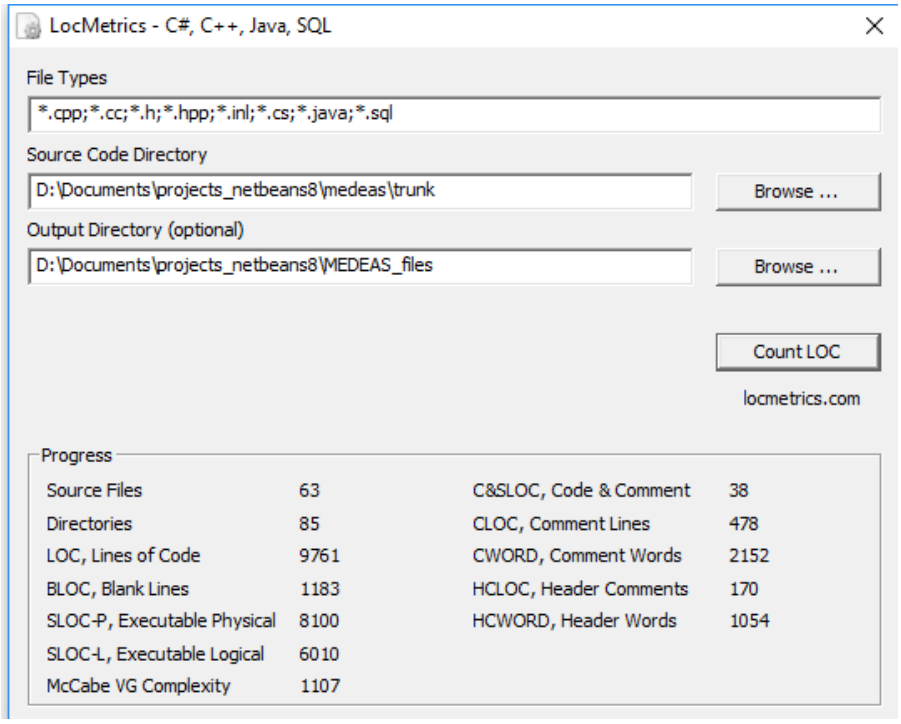
Figure 18. MEDEAS Database Management System architecture



3.5.1 Statistics of source code files

CRES used the program LOC Metrics for the quantitative statistics of source code files. The output, in summary, as per 31 July 2017, is reported in the following table, as depicted in Figure 19.

Figure 19. Quantitative statistics of source code files for the development of MEDEAS Database



The distribution of physical executable code in folders is reported in the graph illustrated in pie below:

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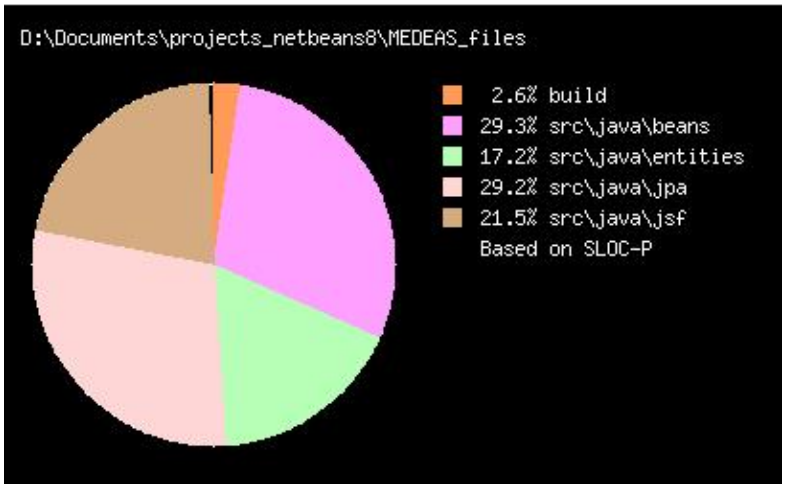
Figure 20. Distribution of physical executable code in folders for the development of MEDEAS Database.



Detailed lists of the Lines Of Code statistics can be found in ANNEX VI of this report.

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ANNEX I. WORLD MEDEAS METADATA

Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	1.00.00	GDP (Final demand)	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous yr prices.
Socioeconomic	2.00.00	Production	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous yr prices.
Socioeconomic	3.00.00	Inequality indicators	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Own calculations. Income share: factor income/GDP
Socioeconomic	3.01.00	Labor share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Labour compensation/GDP.
Socioeconomic	3.02.00	Profit share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Capital compensation/GDP.
Socioeconomic	4.00.00	Income	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Original source in current prices and national currency. Rate exchange in WIOD-SEA. World aggregated. Assumption: Rest of the World region has the same primary income distribution.
Socioeconomic	4.01.00	Labour compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	4.02.00	Capital compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	5.00.00	Population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	6.00.00	Life expectancy at birth	yr	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	7.00.00	Urban population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	8.00.00	Rural population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	9.00.00	Unemployment rate	% of total labour force	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1991-2016	21/04/2017	
Socioeconomic	10.00.00	Energy dependency	%	World Bank	http://data.worldbank.org/indicator/EG.IMP.CONS.ZS	1960-2014	16/05/2017	Net energy imports/Energy use. A negative value indicates that the country is a net exporter.
Socioeconomic	11.00.00	Technical coefficients	Ratio input ($)/output($)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Once world Input-Output table is compiled at 1995 prices, we obtain the ratio between the sectoral transaction and the output by columns.

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	12.00.00	Final energy consumption per capita	kgoe/capita	Own elaboration with data from the IEA	http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE	1971-2014	21/04/2017	
Resources-Economy	13.00.00	Water consumption	m3/yr	WIOD-Environmental Accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	World aggregated.
Resources-Economy	14.00.00	WATER INTENSITY	m3/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	Own calculations. Own calculations: Water consumption(m3)/Production (million $ 1995)
Resources-Economy	15.00.00	Material consumption	ton/hab*yr	Friends of the Earth Austria Overconsumption? Our use of the World's natural resources	https://www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf	1980 1985 1990 1990 2000	28/04/2017	
Resources-Economy	16.00.00	Primary Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	08/05/2017	Own calculation. World aggregated, source and sector disaggregated. Primary Energy Consumption (TJ)/Production(million $ 1995)
Resources-Economy	17.00.00	Final Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	04/05/2017	Own calculation. World aggregated, source and sector disaggregated. Final Energy Consumption (TJ)/Production(million $ 1995)

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Land use	18.00.00	Food land	kha	(FAO) Statistics Division (ESS), Environment Statistics team	http://www.fao.org/faostat/en/?#data/RL	1961-2014	28/04/2017	ITEM: Agricultural area
Land use	19.00.00	Forest land	Km2	World Bank Forest Area, World Bank	http://data.worldbank.org/INDICATOR/AG.LND.FRST.K2?VIEW=CHART	1990-2015	21/04/2017	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stand in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. NA
Land use	20.00.00	Biodiversity protection land	Km2	World Bank	http://data.worldbank.org/INDICATOR/ER.LND.PTLD.ZS	1990, 2000, 2014	02/05/2017	Terrestrial protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. Marine areas, unclassified areas, littoral (intertidal) areas, and sites protected under local or provincial law are excluded.
Land use	21.00.00	Urban land area	Km2	World Bank Urban Land Area, World Bank	http://data.worldbank.org/INDICATOR/AG.LND.TOTL.UR.K2	1990, 2000, 2010	21/04/2017	Urban land area in mega hectares, based on a combination of population counts (persons), settlement points, and the presence of night-time lights. Areas are defined as urban where contiguous lighted cells from the night-time lights or approximated urban extents based on buffered settlement points for which the total

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								population is greater than 5,000 persons. Urban not urbanized land, gives the same number for 1990, 2000 and 2010
Land use	22.00.00	Biofuel and bioelectricity land	Mha	Capellán et al. Deliverable D2.2.e.4 (annex 12)	NA	2008, 2010	02/05/2017	Land for biofuel estimation only biofuels from agriculture, bioelectricity is supposed from waste and forest residues
Land use	23.00.00	Arable and cropland, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	24.00.00	Pastures and meadows, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	25.00.00	Forest, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	26.00.00	Other land, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Energy consumption by sectors	27.00.00	Final Energy Consumption (FEC)	EJ	Own elaboration with data from the IEA and WIOD	http://www.wiod.org/database/eas13	1995-2009	18/05/2017	Sectorial aggregated using WIOD and IEA.
Materials	28.00.00	Mineral production	ton	United States Geological Survey (USGS)	https://minerals.usgs.gov/minerals/pubs/mcs/	1994-2016	25/05/2017	Data for year 2016 is estimated. Lithium, Magnesium and Titanium excludes U.S. production. Data for historical series for manganese is also estimated.

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Materials	29.00.00	Kg material per new MW installed (construction phase)	kg/new MW	Deliverable MEDEAS		2015	25/05/2017	Technology and material disaggregated.
Materials	30.00.00	Kg material per new MW installed (Operation and maintenance)	kg/new MW	Deliverable MEDEAS		2015	25/05/2017	Technology and material disaggregated.
Materials	31.00.00	Initial energy consumption per unit of material consumption	MJ/Kg	Deliverable MEDEAS		2015	25/05/2017	
Materials	31.01.00	Virgin	MJ/Kg	Deliverable MEDEAS		2015	25/05/2017	Virgin materials.
Materials	31.02.00	Recycled	MJ/Kg	Deliverable MEDEAS		2015	25/05/2017	Recycled materials
Materials	32.00.00	Total reserves	Mt	Deliverable MEDEAS		2015	25/05/2017	For further information, consult Deliverable 2.2.c.2 Material disaggregated.
Materials	33.00.00	Total Resources	Mt	Deliverable MEDEAS		2015	25/05/2017	For further information, consult Deliverable 2.2.c.2. Material disaggregated.

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Emission and Climate	34.00.00	CO2 emissions from different activities	Gt CO2	Climate Change 2014 Mitigation of Climate Change Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change	http://www.ipcc.ch/report/ar5/wg3/	1970, 1980, 1990, 2000, 2010	19/04/2017	Chapter 5: Drivers, trends and mitigation data source Figure 5.18 (Page 381)
Emission and Climate	34.01.00	Total CO2 emissions from fossil fuel consumption and cement production	Gt CO2	Carbon Dioxide Information Analysis Center (CDIAC)	http://cdiac.ornl.gov/	1990-2013	18/04/2017	
Emission and Climate	34.02.00	CO2 emissions from cement production	Gt CO2	Global Carbon Project	http://www.globalcarbonproject.org/CARBONBUDGET/16/data.htm	1960-2015	17/04/2017	All values in million tonnes of carbon per yr (MtC/yr). 1MtC = 1 million tonne of carbon = 3.664 million tonnes of CO2
Emission and Climate	34.03.00	Land use change CO2 emissions	Gt CO2	Global Carbon Porject	http://www.globalcarbonproject.org/CARBONBUDGET/16/data.htm	1960-2015	17/04/2017	
Emission and Climate	34.04.00	Land use change CO2 emissions	Gt CO2	Carbon Dioxide Information Analysis Center (CDIAC)	http://cdiac.ornl.gov/	1990-2012	18/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Emission and Climate	34.05.00	RES emissions	Gt CO2	Own estimation with data from IEA CO2 emissions from FUEL COMBUSTION HIGHLIGHTS 2016	http://www.iea.org/media/statistics/CO2HIGHLIGHTS.XLS http://www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustion_Highlights_2016.pdf	1971-2014	19/04/2017	Excel tables with annual historical series of CO2 emissions from fuel combustion. These data refer to CO2 only emissions (not all GHG emissions) and emissions from fuel combustion only (not from all processes, i.e. fugitive emissions and emissions from CO2 transport and storage)
Emission and Climate	34.06.00	Non RES emissions	Gt CO2	Own estimation with data from IEA CO2 emissions from FUEL COMBUSTION HIGHLIGHTS 2016	http://www.iea.org/media/statistics/CO2HIGHLIGHTS.XLS http://www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustion_Highlights_2016.pdf	1971-2014	19/04/2017	Excel tables with annual historical series of CO2 emissions from fuel combustion. These data refer to CO2 only emissions (not all GHG emissions) and emissions from fuel combustion only (not from all processes, i.e. fugitive emissions and emissions from CO2 transport and storage)
Emission and Climate	35.00.00	Nitrous oxide emissions	thousand metric tons of CO2 equivalent	World Bank. European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR): http://edgar.jrc.ec.europa.eu/	http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#	1970-2012	18/04/2017	Nitrous oxide emissions are emissions from agricultural biomass burning, industrial activities, and livestock management. Data are calculated in Gt CO2eq

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Emission and Climate	36.00.00	INCREASE IN TOTAL RADIATIVE FORCING IN RELATION TO PRE-INDUSTRIAL LEVELS	W/m2	The NOAA Annual Greenhouse Gas Index (AGGI). NOAA Earth System Research Laboratory, R/GMD, 325 Broadway, Boulder, CO 80305-3328	https://www.esrl.noaa.gov/gmd/aggi/aggi.html	1979-2015	18/04/2017	
Emission and Climate	37.00.00	CH4 EMISSIONS	Gt CO2eq	World Bank. European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR): http://edgar.jrc.ec.europa.eu/	http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#	1970-2012	18/04/2017	Methane emissions are those stemming from human activities such as agriculture and from industrial methane production. Data are calculated in Gt CO2eq
Emission and Climate	38.00.00	CO2 concentration levels	ppm	NASA. Global Climate Change	https://climate.nasa.gov/vital-signs/carbon-dioxide/	1960-2015	04/05/2017	Parts per million (ppm) is the number of molecules of CO2 in every one million molecules of dried air (water vapour removed).
Emission and	39.00.00	Global mean temperature	ºC	NASA. Global Climate Change	https://climate.nasa.gov/vital-signs/global-temperature/	1960-2015	04/05/2017	Change in global surface temperature relative to 1951-1980 average temperatures

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Climate		increase						
Emission and Climate	40.00.00	GHG Emissions						
Emission and Climate	40.01.00	Excluding Land-Use Change and Forestry (Datos de inputs.xls)	Gt CO2eq	Carbon Dioxide Information Analysis Center (CDIAC)	http://cdiac.ornl.gov/	1990-2012	10/05/2017	
Emission and Climate	40.02.00	Including Land-Use Change and Forestry (Datos de inputs.xls)	Gt CO2eq	Carbon Dioxide Information Analysis Center (CDIAC)	http://cdiac.ornl.gov/	1990-2012	10/05/2017	
Emission and Climate	40.03.00	Other GHG rad forcing	W/m2	baseline scenario from DICE-2013R	http://www.econ.yale.edu/~nordhaus/homepage/documents/DICE_Manual_100413r1.pdf	1990-2015	20/04/2017	
Emission and Climate	40.04.00	Gt CO2 per Mtoe CTL	Gt CO2/MJ	Brandt and Farrell (2007)	http://rdcu.be/r5QG	1960-2015	19/05/2017	
Emission and Climate	40.05.00	Gt CO2 per Mtoe GTL	Gt CO2/MJ	Brandt and Farrell (2007)	http://rdcu.be/r5QG	1960-2015	19/05/2017	
Emission and Climate	40.06.00	Gt CO2 per Mtoe coal	Gt CO2/MJ	BP Statistical Review of World Energy (2013)	http://www.rrojasdatabank.info/bpworld2013.pdf	1960-2015	19/05/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Emission and Climate	40.07.00	GT CO2 per Mtoe conv gas	Gt CO2/MJ	BP Statistical Review of World Energy (2013)	http://www.rrojasdatabank.info/bpworld2013.pdf	1960-2015	19/05/2017	
Emission and Climate	40.08.00	GT CO2 per Mtoe conv oil	Gt CO2/MJ	BP Statistical Review of World Energy (2013)	http://www.rrojasdatabank.info/bpworld2013.pdf	1960-2015	19/05/2017	
Emission and Climate	40.09.00	Gt CO2 per Mtoe unconv gas	Gt CO2/MJ	Howarth (2015) Fig. 2	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf	1960-2015	19/05/2017	
Emission and Climate	40.10.00	Gt CO2 per Mtoe unconv oil	Gt CO2/MJ	Brandt and Farrell (2007)	http://rdcu.be/r5QG	1960-2015	19/05/2017	
Emission and Climate	40.11.00	Gt CO2 per Mtoe shale oil	Gt CO2/MJ	Brandt and Farrell (2007)	http://rdcu.be/r5QG	1960-2015	22/05/2017	
Emission and Climate	40.12.00	Gt CH4/MJ conventional gas (Datos de inputs.xls)	Gt CH4/MJ	Howarth (2015) Fig 2	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf	1960-2015	10/05/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Emission and Climate	40.13.00	Gt CH4/MJ unconventional gas (Datos de inputs.xls)	Gt CH4/MJ	Howarth (2015) Fig 3	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf	1960-2015	10/05/2017	
Emission and Climate	40.14.00	Gt CH4/MJ Coal (Datos de inputs.xls)	Gt CH4/MJ	Howarth (2015) Fig 4	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf	1960-2015	10/05/2017	
Emission and Climate	40.15.00	Gt CH4/MJ oil (Datos de inputs.xls)	Gt CH4/MJ	Howarth (2015) Fig 5	http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf	1960-2015	10/05/2017	
Electricity transformation	41.00.00	Hydroelectricity pumped storage capacity	TWh	U.S. Energy Information Administration and IRENA	http://www.tsp-data-portal.org/Breakdown-of-Electricity-Capacity-by-Energy-Source#tspQvChart and http://resourceirena.irena.org/gateway/dashboard/?topic=3 subtopic=33	1980-2015	28/04/2017	U.S. Energy Information Administration, (1980-2012) and IRENA (2013-2015)

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Electricity transformation	42.00.00	Hydroelectricity pumped storage energy production	TWh	U.S. Energy Information Administration	http://www.tsp-data-portal.org/Historical-Electricity-Generation-Statistics#tspQvChart	1980-2014	28/04/2017	U.S. Energy Information Administration, (1980-2014)
Electricity generation from RES variables	43.00.00	Installed capacity of electrical RES	TWh	IRENA RESOURCE and own estimations	http://resourceirena.irena.org/gateway/dashboard/?topic=3 subtopic=33	1990-2015	12/06/2017	The IRENA renewable energy source of information resource has become the world's largest repository of free information on renewable energy. It enables users to easily find country-specific data, create customized charts and graphs, and compare countries on such metrics as renewable energy use and deployment. Na
Electricity generation from RES variables	44.00.00	ELECTRICITY COST FROM RES	2016$/kW	IRENA RESOURCE	http://resourceirena.irena.org/gateway/dashboard/?topic=3 subtopic=33	2010, 2016	12/06/2017	The IRENA renewable energy source of information resource has become the world's largest repository of free information on renewable energy. It enables users to easily find country-specific data, create customized charts and graphs, and compare countries on such metrics as renewable energy use and deployment. Only available for year 2010 and 2015
Electricity generation from RES variables	45.00.00	RES LIFETIME	yr	IPCC (2011)		2014	12/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	46.00.00	pct CHP plants vs total heat output	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	47.00.00	Pct gas in fossil CHP plants	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	48.00.00	Pct solids in fossil CHP plants	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	49.00.00	Pct liquids in fossil CHP plants	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	50.00.00	Extraction resources	EJ	Mohr et al. 2015 and own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	50.01.00	Unconventional oil	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1990-2012	22/06/2017	
Energy historical data	50.02.00	Unconventional gas	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1990-2012	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	50.03.00	CTL	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	50.04.00	GTL	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	51.00.00	Share resources by sector	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	51.01.00	Share oil Elec	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2010	22/06/2017	
Energy historical data	51.02.00	Share gas vs (coal+gas) Elec	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	52.00.00	Alternative transport	Dmnl	EVI and IANGV	http://www.iangv.org/current-ngv-stats/	2005-2015	22/06/2017	
Energy historical data	52.01.00	Share BEV+HEV	Dmnl	EVI	https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf	2005-2015	22/06/2017	Table 6

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	52.02.00	Share NGV	Dmnl	IANGV	http://www.iangv.org/current-ngv-stats/	2005-2012	22/06/2017	
Energy historical data	53.00.00	Annual generation liquids RES	ktoe	BP	http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html	1990-2015	22/06/2017	
Energy historical data	53.01.00	Biofuels	ktoe	BP	http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html	1990-2015	22/06/2017	
Energy historical data	54.00.00	Capacity installed RES for non-commercial heat	TWth	Own elaboration with data from the IEA, SHC, Lund&Boyer	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	54.01.00	Solid bioE-heat	TWth	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	54.02.00	Solar for heat	TWth	SHC 2016 and own calculations	http://www.iea-shc.org/	1990-2014	22/06/2017	
Energy historical data	54.03.00	Geothermal for heat	TWth	Lund&Boyer (2015) and own calculation	Lund, John W., and Tonya L. Boyd. "Direct Utilization of Geothermal Energy 2015 Worldwide Review." In Proceedings World Geothermal Congress 2015, 31. Melbourne, Australia, 2015.	1990-2014	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	55.00.00	Capacity installed RES for commercial heat	TWth	Own elaboration with data from the IEA, SHC, Lund&Boyer and own calculation	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en http://www.iea-shc.org/	1990-2014	22/06/2017	
Energy historical data	55.01.00	Solid bioE-heat	TWth	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	55.02.00	Solar for heat	TWth	SHC 2016 and own calculations	http://www.iea-shc.org/	1990-2014	22/06/2017	
Energy historical data	55.03.00	Geothermal for heat	TWth	Lund&Boyer (2015) and own calculation	Lund, John W., and Tonya L. Boyd. "Direct Utilization of Geothermal Energy 2015 Worldwide Review." In Proceedings World Geothermal Congress 2015, 31. Melbourne, Australia, 2015.	1990-2014	22/06/2017	
Energy historical data	56.00.00	Nuclear generation TWh	TWh	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	57.00.00	Efficiency gas for electricity	%	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	58.00.00	Electricity consumption	TWh	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1990-2014	22/06/2017	
Energy historical data	59.00.00	Share gas vs (coal+gas) heat	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	60.00.00	Non energy use	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	60.01.00	Solids	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	60.02.00	Liquids	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	60.03.00	Gases	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	60.04.00	Electricity/Heat	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	61.00.00	Losses	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	61.01.00	Coal pct losses	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	61.02.00	OIL pct losses	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	61.03.00	NAT GAS pct losses	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2009	22/06/2017	
Energy historical data	62.00.00	Transformation losses	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	62.01.00	pc losses transformation vs extraction oil	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	62.02.00	pc losses transformation vs extraction coal	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	62.03.00	Ratio gain gas vs lose solids in tranf processes	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	63.00.00	TPES primary solids biofuels	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	64.00.00	Waste	EJ	Industrial waste+municipal waste (renewable)+municipale waste (non-renewable) Own elaboration with data from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.00.00	Efficiencies	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.01.00	Heat plants gas	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.02.00	Elec CHP plants gas	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	65.03.00	Heat CHP plants gas	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.04.00	Heat plants coal	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.05.00	Elec CHP plants coal	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.06.00	Heat CHP plants coal	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.07.00	Heat plants oil	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.08.00	Elec CHP plants oil	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	65.09.00	Heat CHP plants oil	Dmnl	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy historical data	66.00.00	Losses in Charcoal plants	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	67.00.00	Peat	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Energy historical data	68.00.00	Biogases	EJ	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1995-2014	22/06/2017	
Historic constants	69.00.00	BEV/HEV past share growth	%	EVI 2016	https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf	1960-2015	28/06/2017	
Historic constants	70.00.00	NGV past share growth	%	IANGV	http://www.iangv.org/current-ngv-stats/	1960-2015	28/06/2017	
Historic constants	71.00.00	Biofuels past growth	%	BP (2016)	http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html	1960-2015	28/06/2017	
Historic constants	72.00.00	Hist growth CTL	%	Own estimation from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Historic constants	73.00.00	Hist growth GTL	%	Own estimation from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
					balances_enestats-data-en			
Historic constants	74.00.00	Hydro past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	75.00.00	Geothermal past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	76.00.00	Solid bioE-elec	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	77.00.00	Oceanic past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	78.00.00	Wind onshore past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	79.00.00	Wind offshore past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	
Historic constants	80.00.00	Solar PV past capacity growth	%	IRENA	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Historic constants	81.00.00	CSP past capacity growth	%	Own elaboration based on SolarPACES data	https://www.nrel.gov/csp/solarpaces/	1960-2015	28/06/2017	
Historic constants	82.00.00	cumulated conv oil extraction to 1995	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1960-2015	28/06/2017	
Historic constants	83.00.00	cumulated unconventional oil extraction to 1995	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1960-2015	28/06/2017	
Historic constants	84.00.00	cumulated conv gas extraction to 1995	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1960-2015	28/06/2017	
Historic constants	85.00.00	cumulated unconventional gas extraction to 1995	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1960-2015	28/06/2017	
Historic constants	86.00.00	cumulated coal extraction to 1995	EJ	Mohr et al. 2015	http://www.sciencedirect.com/science/article/pii/S0016236114010254	1960-2015	28/06/2017	
Historic constants	87.00.00	cumulated uranium extraction to 1995	EJ	(EWG 2006)	http://www.ewg.org/	1960-2015	28/06/2017	
Historic constants	88.00.00	past solar growth for heat-com	%	Own estimations from IEA balances and SHC (2016)	SHC. "Solar Heat Worldwide. Markets and Contribution to the Energy Supply 2014." Solar Heating & Cooling Programme IEA, 2016.	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Historic constants	89.00.00	past geothermal growth for heat-com	%	own estimations from IEA balances and Lund&Boyd (2015)	Lund, John W., and Tonya L. Boyd. "Direct Utilization of Geothermal Energy 2015 Worldwide Review." In *Proceedings World Geothermal Congress 2015*, 31. Melbourne, Australia, 2015.	1960-2015	28/06/2017	
Historic constants	90.00.00	past solid bioE-heat-com	%	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Historic constants	91.00.00	past solar growth for heat-nc	%	Own elaboration with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Historic constants	92.00.00	past geothermal growth for heat-nc	%	SHC 2016 and own estimations	SHC. "Solar Heat Worldwide. Markets and Contribution to the Energy Supply 2014." Solar Heating & Cooling Programme IEA, 2016.	1960-2015	28/06/2017	
Historic constants	93.00.00	past solid bioE-heat-nc	%	Lund & Boyer (2015) and own estimation	Lund, John W., and Tonya L. Boyd. "Direct Utilization of Geothermal Energy 2015 Worldwide Review." In *Proceedings World Geothermal Congress 2015*, 31. Melbourne, Australia, 2015.	1960-2015	28/06/2017	
Historic constants	94.00.00	Cumulative emissions 1751-1995	Gt C	Data from CDIAC and World Resources Institut	http://cdiac.ornl.gov/	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	95.00.00	Power density	TWe/Mha	Capellán-Pérez et al (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	95.01.00	Geothermal	TWe/Mha	Capellán-Pérez et al (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	95.02.00	Wind onshore	TWe/Mha	Capellán-Pérez et al (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	95.03.00	Solar PV	TWe/Mha	de Castro et al. (2013)	http://www.sciencedirect.com/science/article/pii/S1364032113005807	1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	95.04.00	Wind offshore	TWe/Mha	Capellán-Pérez et al (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	95.05.00	Hydro	TWe/Mha	Capellán-Pérez et al (2017)	http://www.sciencedirect.com/science/article/pii/S1364032117304720	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	95.06.00	CSP	TWe/Mha	De Castro et al (2013); De Castro & Capellán-Pérez (2017)	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	96.00.00	life time	yr	IPCC. Special Report on Renewable Energy Sources and Climate Change Mitigation. Edited by Ottmar Edenhofer, Rafael Pichs-Madruga, Youba Sokona, Kristin Seyboth, Patrick Matschoss, Susanne Kadner, Timm Zwickel, et	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
				al. United Kingdom and New York (USA): Cambridge University Press, 2011. http://srren.ipcc-wg3.de/report.				
Renewable & Nuclear Energy Parameters	97.00.00	Capacity factor initial	Dmnl		-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.01.00	Geothermal	Dmnl	REN21 2016		1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.02.00	Solid bioenergy for electricity	Dmnl	Own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy	97.03.00	Oceanic	Dmnl	Own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Parameters								
Renewable & Nuclear Energy Parameters	97.04.00	Wind onshore	Dmnl	Boccard (2009)	http://www.sciencedirect.com/science/article/pii/S030142150900144X	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.05.00	Solar PV	Dmnl	BP (2016) and own estimation	http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.06.00	Wind offshore	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.07.00	Hydro	Dmnl	IRENA and extrapolation following EIA (2009)	http://www.irena.org/home/index.aspx?PriMenuID=12&mnu=Pri	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	97.08.00	Nuclear	Dmnl	Own elaboration with data from the IEA		1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.09.00	CSP	Dmnl	de Castro & Capellán-Pérez (2017)	De Castro, Carlos, and Iñigo Capellán-Pérez. "A Review of the Real Performance of Concentrating Solar Power." Working Paper. University of Valladolid, 2017.	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.10.00	solar for heat	Dmnl	Own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	97.11.00	geothermal for heat	Dmnl	Own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	97.12.00	Solid bioenergy for heat	Dmnl	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	98.00.00	investment cost	1995T$/TW	RES: Teske et al (2011) Nuclear: (Schneider and Froggatt, 2014).	-	1995, 2007, 2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.00.00	time planification	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.01.00	Geothermal	yr	own estimation		1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.02.00	Solid bioenergy for electricity	yr	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	99.03.00	Oceanic	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.04.00	Wind onshore	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.05.00	Solar PV	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.06.00	Wind offshore	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	99.07.00	Hydro	yr	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	99.08.00	Nuclear	yr	Schneider & Frogatt (2016)	http://www.worldnuclearreport.org/	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	99.09.00	CSP	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.00.00	time construction	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.01.00	Geothermal	yr	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	100.02.00	Solid bioenergy for electricity	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.03.00	Oceanic	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.04.00	Wind onshore	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.05.00	Solar PV	yr	own estimation		1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	100.06.00	Wind offshore	yr	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	100.07.00	Hydro	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.08.00	Nuclear	yr	Schneider & Frogatt (2016)	http://www.worldnuclearreport.org/	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	100.09.00	CSP	yr	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.00.00	min Cp	Dmnl	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	101.01.00	Geothermal	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.02.00	Solid bioenergy for electricity	Dmnl	own estimation		1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.03.00	Oceanic	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.04.00	Wind onshore	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	101.05.00	Solar PV	Dmnl	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	101.06.00	Wind offshore	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.07.00	Hydro	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.08.00	Nuclear	Dmnl	own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	101.09.00	CSP	Dmnl	own estimation		1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Renewable & Nuclear Energy Parameters	102.00.00	EROI initial	Dmnl		-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	102.01.00	Geothermal	Dmnl	Annex 3 from MEDEAS D2.1	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	102.02.00	Solid bioenergy for electricity	Dmnl	de Castro et al (2014)	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	102.03.00	Oceanic	Dmnl	own estimation (Deliverable 4.1)	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Paramet	102.04.00	Hydro	Dmnl	Annex 3 from MEDEAS D2.1	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
ers								
Renewable & Nuclear Energy Parameters	102.05.00	solar for heat	Dmnl	Own estimation	-	1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	102.06.00	Solid bioenergy for heat	Dmnl	Own estimation		1960-2015	28/06/2017	
Renewable & Nuclear Energy Parameters	103.00.00	Employment factors RES	job yr/MW	Energy [G]eneration 2015, Greenpeace and REN21 (2017)	-	1960-2015	28/06/2017	
Other parameters	104.00.00	Energy shares by sector	Dmnl	Own estimation with data from IEA Balances	-	1960-2015	28/06/2017	
Other parameters	104.01.00	share current trends Elec for Transp	Dmnl	Own estimation with data from IEA Balances	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	104.02.00	future share gas vs (coal+gas) for Elec	Dmnl	Own estimation with data from IEA Balances	-	1960-2015	28/06/2017	
Other parameters	105.00.00	Efficiencies	Dmnl	own calculations from IEA balances	-	1960-2015	28/06/2017	
Other parameters	106.00.00	Energy losses	Dmnl	Own estimation with data from IEA Balances	-	1960-2015	28/06/2017	
Other parameters	106.01.00	Prop electrical distribution losses	Dmnl	Own estimation with data from IEA Balances		1960-2015	28/06/2017	
Other parameters	106.02.00	propor gas transp losses	Dmnl	Own estimation with data from IEA Balances	-	1960-2015	28/06/2017	
Other parameters	107.00.00	BioEnergy			-	1960-2015	28/06/2017	
Other parameters	107.01.00	PEpc consumption trad biomass ref	EJ	own estimation derived from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Other parameters	107.02.00	People relying trad biomass ref	inhabitants	(WEO, 2010)	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	107.03.00	Land productivity biofuels 2nd gen EJ MHa	EJ/Mha	Mediavilla2013; de Castro et al (2014) and MEDEAS D2.2 Task 2.2.e.4	-	1960-2015	28/06/2017	
Other parameters	107.04.00	BioE potencial NPP marginal lands	EJ/yr	Field et al., 2008	-	1960-2015	28/06/2017	
Other parameters	107.05.00	Conv efficiency from NPP to biofuels	Dmnl	de Castro & Carpintero (2014).		1960-2015	28/06/2017	
Other parameters	107.06.00	Land occupation ratio biofuels marg land	Mha/EJ	Field et al. (2008)	-	1960-2015	28/06/2017	
Other parameters	108.00.00	Life time RES Thermal	yr	own estimation	-	1960-2015	28/06/2017	
Other parameters	109.00.00	Alternative transport			-	1960-2015	28/06/2017	
Other parameters	109.01.00	technological max pct of change	Dmnl	own estimation	-	1960-2015	28/06/2017	
Other parameters	109.02.00	K liquid E EV TWh EJ	TWh/EJ	EABEV, 2008	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	110.00.00	Grid reinforcement costs ref	1995$/kW	Mills et al (2012)	-	1960-2015	28/06/2017	
Other parameters	111.00.00	Oil refinery gains share	Dmnl	WEO (2010) gives a 2.8% for the yr 2009 and BP (2007) 2.6%. The value 2.7% is taken.		1960-2015	28/06/2017	
Other parameters	112.00.00	TPEFpc threshold high development	GJ/inhabitants	Arto et al., (2016)	-	1960-2015	28/06/2017	
Other parameters	113.00.00	TPED acceptable standard living	GJ/inhabitants	(Goldemberg, 2011; Rao et al, 2014, WBGU,2003)	-	1960-2015	28/06/2017	
Other parameters	114.00.00	Prop heat distribution losses	Dmnl	Own estimation with data from IEA balances	-	1960-2015	28/06/2017	
Other parameters	115.00.00	Waste	Dmnl	Own estimation with data from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Other parameters	116.00.00	Biogas	Dmnl	Own estimation with data from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	117.00.00	Climate parameters		DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2013	1960-2015	28/06/2017	
Other parameters	117.01.00	Marginal Atmos Retention	Dmnl	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2014	1960-2015	28/06/2017	
Other parameters	117.02.00	init CO2 in Atmos ppm	ppm	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2015	1960-2015	28/06/2017	
Other parameters	117.03.00	Rate of CO2 Transfer	%	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2016	1960-2015	28/06/2017	
Other parameters	117.04.00	Preindustrial CO2	Ton C	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2017	1960-2015	28/06/2017	
Other parameters	117.05.00	CO2 Rad Force Coeff	W/m2	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2018	1960-2015	28/06/2017	
Other parameters	117.06.00	Transfer coefficient for lower level	%	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2019	1960-2015	28/06/2017	
Other parameters	117.07.00	Heat Capacity Ratio	W/(m2*ºC)	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2020	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	117.08.00	Climate equation coefficient for upper level	ºC*meter*meter/(watt*yr)	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2021	1960-2015	28/06/2017	
Other parameters	117.09.00	init Atmos UOcean Temp	ºC	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2022	1960-2015	28/06/2017	
Other parameters	117.10.00	init Deep Ocean Temp	ºC	DICE model	Nordhaus 1992, 1994; Nordhaus&Sztorc, 2023	1960-2015	28/06/2017	
Other parameters	117.11.00	carbon budget	Gt C	IPCC 2014	IPCC. "Climate Change 2014: Mitigation of Climate Change." Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 2014.	1960-2015	28/06/2017	
Other parameters	118.00.00	share trad biomass vs solids in households	Dmnl	Own estimation with data from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Other parameters	119.00.00	Efficiency solar panels for heat	Dmnl	SHC (2016)	-	1960-2015	28/06/2017	
Other parameters	120.00.00	Losses solar for heat	Dmnl	Nielsen & WoLiM 1.5	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	121.00.00	Efficiency geothermal for heat	Dmnl	Own estimation with data from IEA balances	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	average 1995-2015
Other parameters	122.00.00	EV batteries			-	1960-2015	28/06/2017	
Other parameters	122.01.00	Round-trip storage efficiency EV batteries	Dmnl	Dale & Barnhart (2013)	http://pubs.rsc.org/en/content/articlelanding/2013/ee/c3ee41973h	1960-2015	28/06/2017	
Other parameters	122.02.00	Cp EV batteries for elec storage	Dmnl	Own elaboration	-	1960-2015	28/06/2017	
Other parameters	122.03.00	ESOI EV batteries	Dmnl	Own elaboration	-	1960-2015	28/06/2017	
Other parameters	122.04.00	Wattios per battery EV	kW/battery	own estimation	-	1960-2015	28/06/2017	
Other parameters	123.00.00	Pumped hydro storage (PHS)			-	1960-2015	28/06/2017	
Other parameters	123.01.00	Round-trip storage efficiency PHS	Dmnl	Denholm and Margolis, 2008		1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	123.02.00	Cp PHS	Dmnl	IRENA database	-	1960-2015	28/06/2017	
Other parameters	123.03.00	ESOI PHS full potential	Dmnl	Own estimation	-	1960-2015	28/06/2017	
Other parameters	124.00.00	Materials	Dmnl		-	1960-2015	28/06/2017	
Other parameters	124.01.00	Max recycling rates minerals	Dmnl	(Ragnarsdóttir et al., 2012)	-	1960-2015	28/06/2017	
Other parameters	124.02.00	Share of Heat output vs electricity in nuclear	Dmnl	Own estimation with data from IEA balances	-	1960-2015	28/06/2017	
Other parameters	125.00.00	EROI NRE fuels	Dmnl	datos ad hoc o de Hall et al (2014)	-	1960-2015	28/06/2017	
Other parameters	126.00.00	Heat demand	Dmnl	Own estimation with data from the IEA	http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en	1960-2015	28/06/2017	
Other parameters	127.00.00	Lifetime CTL	yr	own estimation	-	1960-2015	28/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Other parameters	128.00.00	Lifetime GTL	yr	own estimation	-	1960-2015	28/06/2017	
Transport	129.00.00	Household vehicles	million vehicles	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	
Transport	130.00.00	Commercial vehicles	million vehicles	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	
Transport	131.00.00	Share of household vehicles	%	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	
Transport	132.00.00	Share of commercial vehicles	%	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	
Transport	133.00.00	Energy used in Households vehicles	EJ	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Transport	134.00.00	Energy used in commercial vehicles	EJ	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	2015	26/06/2017	
Transport	135.00.00	Saving ratios of alternative HOUSEHOLDS vehicles relative to liquids vehicles	Dmnl	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	1960-2015	26/06/2017	
Transport	136.00.00	Saving ratios of alternative commercial vehicles relative to liquids vehicles	Dmnl	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	1960-2015	26/06/2017	
Transport	137.00.00	Batteries ratio	Dmnl	Own elaboration with data from the IEA	https://www.iea.org/publications/freepublications/publication/EnergyTechnologyPerspectives2016_ExecutiveSummary_EnglishVersion.pdf	1960-2015	26/06/2017	
Scenarios	138.00.00	Trend demand (all sectors)		Own estimation		2016	05/07/2017	
Scenarios	138.01.00	P variation trend demand households	Dmnl	Own estimation	-	2016	05/07/2017	
Scenarios	138.02.00	P labour share	Dmnl	Own estimation		2016	05/07/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	139.00.00	Waste		Own estimation	-	2016	05/07/2017	
Scenarios	139.01.00	max waste	EJ	Own estimation		2016	05/07/2017	
Scenarios	139.02.00	P waste change	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	140.00.00	Intensities		Own estimation		2016	05/07/2017	
Scenarios	140.01.00	Min energy intensity vs initial	Dmnl	Own estimation	-	2016	05/07/2017	
Scenarios	141.00.00	Minerals		Own estimation		2016	05/07/2017	
Scenarios	141.01.00	P recycling minerals Rest	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	141.02.00	P recycling minerals alternative technologies (RES elec & EV batteries)	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	142.00.00	Nuclear		Own estimation	-	2016	05/07/2017	
Scenarios	142.01.00	Selection of nuclear scenario	Dmnl	Own estimation		2016	05/07/2017	Possible scenarios: 1. Constant power capacity at current levels. 2. No more nuclear installed, current capacity depreciates. 3. Growth of nuclear power. 4. Phase-out of nuclear power
Scenarios	143.00.00	Techno-ecological		Own estimation	-	2016	05/07/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
		potential electric RES						
Scenarios	143.01.00	max hydro	TWe	Own estimation		2016	05/07/2017	
Scenarios	143.02.00	max PE geot-elec	TWth	Own estimation	-	2016	05/07/2017	
Scenarios	143.03.00	max oceanic	TWe	Own estimation		2016	05/07/2017	
Scenarios	143.04.00	max onshore wind	TWe	Own estimation	-	2016	05/07/2017	
Scenarios	143.05.00	max offshore wind	TWe	Own estimation		2016	05/07/2017	
Scenarios	143.06.00	max solar on land (PV and CSP)	Mha	Own estimation	-	2016	05/07/2017	
Scenarios	143.07.00	max potential PHS	TWe	Own estimation		2016	05/07/2017	
Scenarios	144.00.00	Projection electric RES		Own estimation	-	2016	05/07/2017	
Scenarios	144.01.00	P hydro growth	vs past trends	Own estimation		2016	05/07/2017	
Scenarios	144.02.00	P geot-elec growth	vs past trends	Own estimation	-	2016	05/07/2017	
Scenarios	144.03.00	P solid bioE-elec growth	vs past trends	Own estimation		2016	05/07/2017	
Scenarios	144.04.00	P oceanic	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	144.05.00	P onshore wind	annual growth%	Own estimation		2016	05/07/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	144.06.00	P wind offshore	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	144.07.00	P solar PV	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	144.08.00	P CSP	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	145.00.00	BioEnergy		Own estimation		2016	05/07/2017	
Scenarios	145.01.00	P biofuels 2gen	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	145.02.00	Additional land compet available for biofuels	Mha	Own estimation		2016	05/07/2017	
Scenarios	145.03.00	P biofuels 3gen	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	145.04.00	start yr 3gen	yr	Own estimation		2016	05/07/2017	
Scenarios	145.05.00	Annual shift from 2gen to 3gen	Dmnl	Own estimation	-	2016	05/07/2017	
Scenarios	145.06.00	start yr biofuels land marg	yr	Own estimation		2016	05/07/2017	
Scenarios	145.07.00	P bioE residues for heat+elec	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	145.08.00	start yr BioE residues for heat+elec	yr	Own estimation		2016	05/07/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	145.09.00	P cellulosic biofuels	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	145.10.00	start yr cellulosic biofuels	yr	Own estimation		2016	05/07/2017	
Scenarios	145.11.00	share cellulosic biofuels vs BioE residues	Dmnl	Own estimation	-	2016	05/07/2017	
Scenarios	145.12.00	evol biogases	vs past trends	Own estimation		2016	05/07/2017	
Scenarios	145.13.00	Max biogases	EJ	Own estimation	-	2016	05/07/2017	
Scenarios	145.14.00	Max potential thermal BioE conventional	EJ	Own estimation		2016	05/07/2017	
Scenarios	145.15.00	Max NPP potential BioE residues for heat	EJ	Own estimation	-	2016	05/07/2017	
Scenarios	146.00.00	Techno-ecological potential RES for heat		Own estimation		2016	05/07/2017	
Scenarios	146.01.00	FE solar thermal potential	EJ	Own estimation	-	2016	05/07/2017	
Scenarios	146.02.00	Geot PE potential for heat TWth	TWth	Own estimation		2016	05/07/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	147.00.00	Projection RES for heat		Own estimation	-	2016	05/07/2017	
Scenarios	147.01.00	P solar for heat	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	147.02.00	P geothermal for heat	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	147.03.00	P solid bioE for heat	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	148.00.00	Alternative transport		Own estimation	-	2016	05/07/2017	
Scenarios	148.01.00	P BEV growth	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	148.02.00	P HEV growth	annual growth%	Own estimation	-	2016	05/07/2017	
Scenarios	148.03.00	P NGV growth	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	149.00.00	Afforestation		Own estimation	-	2016	05/07/2017	
Scenarios	149.01.00	Activate afforestation program	Dmnl	Own estimation		2016	05/07/2017	1=Yes; 0=No
Scenarios	150.00.00	Resources Oil		Own estimation	-	2016	05/07/2017	
Scenarios	150.01.00	Selection of conv oil curve	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1. Maggio12 middle. 2. Maggio12 High. 3. Maggio12 Low. 4. User defined in '139A'
Scenarios	150.02.00	Selection of unconv oil curve	Dmnl	Own estimation	-	2016	05/07/2017	Possibilities: 1. Mohr15 BG. 2. Mohr15 Low. 3. Mohr15 High. 4. User defined in '141A'

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	150.03.00	Selection of total oil curve	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1.Laherrère 2006. 2.User defined in '143A'
Scenarios	150.04.00	Selection constraint extraction unconv oil	Dmnl	Own estimation	-	2016	05/07/2017	Possibilities: 1. User constant (annual growth%). 2. User defined as function of time '161A'
Scenarios	151.00.00	Resources Gas		Own estimation		2016	05/07/2017	
Scenarios	151.01.00	Selection of conv gas curve	Dmnl	Own estimation	-	2016	05/07/2017	Possibilities: 1. BG Mohr15. 2. Low Mohr15. 3. High Mohr15. 4. User defined in '146A'
Scenarios	151.02.00	Selection of unconventional gas curve	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1. Mohr15 BG. 2. Mohr15 Low. 3. Mohr15 High. 4. User defined in '148A'
Scenarios	151.03.00	Selection of total gas curve	Dmnl	Own estimation	-	2016	05/07/2017	Possibilities: 1.Laherrére10. 2.Mohr12 BG. 3.User defined in '150A'
Scenarios	151.04.00	Selection constraint extraction unconv gas	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1. User constant (annual growth%). 2. User defined as function of time '163A'
Scenarios	152.00.00	Resources Coal		Own estimation	-	2016	05/07/2017	
Scenarios	152.01.00	Selection of coal curve	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1. Mohr12 high. 2. Mohr15 low. 3. Mohr15 BG. 4. Mohr15 high. 5. User defined in '153A'.
Scenarios	153.00.00	Resources Uranium		Own estimation	-	2016	05/07/2017	
Scenarios	153.01.00	Selection of uranium curve	Dmnl	Own estimation		2016	05/07/2017	Possibilities: 1.EWG13. 2.Zittel12. 3.User defined in '156A'

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Scenarios	154.00.00	CTL		Own estimation	-	2016	05/07/2017	
Scenarios	154.01.00	P CTL (annual growth%)	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	155.00.00	GTL		Own estimation	-	2016	05/07/2017	
Scenarios	155.01.00	P GTL (annual growth%)	annual growth%	Own estimation		2016	05/07/2017	
Scenarios	156.00.00	Climate		Own estimation	-	2016	05/07/2017	
Scenarios	156.01.00	Climate Sensitivity	ºC	Own estimation		2016	05/07/2017	
Scenarios	157.00.00	CC impacts		Own estimation	-	2016	05/07/2017	
Scenarios	157.01.00	Activate ELF?	Dmnl	Own estimation		2016	05/07/2017	1=Yes;0=No
Scenarios	158.00.00	Policies to reduce oil contribution in heat and electricity linearly following linear decreasing trend		Own estimation	-	2016	05/07/2017	
Scenarios	158.01.00	Reduce oil for electricity?	Dmnl	Own estimation		2016	05/07/2017	1: YES; 0: constant current share
Scenarios	158.02.00	Reduce oil for heat?	Dmnl	Own estimation	-	2016	05/07/2017	1: YES; 0: constant current share

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ANNEX II. EUROPE MEDEAS METADATA

Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	1.00.00	GDP (Final demand)	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	2.00.00	Production	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	3.00.00	Inequality indicators	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Own calculations. Income share: factor income/GDP
Socioeconomic	3.01.00	Labour share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Labour compensation/GDP.
Socioeconomic	3.02.00	Profit share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Capital compensation/GDP.
Socioeconomic	4.00.00	Income	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Original source in current prices and national currency. Rate exchange in WIOD-SEA. World aggregated. Assumption: Rest of the

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								World region has the same primary income distribution.
Socioeconomic	4.01.00	Labour compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	4.02.00	Capital compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	5.00.00	Population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	6.00.00	Life expectancy at bith	years	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	7.00.00	Urban population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	8.00.00	Rural population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	9.00.00	Unemployment rate	% of total labour force	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1991-2016	21/04/2017	
Socioeconomic	10.00.00	Energy dependency	%	World Bank Group	http://data.worldbank.org/indicator/EG.IMP.CONS.ZS	1960-2014	16/05/2017	Net energy imports/Energy use. A negative value indicates that the country is a net exporter.

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	11.00.00	Technical coefficients	Ratio input ($)/output($)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Once world Input-Output table is compiled at 1995 prices, we obtain the ratio between the sectoral transaction and the output by columns.
Socioeconomic	12.00.00	Final energy consumption per capita	kgoe/capita	Own elaboration based on data from the IEA	http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE	1971-2014	21/04/2017	
Resources-Economy	13.00.00	Water consumption	m3/yr	WIOD-Environmental Accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	World aggregated.
Resources-Economy	14.00.00	Water intensity	m3/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	Own calculations. Own calculations: Water consumption(m3)/Production (million $ 1995)
Resources-Economy	15.00.00	Material consumption	ton/hab*yr	Friends Of The Earth Austria Overconsumption? Our use of the World's natural resources	https://www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf	1980 1985 1990 1990 2000	28/04/2017	
Resources-Economy	16.00.00	Primary Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-	http://www.wiod.org/database/eas13	1995-2009	08/05/2017	Own calculation. World aggregated, source and sector disaggregated. Primary Energy Consumption (TJ)/Production(million $

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
				Environmental accounts				1995)
Resources-Economy	17.00.00	Final Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	04/05/2017	Own calculation. World aggregated, source and sector disaggregated. Final Energy Consumption (TJ)/Production(million $ 1995)
Land use	18.00.00	Food land	kHa	Nations (FAO) Statistics Division (ESS), Environment Statistics team	http://www.fao.org/faostat/en/?#data/RL	1961-2014	28/04/2017	ITEM: Agricultural area
Land use	19.00.00	Forest land	km2	World Bank Forest Area, World Bank	http://data.worldbank.org/INDICATOR/AG.LND.FRST.K2?VIEW=CHART	1990-2015	21/04/2017	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. NA
Land use	20.00.00	Biodiversity protection land	km2	World Bank Terrestrial Protected Areas, World Bank	http://data.worldbank.org/INDICATOR/ER.LND.PTLD.ZS	1990, 2000, 2014	02/05/2017	Terrestrial protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. Marine

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								areas, unclassified areas, littoral (intertidal) areas, and sites protected under local or provincial law are excluded.
Land use	21.00.00	Urban land area	km2	World Bank Urban Land Area	http://data.worldbank.org/INDICATOR/AG.LND.TOTL.UR.K2	1990, 2000, 2010	21/04/2017	Urban land area in mega hectares, based on a combination of population counts (persons), settlement points, and the presence of night-time lights. Areas are defined as urban where contiguous lighted cells from the night-time lights or approximated urban extents based on buffered settlement points for which the total population is greater than 5,000 persons. Urban not urbanized land, gives the same number for 1990, 2000 and 2010
Land use	22.00.00	Biofuel and bioelectricity land	Mha	CAPELLÁN ET AL. DELIVERABLE D2.2.E.4 (ANNEX 12)	NA	2008, 2010	02/05/2017	Land for biofuel estimation only biofuels from agriculture, bioelectricity is supposed from waste and forest residues
Land use	23.00.00	Arable and cropland, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	24.00.00	Pastures and meadows, % total	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
		land area						
Land use	25.00.00	Forest, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	26.00.00	Other land, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Energy consumption by sectors	27.00.00	Final Energy Consumption (FEC)	EJ	Own elaboration based on data from the IEA and WIOD	http://www.wiod.org/database/eas13	1995-2009	18/05/2017	Sectorally aggregated using WIOD and IEA.
Commerce	28.00.00	Total commerce	(constant 2010 US$)	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	1970-2015	18/05/2017	
Energy	29.00.00	Energy exchange	TJ	Eurostats	http://ec.europa.eu/eurostat/web/energy/data/database	1990-2014	18/05/2017	

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ANNEX III. AUSTRIA MEDEAS METADATA

Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	1.00.00	GDP (Final demand)	million $(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	2.00.00	Production	million $(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	3.00.00	Inequality indicators	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Own calculations. Income share: factor income/GDP
Socioeconomic	3.01.00	Labour share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Labour compensation/GDP.
Socioeconomic	3.02.00	Profit share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Capital compensation/GDP.
Socioeconomic	4.00.00	Income	million $(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Original source in current prices and national currency. Rate exchange in WIOD-SEA. World aggregated. Assumption: Rest of the

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								World region has the same primary income distribution.
Socioeconomic	4.01.00	Labour compensation	million $(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	4.02.00	Capital compensation	million $(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	5.00.00	Population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	6.00.00	Life expectancy at birth	years	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	7.00.00	Urban population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	8.00.00	Rural population	inhabitants	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	9.00.00	Unemployment rate	% of total labour force	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1991-2016	21/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	10.00.00	Energy dependency	%	World Bank Group	http://data.worldbank.org/indicator/EG.IMP.CONS.ZS	1960-2014	16/05/2017	Net energy imports/Energy use. A negative value indicates that the country is a net exporter.
Socioeconomic	11.00.00	Technical coefficients	Ratio input ($)/output($)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Once world Input-Output table is compiled at 1995 prices, we obtain the ratio between the sectoral transaction and the output by columns.
Socioeconomic	12.00.00	Final energy consumption per capita	kgoe/capita	Own elaboration based on data from the IEA	http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE	1971-2014	21/04/2017	
Resources-Economy	13.00.00	Water consumption	m3/yr	WIOD-Environmental Accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	World aggregated.
Resources-Economy	14.00.00	Water intensity	m3/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	Own calculations. Own calculations: Water consumption(m3)/Production (million $ 1995)
Resources-Economy	15.00.00	Material consumption	ton/hab*yr	Friends Of The Earth Austria Overconsumption? Our use of the World's natural resources	https://www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf	1980 1985 1990 1990 2000	28/04/2017	
Resources-Economy	16.00.00	Primary Energy	TJ/$(1995)	Own calculations on the basis of	http://www.wiod.org/database/eas13	1995-2009	08/05/2017	Own calculation. World aggregated, source and sector disaggregated. Primary Energy

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
		Intensity		WIOD-Environmental accounts				Consumption (TJ)/Production(million $ 1995)
Resources-Economy	17.00.00	Final Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	04/05/2017	Own calculation. World aggregated, source and sector disaggregated. Final Energy Consumption (TJ)/Production(million $ 1995)
Land use	18.00.00	Food land	kHa	Food and Agriculture Organization of the United Nations (FAO) Statistics Division (ESS), Environment Statistics team	http://www.fao.org/faostat/en/?#data/RL	1961-2014	28/04/2017	ITEM: Agricultural area
Land use	19.00.00	Forest land	km2	World Bank Forest Area, World Bank	http://data.worldbank.org/INDICATOR/AG.LND.FRST.K2?VIEW=CHART	1990-2015	21/04/2017	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. NA
Land use	20.00.00	Biodiversity protection land	km2	World Bank Terrestrial Protected Areas,	http://data.worldbank.org/INDICATOR/ER.LND.PTLD.ZS	1990, 2000, 2014	02/05/2017	Terrestrial protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
				World Bank				authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. Marine areas, unclassified areas, littoral (intertidal) areas, and sites protected under local or provincial law are excluded.
Land use	21.00.00	Urban land area	km2	World Bank Urban Land Area	http://data.worldbank.org/INDICATOR/AG.LND.TOTL.UR.K2	1990, 2000, 2010	21/04/2017	Urban land area in mega hectares, based on a combination of population counts (persons), settlement points, and the presence of night-time lights. Areas are defined as urban where contiguous lighted cells from the night-time lights or approximated urban extents based on buffered settlement points for which the total population is greater than 5,000 persons. Urban not urbanized land, gives the same number for 1990, 2000 and 2010
Land use	22.00.00	Biofuel and bioelectricity land	Mha	Capellán et al. Deliverable D2.2.e.4 (annex 12)	NA	2008, 2010	02/05/2017	Land for biofuel estimation only biofuels from agriculture, bioelectricity is supposed from waste and forest residues
Land use	23.00.00	Arable and cropland, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Land use	24.00.00	Pastures and meadows, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	25.00.00	Forest, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	26.00.00	Other land, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Energy consumption by sectors	27.00.00	Final Energy Consumption (FEC)	EJ	Own elaboration based on data from the IEA and WIOD	http://www.wiod.org/database/eas13	1995-2009	18/05/2017	Sectorally aggregated using WIOD and IEA.
Commerce	28.00.00	Total commerce	Chained linked volumes (2010), million euro	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2006-2015	18/05/2017	
Commerce	29.00.00	Intra EU28 Trade	Chained linked volumes (2010),	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2008-2015	18/05/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
			million euro					
Commerce	30.00.00	Extra EU28 Trade	Chained linked volumes (2010), million euro	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2008-2015	18/05/2017	
Energy	31.00.00	Energy exchange	TJ	Eurostats	http://ec.europa.eu/eurostat/web/energy/data/database	1990-2014	18/05/2017	

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ANNEX IV. BULGARIA MEDEAS METADATA

Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	1.00.00	GDP (Final demand)	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	2.00.00	Production	million$(1995)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Original source in current prices. Own calculations. World aggregated and sectoral disaggregated. Chained volumes prices (1995) on the basis of IOT at previous year prices.
Socioeconomic	3.00.00	Inequality indicators	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Own calculations. Income share: factor income/GDP
Socioeconomic	3.01.00	Labour share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Labour compensation/GDP.
Socioeconomic	3.02.00	Profit share in GDP	%	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	26/04/2017	Own calculations. Capital compensation/GDP.
Socioeconomic	4.00.00	Income	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	Original source in current prices and national currency. Rate exchange in WIOD-SEA. World aggregated. Assumption: Rest

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								of the World region has the same primary income distribution.
Socioeconomic	4.01.00	Labour compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	4.02.00	Capital compensation	million$(1995)	WIOD- Socio Economic Accounts	http://www.wiod.org/database/seas13	1995-2009	17/05/2017	
Socioeconomic	5.00.00	Population	inhabitants	World Bank Group World Development Indicators	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	6.00.00	Life expectancy at birth	years	World Bank Group World Development Indicators	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	7.00.00	Urban population	inhabitants	World Bank Group World Development Indicators	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	
Socioeconomic	8.00.00	Rural population	inhabitants	World Bank Group World Development Indicators	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1960-2015	21/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Socioeconomic	9.00.00	Unemployment rate	% of total labour force	World Bank Group World Development Indicators	http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.PETR.ZS&country=#	1991-2016	21/04/2017	
Socioeconomic	10.00.00	Energy dependency	%	World Bank Group	http://data.worldbank.org/indicator/EG.IMP.CONS.ZS	1960-2014	16/05/2017	Net energy imports/Energy use. A negative value indicates that the country is a net exporter.
Socioeconomic	11.00.00	Technical coefficients	Ratio input ($)/output ($)	WIOD	http://www.wiod.org/database/wiots13	1995-2009	17/05/2017	Once world Input-Output table is compiled at 1995 prices, we obtain the ratio between the sectoral transaction and the output by columns.
Socioeconomic	12.00.00	Final energy consumption per capita	kgoe/capita	Own elaboration based on data from the IEA	http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE	1971-2014	21/04/2017	
Resources-Economy	13.00.00	Water consumption	m3/yr	WIOD-Environmental Accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	World aggregated.
Resources-Economy	14.00.00	Water intensity	m3/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	28/04/2017	Own calculations. Own calculations: Water consumption(m3)/Production (million $ 1995)

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Resources-Economy	15.00.00	Material consumption	ton/hab*yr	Friends Of The Earth Austria Overconsumption ? Our use of the World's natural resources	https://www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf	1980 1985 1990 1990 2000	28/04/2017	
Resources-Economy	16.00.00	Primary Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	08/05/2017	Own calculation. World aggregated, source and sector disaggregated. Primary Energy Consumption (TJ)/Production(million $ 1995)
Resources-Economy	17.00.00	Final Energy Intensity	TJ/$(1995)	Own calculations on the basis of WIOD-Environmental accounts	http://www.wiod.org/database/eas13	1995-2009	04/05/2017	Own calculation. World aggregated, source and sector disaggregated. Final Energy Consumption (TJ)/Production(million $ 1995)
Land use	18.00.00	Food land	kHa	Food and Agriculture Organization of the United Nations (FAO) Statistics Division (ESS), Environment Statistics team	http://www.fao.org/faostat/en/?#data/RL	1961-2014	28/04/2017	ITEM: Agricultural area

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Land use	19.00.00	Forest land	km2	World Bank Forest Area, World Bank	http://data.worldbank.org/INDICATOR/AG.LND.FRST.K2?VIEW=CHART	1990-2015	21/04/2017	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. NA
Land use	20.00.00	Biodiversity protection land	km2	World Bank Terrestrial Protected Areas, World Bank	http://data.worldbank.org/INDICATOR/ER.LND.PTLD.ZS	1990, 2000, 2014	02/05/2017	Terrestrial protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. Marine areas, unclassified areas, littoral (intertidal) areas, and sites protected under local or provincial law are excluded.
Land use	21.00.00	Urban land area	km2	World Bank Urban Land Area	http://data.worldbank.org/INDICATOR/AG.LND.TOTL.UR.K2	1990, 2000, 2010	21/04/2017	Urban land area in mega hectares, based on a combination of population counts (persons), settlement points, and the presence of night-time lights. Areas are defined as urban where contiguous lighted cells from the night-time lights or approximated urban extents based on

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
								buffered settlement points for which the total population is greater than 5,000 persons. Urban not urbanized land, gives the same number for 1990, 2000 and 2010
Land use	22.00.00	Biofuel and bioelectricity land	Mha	Capellán et al. Deliverable D2.2.e.4 (annex 12)	NA	2008, 2010	02/05/2017	Land for biofuel estimation only biofuels from agriculture, bioelectricity is supposed from waste and forest residues
Land use	23.00.00	Arable and cropland, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	24.00.00	Pastures and meadows, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	25.00.00	Forest, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	
Land use	26.00.00	Other land, % total land area	%	OECD. Green growth indicators	http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	1990-2014	17/04/2017	

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Topic	id	Entries	Unit	Source	Link	Data period	Date collection	Comments
Energy consumption by sectors	27.00.00	Final Energy Consumption (FEC)	EJ	Own elaboration based on data from the IEA and WIOD	http://www.wiod.org/database/eas13	1995-2009	18/05/2017	Sectorally aggregated using WIOD and IEA.
Commerce	28.00.00	Total commerce	Chained linked volumes (2010), million euro	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2006-2015	18/05/2017	
Commerce	29.00.00	Intra EU28 Trade	Chained linked volumes (2010), million euro	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2008-2015	18/05/2017	
Commerce	30.00.00	Extra EU28 Trade	Chained linked volumes (2010), million euro	Datacomex	http://datacomex.comercio.es/principal_comex_ue.aspx	2008-2015	18/05/2017	
Energy	31.00.00	Energy exchange	TJ	Eurostats	http://ec.europa.eu/eurostat/web/energy/data/database	1990-2014	18/05/2017	

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ANNEX V. DATABASE SCHEMA DEFINITION

```
CREATE SCHEMA IF NOT EXISTS `medeas` DEFAULT CHARACTER SET latin1 ;
USE `medeas` ;

-- -----------------------------------------------------
-- Table `medeas`.`UNIT`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`UNIT` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `title` VARCHAR(45) NOT NULL,
  PRIMARY KEY (`id`))

AUTO_INCREMENT = 63
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`QUANTITY`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`QUANTITY` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `title` VARCHAR(45) NOT NULL,
  `baseunit` INT(11) NOT NULL,
  PRIMARY KEY (`id`),
  INDEX `fk_group_1_idx` (`baseunit` ASC),
  CONSTRAINT `fk_group_1`
    FOREIGN KEY (`baseunit`)
    REFERENCES `medeas`.`UNIT` (`id`)
    ON UPDATE CASCADE)

AUTO_INCREMENT = 44
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`TOPIC`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`TOPIC` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `title` VARCHAR(255) NOT NULL,
```


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```
  PRIMARY KEY (`id`),
  UNIQUE INDEX `title_UNIQUE` (`title` ASC))

AUTO_INCREMENT = 17
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`VARIABLETYPE`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`VARIABLETYPE` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `title` VARCHAR(20) NOT NULL,
  PRIMARY KEY (`id`))

AUTO_INCREMENT = 4
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`VARIABLE`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`VARIABLE` (
  `id` VARCHAR(12) NOT NULL,
  `title` VARCHAR(255) NOT NULL,
  `quantity` INT(11) NOT NULL,
  `topic` INT(11) NOT NULL,
  `variabletype` INT(11) NOT NULL,
  `insert_user` VARCHAR(45) NULL DEFAULT NULL,
  `insert_dt` DATETIME NULL DEFAULT NULL,
  PRIMARY KEY (`id`),
  INDEX `fk_variable_2_idx` (`topic` ASC),
  INDEX `fk_variable_1_idx` (`quantity` ASC),
  INDEX `fk_variable_3_idx` (`variabletype` ASC),
  CONSTRAINT `fk_variable_1`
    FOREIGN KEY (`quantity`)
    REFERENCES `medeas`.`QUANTITY` (`id`)
    ON UPDATE CASCADE,
  CONSTRAINT `fk_variable_2`
    FOREIGN KEY (`topic`)
    REFERENCES `medeas`.`TOPIC` (`id`)
    ON UPDATE CASCADE,
  CONSTRAINT `fk_variable_3`
    FOREIGN KEY (`variabletype`)
```


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```
  REFERENCES `medeas`.`VARIABLETYPE` (`id`)
  ON UPDATE CASCADE)

DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`METADATA`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`METADATA` (
 `id` INT(11) NOT NULL AUTO_INCREMENT,
 `variable` VARCHAR(12) NOT NULL,
 `source` VARCHAR(255) NULL DEFAULT NULL,
 `source_update` VARCHAR(45) NULL DEFAULT NULL,
 `identifier` VARCHAR(255) NULL DEFAULT NULL,
 `reliability` DOUBLE NULL DEFAULT NULL,
 `license` VARCHAR(45) NULL DEFAULT NULL,
 `data_period` VARCHAR(45) NULL DEFAULT NULL,
 `collection_dt` VARCHAR(45) NULL DEFAULT NULL,
 `comments` VARCHAR(2000) NULL DEFAULT NULL,
 `valuetype` VARCHAR(45) NULL DEFAULT NULL,
 PRIMARY KEY (`id`),
 UNIQUE INDEX `variable_UNIQUE` (`variable` ASC),
 INDEX `fk__idx` (`variable` ASC),
 CONSTRAINT `fk_metadata_1`
  FOREIGN KEY (`variable`)
  REFERENCES `medeas`.`VARIABLE` (`id`)
  ON UPDATE CASCADE)

AUTO_INCREMENT = 56
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`MODEL`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`MODEL` (
 `id` INT(11) NOT NULL AUTO_INCREMENT,
 `title` VARCHAR(20) NOT NULL,
 PRIMARY KEY (`id`),
 UNIQUE INDEX `title_UNIQUE` (`title` ASC))

AUTO_INCREMENT = 5
DEFAULT CHARACTER SET = latin1;
```


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```
-- -----------------------------------------------------
-- Table `medeas`.`UNITQUANTITY`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`UNITQUANTITY` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `quantity` INT(11) NOT NULL,
  `unit` INT(11) NOT NULL,
  `multiplier` DOUBLE NOT NULL,
  PRIMARY KEY (`id`),
  INDEX `fk_unitgroup_1_idx` (`unit` ASC),
  INDEX `fk_unitgroup_1` (`quantity` ASC),
  CONSTRAINT `fk_unitgroup_1`
    FOREIGN KEY (`quantity`)
    REFERENCES `medeas`.`QUANTITY` (`id`)
    ON UPDATE CASCADE,
  CONSTRAINT `fk_unitgroup_2`
    FOREIGN KEY (`unit`)
    REFERENCES `medeas`.`UNIT` (`id`)
    ON UPDATE CASCADE)

AUTO_INCREMENT = 63
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`VALUE`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`VALUE` (
  `id` INT(11) NOT NULL AUTO_INCREMENT,
  `variable` VARCHAR(12) NOT NULL,
  `model` INT(11) NOT NULL,
  `time` INT(11) NOT NULL,
  `value` DOUBLE NOT NULL,
  `insert_user` VARCHAR(45) NULL DEFAULT NULL,
  `insert_dt` DATETIME NULL DEFAULT NULL,
  PRIMARY KEY (`id`),
  UNIQUE INDEX `fields_UNIQUE` (`variable` ASC, `model` ASC, `time` ASC),
  INDEX `fk_value_2_idx` (`variable` ASC),
  INDEX `model_idx` (`model` ASC),
  INDEX `time_idx` (`time` ASC),
  CONSTRAINT `fk_value_1`
    FOREIGN KEY (`model`)
```


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```
  REFERENCES `medeas`.`MODEL` (`id`)
  ON UPDATE CASCADE,
 CONSTRAINT `fk_value_2`
  FOREIGN KEY (`variable`)
  REFERENCES `medeas`.`VARIABLE` (`id`)
  ON UPDATE CASCADE)

AUTO_INCREMENT = 143404
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`VALUE_HISTORY`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`VALUE_HISTORY` (
 `id` INT(11) NOT NULL AUTO_INCREMENT,
 `variable` VARCHAR(12) NOT NULL,
 `model` INT(11) NOT NULL,
 `time` INT(11) NOT NULL,
 `value` DOUBLE NOT NULL,
 `insert_user` VARCHAR(45) NULL DEFAULT NULL,
 `insert_dt` DATETIME NULL DEFAULT NULL,
 `lup` DATETIME NOT NULL,
 `lupuser` VARCHAR(45) NULL DEFAULT NULL,
 PRIMARY KEY (`id`),
 UNIQUE INDEX `variable_lup_UNIQUE` (`model` ASC, `variable` ASC, `time` ASC, `lup` ASC))
ENGINE = MyISAM
AUTO_INCREMENT = 656
DEFAULT CHARACTER SET = latin1;


-- -----------------------------------------------------
-- Table `medeas`.`user`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`user` (
 `USER_ID` INT(11) NOT NULL AUTO_INCREMENT,
 `user_name` VARCHAR(50) NULL DEFAULT NULL,
 `user_pass` CHAR(20) NULL DEFAULT NULL,
 `user_otp` VARCHAR(32) NULL DEFAULT NULL,
 `user_type` CHAR(1) NULL DEFAULT NULL,
 `user_level` INT(2) NULL DEFAULT NULL,
 `user_pass_expiry_date` DATETIME NULL DEFAULT '0001-01-01 00:00:00',
 PRIMARY KEY (`USER_ID`),
 UNIQUE INDEX `USERS001` USING BTREE (`user_name` ASC))
```


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```
AUTO_INCREMENT = 64
DEFAULT CHARACTER SET = latin1
ROW_FORMAT = DYNAMIC;


-- -----------------------------------------------------
-- Table `medeas`.`user_role`
-- -----------------------------------------------------
CREATE TABLE IF NOT EXISTS `medeas`.`user_role` (
  `USER_ROLE_ID` INT(11) NOT NULL AUTO_INCREMENT,
  `user_name` VARCHAR(50) NOT NULL,
  `role_name` CHAR(20) NOT NULL,
  PRIMARY KEY (`USER_ROLE_ID`),
  UNIQUE INDEX `USER_ROLE001` USING BTREE (`user_name` ASC, `role_name` ASC),
  CONSTRAINT `user_fk`
    FOREIGN KEY (`user_name`)
    REFERENCES `medeas`.`user` (`user_name`)
    ON UPDATE CASCADE)

AUTO_INCREMENT = 63
DEFAULT CHARACTER SET = latin1;
```


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ANNEX VI. SOURCE CODE FILE STATISTICS

D:\Documents\projects_netbeans8\MEDEAS_files - FILES										
File	LOC	SLOC Physical	SLOC Logical	MVG	BLOC	C&SLOC	CLOC	CWORD	HCLOC	HCWORD
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Metadata_.java	24	20	17	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Model_.java	17	13	10	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Quantity_.java	21	17	14	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Topic_.java	17	13	10	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Unitquantity_.java	18	14	11	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Unit_.java	19	15	12	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\UserRole_.java	16	12	9	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\User_.java	23	19	16	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\ValueHistoryPK_.java	15	11	8	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\ValueHistory_.java	22	18	15	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Value_.java	22	18	15	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Variabletype_.java	17	13	10	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\build\generated-sources\ap-source-output\entities\Variable_.java	28	24	21	0	4	0	0	0	0	0
D:\Documents\projects_netbeans8\medeas\trunk\src\java\beans\chartsdBean.java	590	492	378	68	71	0	27	89	5	31
D:\Documents\projects_netbeans8\medeas\trunk\src\java\beans\excelBean.java	938	738	606	81	86	0	114	312	5	31
D:\Documents\projects_netbeans8\medeas\trunk\src\java\beans\modelDataBean.java	495	421	321	59	62	0	12	46	5	31
D:\Documents\projects_netbeans8\medeas\trunk\src\java\beans\quantityBean.java	51	34	26	1	9	0	8	40	5	31

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691287

References

Agency, International Energy. 2010. *World Energy Outlook 2010*. Paris: IEA Publications.

Arto, Iñaki, Iñigo Capellán-Pérez, Rosa Lago, Gorka Bueno, and Roberto Bermejo. 2016. "The Energy Requirements of a Developed World." *Energy for Sustainable Development* 33 (August): 1–13. doi:10.1016/j.esd.2016.04.001.

Barnhart, Charles J., Michael Dale, Adam R. Brandt, and Sally M. Benson. 2013. "The Energetic Implications of Curtailing versus Storing Solar- and Wind-Generated Electricity." *Energy & Environmental Science* 6 (10): 2804–10. doi:10.1039/C3EE41973H.

Boccard, Nicolas. 2009. "Capacity Factor of Wind Power Realized Values vs. Estimates." *Energy Policy* 37 (7): 2679–88. doi:10.1016/j.enpol.2009.02.046.

Brandt, Adam R., and Alexander E. Farrell. 2007. "Scraping the Bottom of the Barrel: Greenhouse Gas Emission Consequences of a Transition to Low-Quality and Synthetic Petroleum Resources." *Climatic Change* 84 (3–4): 241. doi:10.1007/s10584-007-9275-y.

Capellán-Pérez, Iñigo, Carlos de Castro, and Iñaki Arto. 2017. "Assessing Vulnerabilities and Limits in the Transition to Renewable Energies: Land Requirements under 100% Solar Energy Scenarios." *Renewable and Sustainable Energy Reviews* 77 (September): 760–82. doi:10.1016/j.rser.2017.03.137.

Castro, Carlos de, Óscar Carpintero, Fernando Frechoso, Margarita Mediavilla, and Luis J. de Miguel. 2014. "A Top-down Approach to Assess Physical and Ecological Limits of Biofuels." *Energy* 64 (January): 506–12. doi:10.1016/j.energy.2013.10.049.

Castro, Carlos de, Margarita Mediavilla, Luis Javier Miguel, and Fernando Frechoso. 2013. "Global Solar Electric Potential: A Review of Their Technical and Sustainable Limits." *Renewable and Sustainable Energy Reviews* 28: 824–35. doi:10.1016/j.rser.2013.08.040.

Denholm, Paul, and Robert M. Margolis. 2008. "Land-Use Requirements and the per-Capita Solar Footprint for Photovoltaic Generation in the United States." *Energy Policy* 36 (9): 3531–43. doi:10.1016/j.enpol.2008.05.035.

Dietzenbacher, Erik, Bart Los, Robert Stehrer, Marcel Timmer, and Gaaitzen de Vries. 2013. "The Construction of World Input–Output Tables in the Wiod Project." *Economic Systems Research* 25 (1): 71–98. doi:10.1080/09535314.2012.761180.

Field, Christopher B., J. Elliott Campbell, and David B. Lobell. 2008. "Biomass Energy: The Scale of the Potential Resource." *Trends in Ecology & Evolution* 23 (2): 65–72. doi:10.1016/j.tree.2007.12.001.

Genty, Aurélien. 2012. *Final Database of Environmental Satellite Accounts: Technical Report on Their Compilation*. WIOD Deliverable 4.6, Documentation. http://www.wiod.org/publications/source_docs/Environmental_Sources.pdf.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691287

Goldemberg, Jose. 2001. "Energy and Human Well Being." Human Development Occasional Papers (1992-2007) HDOCPA-2001-02. Human Development Report Office (HDRO), United Nations Development Programme (UNDP). http://econpapers.repec.org/paper/hdrhdocpa/hdocpa-2001-02.htm.

Hall, Charles A. S., Jessica G. Lambert, and Stephen B. Balogh. 2014. "EROI of Different Fuels and the Implications for Society." *Energy Policy* 64 (January): 141–52. doi:10.1016/j.enpol.2013.05.049.

Howarth, Robert W. 2015. "Methane Emissions and Climatic Warming Risk from Hydraulic Fracturing and Shale Gas Development: Implications for Policy." *Energy and Emission Control Technologies* 3: 45–54.

Lund, John W., and Tonya L. Boyd. 2016. "Direct Utilization of Geothermal Energy 2015 Worldwide Review." *Geothermics* 60 (March): 66–93. doi:10.1016/j.geothermics.2015.11.004.

M. Timer. 2012. "The World Input–output Database (WIOD): Contents, Sources and Methods." WIOD Background document available at http://www.wiod.org, 2012.

Mohr, S. H., J. Wang, G. Ellem, J. Ward, and D. Giurco. 2015. "Projection of World Fossil Fuels by Country." *Fuel* 141 (February): 120–35. doi:10.1016/j.fuel.2014.10.030.

Nordhaus, W., and Paul Sztorc. 2013. "DICE 2013R: Introduction and User's Manual." New Haven: Yale University.

Ragnarsdóttir, K.V., H. Sverdrup, and D. Koca. 2012. "Assessing Long Term Sustainability of Global Supply of Natural Resources and Materials." In *Sustainable Development-Energy, Engineering and Technologies-Manufacturing and Environment*. Shanghai: InTech.

Rao, Narasimha D., Keywan Riahi, and Arnulf Grubler. 2014. "Climate Impacts of Poverty Eradication." *Nature Climate Change* 4 (9): 749–51. doi:10.1038/nclimate2340.

Schneider, Mycle, and Antony Froggatt. 2014. "The World Nuclear Industry Status Report 2014." Paris, London, Washington DC: Mycle Schneider Consulting.

Teske, Sven, Thomas Pregger, Sonja Simon, Tobias Naegler, Wina Graus, and Christine Lins. 2011. "Energy [R]evolution 2010—a Sustainable World Energy Outlook." *Energy Efficiency* 4 (3): 409–33. doi:10.1007/s12053-010-9098-y.

WBGU. 2003. "Climate Prediction Strategies for the 21st Century: Kyoto and Beyond." Berlin: WBGU.

Wiser, Ryan. 2014. "The Cost of Transmission for Wind Energy in the United States: A Review of Transmission Planning Studies." *Renewable and Sustainable Energy Reviews , 16, 1, 1-19*, April. doi:10.1016/j.rser.2011.07.131.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691287