



AWESOME

WATER-ECOSYSTEM-FOOD

DATA MANAGEMENT PLAN

Final version

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LIST OF ACRONYMS

Abbreviations

| | |
|--------|--|
| AB: | Advisory Board |
| AHD: | Aswan High Dam |
| CA: | Consortium Agreement |
| CS: | Case Study |
| DDP: | Deliverable Development Plan |
| DoA: | Description of Action (Annex I of the Grant Agreement) |
| DM: | Deliverable Manager |
| EU: | European Union |
| GA: | Grant Agreement |
| GAs: | General Assembly |
| GERD | Grand Ethiopian Renaissance Dam |
| GDP: | Gross Domestic Product |
| GHG: | Greenhouse Gas Emissions |
| HPP: | Hydropower Plant |
| IEA: | International Energy Agency |
| IRENA: | International Renewable Energy Agency |
| MB: | Management Board |
| MED: | Mediterranean |
| Mx: | Month number |
| PC: | Project Coordinator |
| PI: | Principal Investigator |
| PO: | Project Officer |
| PR: | Project Review |
| PV: | Photovoltaic |
| RES: | Renewable Energy Sources |
| RO: | Reverse Osmosis |
| RP: | Reporting Period |
| SSP | Shared Socio-economic Pathways |
| QC: | Quality Control |
| QM: | Quality Management |
| UoK: | University of Khartoum |
| WP: | Work Package |

EXECUTIVE SUMMARY

The AWESOME Data Management Plan (DMP) defines the general policy and approach to data management in the project and assesses the related issues at the administrative and technical level, following the FAIR (Findable, Accessible, Interoperable and Reusable) principles of the European Union (EU) guidelines. The DMP evolved during the project's lifetime in the development of the metadata catalogue, describing the project's research data. This final version presents the datasets collected and generated by the AWESOME project in the final version of the AWESOME metadata catalogue. It is worth specifying that the AWESOME Grant Agreement (GA) and Consortium Agreement (CA) take precedence over this document, which does not replace by any means the contractual obligations among partners, and between partners and the PRIMA Foundation.

INTRODUCTION

Deliverable D1.3 is the AWESOME Data Management Plan (DMP) and is designed to set out key operational procedures to handle and manage research data, to ensure data security and quality as well as to foster data exchange and cooperation following the FAIR (findable, accessible, interoperable and re-usable) principles. The purpose of the DMP is to support the data management life cycle for all data that have been collected, processed or generated by the project. Indeed, the DMP describes the policy and the procedures concerning the acquisition, storage, classification, management, protection, and distribution of project data. This activity also includes timely and effective publication of relevant data and project results through the production of peer-reviewed articles (open access) as well as the active participation in international conferences, and - when applicable - as open data in online repositories, to improve project impacts and post-project legacy. The AWESOME ethical procedures are briefly presented as well in this document. The nature and extent of the datasets that the project collected and generated are described in the AWESOME metadata catalogue, which constitutes an extension of the DMP and that was periodically updated during the project's lifetime, when needed. The document is available online¹ and also stored in the internal project repository in its final version (M42)².

The document is structured after the European guidelines in the following way: Section 1 is the Data Summary and describes the purpose behind data collection, process and generation, and their relation to AWESOME objectives, while Section 2 explains how the FAIR principles are applied to the project, including tools, methodology and licences adopted. Section 3 presents how the project resources are allocated for data management, while Section 4 is dedicated to data security and storage. The final sections (5-7) are dealing with the ethical and legal aspects, and further issues that may arise. The document ends with the Annex 1, which contains the first version of the metadata catalogue, and is followed by the Annex 2 with the full list of references of the Annex 1.

¹ https://docs.google.com/spreadsheets/d/1E9kqONldIWXXC7aG_IU3kNIsoGpA1U9w2XgCCsXD_Uo/edit?usp=sharing

² <https://131.175.15.9/share.cgi?ssid=8de9810efc564f2587b09e241450de39>

1. DATA SUMMARY

In a context of increasing population growth in the Mediterranean (MED) region and, thus, increasing water, energy and food demands, the main objective of AWESOME is developing a decision-analytic platform based on a multi-level, integrated modelling approach to address the water-ecosystem-food (WEF) Nexus across a hierarchy of spatial scales: from the macroeconomic development to regional planning down to the single farm. The adoption of integrated and participatory approaches in a transboundary basin such as the River Nile Valley enables the project researchers to explore tradeoffs, synergies, and nested interdependencies across sectors and scales and to generate shared economic, environmental, and societal benefits. AWESOME aimed at developing alternative WEF planning portfolios composed of regional policies, river-basin strategic planning solutions, and innovative technological options demonstrated at the local scale.

For all the reasons above, data management turned out to be very important for the successful achievement of the AWESOME goals. At the beginning of the project, it was important to assess the nature and extent of the datasets the project would have collected, processed and generated, even if in a preliminary way. The initial version of DMP and metadata catalogue (submitted by M6) served as fundamental step for model setup and integration for all the involved partners, to foster discussions and implementation, to then timely and successfully fulfill the project tasks. The initial version of the metadata catalogue (V01) can be found at the end of this document in the Annex 1, while the linked references in Annex 2. As mentioned in the introduction, periodic updates of the DMP followed during the project period and turned in the further development and completion of the metadata catalogue. The metadata catalogue is available as a Google Doc¹ shared among the principal investigators (PIs) and is stored as an Excel file in the internal project repository² (further details in the next section, §2) following the guidelines for naming and version numbering after updates described in the Project Management Plan (PMP, D1.1). The reference directory in the AWESOME repository is “AWESOME_public/Data/Metadata/”, in which the first and last version of the metadata file are respectively named as “AWESOME_D13_POLIMI_WP1_V01D_Metadata.xls” and “AWESOME_D13_POLIMI_WP1_F_Metadata.xls”.

Even if AWESOME data are described in detail in the metadata catalogue, a summary of the main data information follows here. Firstly, data were collected, serving as inputs for the models at the different scales i.e. top-down: MED Region, Nile River Basin, demo site in Egypt). The input data have been processed in the models and used for the local experiments (and vice versa). Secondly, data have been generated by AWESOME and turned into outputs of the different models and work package (WP) tasks. Therefore, the data are:

- **Collected** from multiple sources – e.g. literature, global datasets and prospects, environmental agencies, universities, research centres – to identify demographic, climatic, economic, energetic, land use and hydrological aspects and indicators, and to characterize hydrologic regime, agriculture developments, energy production, social and economic systems, terrestrial and aquatic ecosystems. Data collected are structured in the metadata

table according to the topic, to the different spatial and temporal scale (e.g. climate data for a certain country/region, recorded at a certain gauge, over a certain period, with a certain frequency) and to the correspondent WP involved/interested in the data. Information concerning the source, the format and the file naming are also given, as long as currently applicable. The definition of the modelling baseline and variation scenarios are under internal discussion at the moment among WP2-3-4, e.g. to download data from the global models agreeing on the most proper combinations/matrixes of SSPs and RCMs (respectively Shared Socioeconomic Pathways and Regional Climate Models) for the project aims and to align the different model setups accordingly.

- **Generated** from AWESOME models – i.e. macroeconomic, energetic, climatic and demographic models at the MED scale, decision analytic framework (DAF) model for the Nile River Basin – and from innovative technological solutions at the local scale, like hydroponics and aquaponics in the demo site. As for data collection, also for data generation the definition of the modelling baseline and variation scenarios, as well as model boundaries, have been deeply discussed among WP2-3-4, intending to align the different model setups accordingly. Data generated from models have been used in fact to simulate scenarios and future projections, to then create planning portfolios adopting different water, ecosystems and food management policies, aimed to assess the impacts of changes in the system. Existing data, available in public repositories or from institutional partners or in literature have been re-used whenever possible, while new generated data are securely stored in the AWESOME internal repository, as addressed later. Generated data have been and will be presented through the publication of results in peer-reviewed publications (open access) and in form of oral contributions and posters at international conferences. When possible, some of the generated data can be published on open access repositories like *Zenodo*³, (for details, s. §2 of this document).

2. FAIR DATA

As announced in the PMP (D1.1), AWESOME has managed data through an internal repository⁴, curated and hosted by Politecnico di Milano (POLIMI), where all technical information (e.g., officially released documents, contractual information, templates, meeting minutes) about the project are stored in a structured way in shared directories (Fig. 1). Data have been also stored and exchanged among project partners using the same repository, which has a total capacity of 16,607 GB. The access to the internal repository is password-protected and restricted to designated project partners, as described in §4.2 of the PMP. In case of need of higher storage space, a cloud service external to the project (*Dropbox Business*⁵) can be made available by POLIMI.

³ Free and open digital archive built by CERN and OpenAIRE. (<https://zenodo.org/>)

⁴ <https://131.175.15.9/cgi-bin/>

⁵ <https://www.dropbox.com/business>

The final project outcomes, deliverables and scientific publications have been published and maintained on the AWESOME website⁶ and can be eventually uploaded on *Zenodo* in a second moment, and consequently visible on the *OpenAIRE* portal⁷. The final decision on whether to store some research data in open access on *Zenodo* as well and to which extent is left to the Principal Investigators (PIs) of each WP. Information about relevant project updates have been usually announced on the AWESOME website and the AWESOME Twitter account (@AWESOME_PRIMA), as described in D7.1 (Multi-stakeholders Outreach Plan) and dissemination and communication updates (D7.2, D7.3, D7.4).

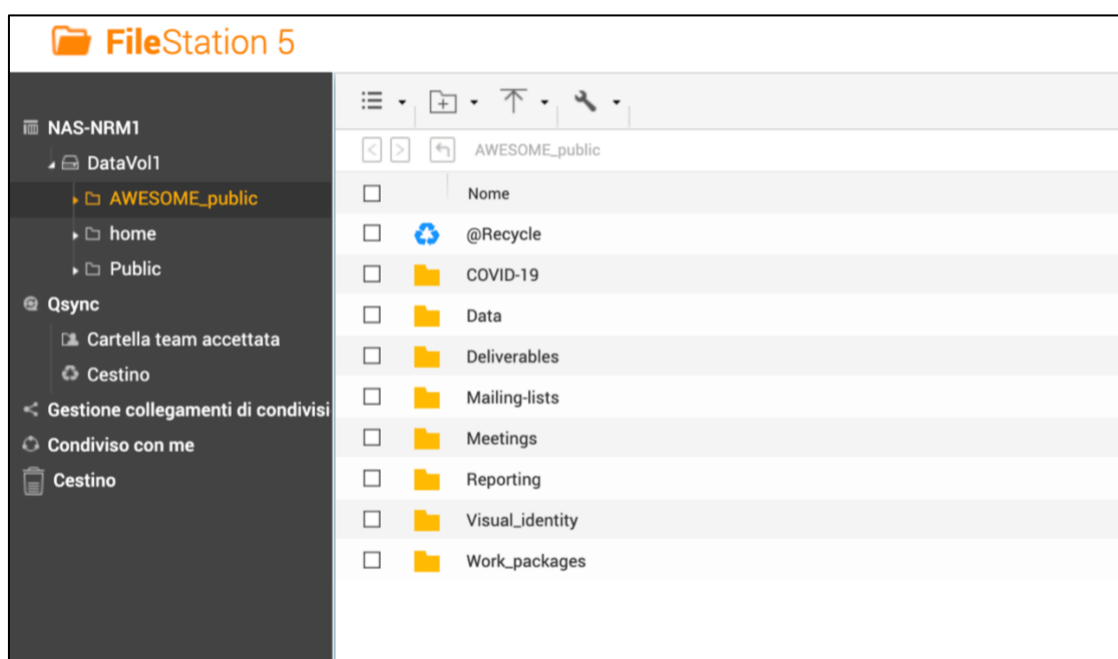


Figure 1 Overview of the shared directories in the AWESOME internal repository hosted by POLIMI

2.1. Making data findable, including provisions for metadata

In addition to what mentioned before, AWESOME would adopt the *Zenodo* repository to publish project outcomes and datasets, if needed. Using this repository, all the public data of the project will be provided with a Digital Object Identifier (DOI) and a common dataset of metadata (based on Dublin Core⁸). Keywords would be sourced by the standard dictionaries, like the USGS water dictionary⁹. Versions of each dataset would be numbered and report main and minor changes. Main version change would occur after significant changes in the data (e.g. change in the data structure, massive correction or update, changes in the procedure for data collection or generation), while minor version changes after data updates or limited correction. Any changes would also be mentioned in the description metadata field. Metadata identification, description and naming

⁶ <https://awesome-prima.eu/>

⁷ European Commission Portal for reporting H2020's scientific publications. (<https://www.openaire.eu/>)

⁸ A set of "core metadata" for simple and generic resource descriptions (<http://dublincore.org>).

⁹ Water Science Glossary of Terms, compiled by USGS (<https://water.usgs.gov/edu/dictionary.html>).

conventions are reported, whenever applicable, in the attached metadata catalogue in its final version (M42)¹⁰.

2.2. Making data openly accessible

According to art. 29.3 of the GA, it is not required to the AWESOME Consortium to make research data openly accessible. However, some categories of data are already with open access in the internet (e.g. global datasets, global and regional projections such as CORDEX).

Data generated in AWESOME could be published in the *Zenodo* repository, together with associated metadata, if applicable and agreed among the involved institutions, and if relevant for validation of scientific publications and/or deliverables, as described in the foreword of §2 and §2.1. Data collected in AWESOME from various institutions and agencies, and thus with closed access, might be published on *Zenodo* as well, but only after written agreements with the correspondent data sources. Data collected and generated, along with all relevant project documents, are securely stored in the internal project repository hosted by POLIMI (foreword of §2, and Fig.1). In general, data have been stored using standard formats specified in the metadata catalogue for each dataset.

Finally, each PI will consider whether to publish any open source software and tool developed within AWESOME on public software code repositories, like Github¹¹. E.g. POLIMI has already published the so-called ClimateScenarioAnalysisToolbox¹², where some scripts (in Matlab and R) for downscaling climate scenarios are freely available.

2.3. Making data interoperable

The AWESOME project covers several disciplines and scientific foci; therefore, it is of highest priority to find a common language between partners and stakeholders, to integrate data and information from the different domains. In order to provide a common understanding on data within the project itself, the use of the Dublin Core Metadata Element set vocabulary will be adopted, which is a basic, domain-agnostic standard which can be easily understood and implemented, and as such is one of the best known and most widely used metadata standards. It is sponsored by the Dublin Core Metadata Initiative and was published as ISO Standard 15836 in February 2009 (reference and link in the footnote of §2.1).

Whenever possible and useful, more discipline-specific metadata can be also adopted, as those defined by OGC¹³ for geospatial data, or further economic/agriculture-related glossaries.

¹⁰ <https://131.175.15.9/share.cgi?ssid=fa0766a763564f4a8ef15c8099fdc859>

¹¹ Online project hosting platform (<http://github.com/>).

¹² <https://github.com/mxgiuliani00/ClimateScenarioAnalysisToolbox>

¹³ Open Geospatial Consortium (<http://www.opengeospatial.org/>).

2.4. Increase data re-use (through clarifying licences)

Data reuse for the public is not required by AWESOME (art. 29.3 of the GA). Nevertheless, there are few points that should be addressed and reminded to ensure a smooth management of research data and research results.

According to art. 26 of the Grant Agreement (GA), research data and software are owned by the PI (beneficiary) that generates them. In case of joint ownership of results, each PI must agree (in writing) on the allocation and terms of exercise of their joint ownership, stipulating a joint ownership agreement, to ensure compliance with their obligations under the GA. The PRIMA Foundation may assume ownership of results to protect them (art. 26.4 of GA for further details). Notwithstanding the above, owners of open results arising from the AWESOME project are encouraged to release their work under a Creative Commons license, preferably Creative Commons Attribution 4.0 CC-BY-4.0 licence¹⁴.

Concerning the dissemination and exploitation of results, as written in art. 29 of the GA, each PI must 'disseminate' its results by disclosing them to the public by appropriate means (i.e. peer-reviewed journal articles) and ensure open access – free of charge, online access for any user. In particular, each PI that intends to disseminate its results must give advance notice to the other PIs of at least 45 days, together with sufficient information on the results to be disseminated, while any other PI may object within 30 days of receiving notification. Further, any dissemination of results must indicate that it reflects only the author's view and that the PRIMA Foundation is not responsible for any use that may be made of the information it contains (art. 29 of the GA for further details). Any update of relevant project outcome was published on the AWESOME website (and on the AWESOME Twitter account) as addressed in detail in D7.1 (Multi-stakeholder Outreach Plan) and open access publications will be advertised on various partner institutions websites, as well as on scientific social networks like *Research Gate*¹⁵.

In regard to research data and results ownership, each PI may transfer ownership of its results. It must however ensure that its obligations under art. 26.2, 26.4, 27, 28, 29, 30 and 31 of the GA also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer. This does not change the security obligations in art. 37, which still apply. Nevertheless, the PRIMA Foundation has the right to object to any transfers or licensing, if the conditions explained in art. 30.3 apply.

Quality assurance concerning accuracy and completeness of metadata was performed with the overall supervision and responsibility of WP1, with mandatory participation and collaboration of the other WP and Case Study (CS) Leaders, since they are responsible for data collection, process and generation within their tasks – in agreement with the project ethical obligations, as addressed later in §5. In detail, data quality assurance was performed through the following steps:

- Collected data

¹⁴ Creative Commons Attribution-ShareAlike 4.0 International Public License (<https://creativecommons.org/licenses/by-sa/4.0/legalcode>).

¹⁵ ResearchGate is an open scientific social network for researchers (www.researchgate.net).

1. Storage of raw datasets, without any further processing, in a dedicated folder (under “AWESOME_public/Data/WP.../...” or “AWESOME_public/Literature/Data/...” in the project internal repository;
 2. Data check and editing for assuring positional, attribute and temporal quality, completeness and consistency, under the responsibility of the project partner interested in the data (“Contributor”), as listed in the metadata catalogue;
 3. Compilation of metadata updating the metadata catalogue (both generic and domain specific where applicable) reporting a brief summary with the editing done; where the metadata file was available as shared Google Doc (see §1 of this document);
 4. Storage of the final version of the datasets in a dedicated folder in the internal repository under the directory “AWESOME_public/Data/WP.../...”;
 5. Uploading of the datasets on *Zenodo* repository, if compliant with agreements among PIs and eventual limitation detailed in the metadata catalogue, as well as if relevant for maintaining also after the project lifetime.
- Generated data
 1. Compilation of metadata updating the metadata catalogue (both generic and domain specific where applicable) reporting a brief summary with the editing done; where the metadata file is available as shared Google Doc (see §1 of this document);
 2. Storage of the final version of the datasets in a dedicated folder in the internal repository under the directory “AWESOME_public/Data/WP.../...”;
 3. Uploading of the datasets on *Zenodo* repository, if compliant with agreements among PIs and eventual limitation detailed in the metadata catalogue, as well as if relevant for maintaining also after the project lifetime.

Any update concerning data collection and/or generation within the AWESOME project as well as any editing of the metadata catalogue should be promptly communicated to the Project Coordinator (PCo) and to the PIs by short email notice.

3. ALLOCATION OF RESOURCES

The metadata catalogue reported in its final version (M42)¹⁶ identifies, for each dataset, the responsible WP. Costs are included in the tasks related to data collection and generation and cannot be listed separately.

Costs of the project internal repository are covered by internal POLIMI resources. It was not needed to have additional tools accessible to all partners to have more space where to store and share raw datasets and simulation outputs.

4. DATA SECURITY

The tools mentioned in the foreword of §2 of this document are hosted by POLIMI and the internal project repository on the POLIMI server is protected by firewall and institutional security policies. In detail:

¹⁶ <https://131.175.15.9/share.cgi?ssid=fa0766a763564f4a8ef15c8099fdc859>

- The internal repository is relying on POLIMI storage facilities and accessibility is reserved, protected by username and password known only by the selected users (PIs), for both upload and download functionalities;
- *Zenodo* repository is hosted at CERN and it is subject to its rules for data security as reported at <https://zenodo.org/policies>

All datasets maintained on the POLIMI server have been periodically subject to incremental backup to avoid data loss. WP1 (POLIMI) took the responsibility of management, organisation and preservation of the AWESOME repository.

Finally, regarding security, AWESOME did not involve any activity raising security issues and did not handle EU classified information, neither as background nor as result (as in §5.2 of the DoA on security issues).

5. ETHICAL ASPECTS

As written in §5.1 of DoA, AWESOME involved stakeholders that participated in a series of meetings both in person and online, as well as in questionnaires performed by WP6. The purpose was to bring their local and regional expertise into the project and to share knowledge and develop capacity in the approaches and tools used in the project. Confidentiality was always assured, in that:

- No personal information will be collected from participant stakeholders other than contact information and a brief description of their work, and this information was not be shared beyond the limits of the project without the explicit written consent of the stakeholders.
- No quotes made by the stakeholders in the online discussion of the workshops was published in print or on the internet without their explicit written consent.
- The project consortium ensured that EU legislation, international guidelines and the ethical and legal requirements of the countries involved in the project are adhered to.

Ethical aspects related to data management are following the obligation to comply with ethical and research integrity principles of art. 34.1 of the GA, for which the PIs must follow the ethical principles (including the highest standards of research integrity) and the applicable international, EU and national law. The PIs must ensure that the activities, also the data-related ones, under the action have an exclusive focus on civil applications. In addition, the PIs must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity¹⁷. This implies compliance with the fundamental principles detailed in the art. 34.1 of the GA, applied here to data, which are wrapped up here in short:

- reliability in ensuring the quality of research data;
- honesty in developing, undertaking, reviewing, reporting and communicating research data in a transparent, fair and unbiased way;
- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment;

¹⁷ European Code of Conduct for Research Integrity of ALLEA - All European Academies
(http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-ofconduct_en.pdf).

- accountability for the research data from idea to publication, for data management and organisation, and well as for their wider impacts meaning that the PIs must ensure that persons carrying out research tasks and processing data follow the good research practices and refrain from the research integrity violations described in this Code.

This summary of the ethical aspects here does not change the other obligations under the GA or obligations under applicable international, EU or national law, all of which still apply.

Finally, it is worth specifying that informed consent will come along with data sharing and long-term preservation, in case of questionnaires dealing with personal data implemented within the project.

6. OTHER ISSUES

At the time of the DMP deployment, the AWESOME project does not make use of any other national/funder/sectorial/departmental procedures for data management. This will be reported in case of occurrence on a later stage of the project (further versions of the DMP).

ANNEX 1: METADATA CATALOGUE

The first version of the AWESOME metadata catalogue is reported in Table 1, which was updated during the project lifetime. The references mentioned in Table 1 are extensively reported in Annex 2.

Table 1 – AWESOME metadata catalogue, version 01 (V01).

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|-----------------|---|---|-------------------|---------------------|--------------------------------------|---|---------|------------------|------------------|-----------------------|--------------------------|
| MED Area, Egypt | Climate - historical meteorological variables (precipitation, Temperature, Radiation, Humidity, Wind Speed and Direction, etc.) | Station data from national agencies | POLIMI | River Nile Basin | | Existing at National Water Research Center? | | 2 | | | Not yet available |
| MED Area | Climate - historical meteorological variables | Gridded reanalysis/satellite datasets (e.g. Copernicus ERA5, CHIRPS, etc) | POLIMI | Worldwide/ MED Area | 1950-2020 (ERA5), 1981-2015 (CHIRPS) | Various, e.g. CHIRPS: Funk et al. (2015) | Good | 2 | xls, nc (netcdf) | | (Pre-) processing needed |
| MED Area | Climate - past conditions | Climate model simulations over control period | POLIMI | Worldwide | 1981-2005 | CORDEX | Good | 2 | nc (netcdf) | | (Pre-) processing needed |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------|--|---|-------------------|---|---|---|---|------------------|-------------|------------------------------|---|
| MED Area | Climate - future conditions | Climate model simulations over future horizons for different scenarios | POLIMI | Worldwide | 2006-2100 | AWESOME | Good | 2, 3 | | | (Pre-) processing needed |
| Egypt | Energy Demand Projection | The projection of yearly total demand of energy carriers specific for the defined nodes if it is needed | POLIMI | Country/ Sub-Country Node specific | ModelLifeTime (Yearly) | Econometric Models using the endogenous results of other models such as CGE model; IRENA Report: Renewable Energy Outlook for Egypt | Scenario specific: depends on the definition of scenario and the quality of the economic model output | 2 | xlsx, csv | Energy carrier, year, demand | |
| Egypt | Renewable Energy Resource (RES) Availability | Availability of RES based on the technology and location | POLIMI | Based on the Location of the RES, if the model is multi-node, or the average for the country in case of a single node model | Can be considered constant for the whole model lifetime | RenewableNinja: an open-source model to estimate the hourly availability of wind and solar sources for a specific region, hydromodels from other groups | High | 2 | xlsx, csv | Location, year | Based on the number of nodes, we may need to make estimations because of high variability of the data based on location |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------|--|---|-------------------|------------------|--|--|---------------------------|------------------|---------------|---------------------------------------|---|
| Egypt | Techno-Economic Parameters for Energy Production Techs | Full detail of current and future techno-economic parameters of generation technologies, e.g. efficiencies, capital, fixed and operation & maintenance cost, the price of fuels | POLIMI | Country | If the model period is not so long, can be considered constant | General information: average techno-economic parameters of the world, country Specific information | General information: Good | 2 | xlsx, csv | Parameter, technology, location, year | |
| Egypt | History - Current Energy Situation | Historic - Current Energy generation mix with full details for calibration of the model | POLIMI | Country\Nodes | Year | International Energy Agency (IEA), Egyptian Electricity Holding Company | Good | 2 | html --> xlsx | Energy Production, technology, year | General Categories are available not high details |
| Egypt | Fossil Fuels (FF) Resource Availability | Defines maximum extractable FF from domestic reservoirs | POLIMI | Egypt | Yearly Whole Timeline | EGPC, BMI (fitch group company) | High | 2 | xlsx | FF Type, Year, Availability | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------------------------|----------------------------------|--|-------------------|---------------------------|-------------------|--|---------|------------------|-------------|------------------------|---|
| World or at least MED Area | Water types for crops production | For each crop what water types can be used and what is the substitutability between them | POLIMI | Country or regional level | 1990-2016 | POLIMI | | 2, 3 | tif; asc | Crop, water type, year | Data depending on croplands data availability. At the moment only year 2000 croplands are available at global scale |
| World or at least MED Area | Watneeds (crop model) | Precipitation and Evapotranspiration data | POLIMI | Global (10 km resolution) | 1980-2018 | CRU CL 2.0 New et al. (2002), Harris et al. (2014) | Good | 2 | netcdf | Variable, year, month | |
| World or at least MED Area | Watneeds (crop model) | Maximum available soil moisture | POLIMI | Global (1 km resolution) | | HWSD, FAO (2012) Nachtergaele et al. (2009) | Good | 2 | tif | | |
| World or at least MED Area | Watneeds (crop model) | Maximum infiltration rate | POLIMI | Global (1 km resolution) | | BGR & UNESCO (2008) | Good | 2 | tif | | |
| World or at least MED Area | Watneeds (crop model) | Crop parameters | POLIMI | Crop specific | | Portman et al. (2010); Siebert and al., (2012) | Good | 2 | xls | | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------------------------|-----------------------|--|-------------------|---------------------------|-------------------|---------|---------|------------------|-------------|------------------------|--|
| World or at least MED Area | Watneeds (crop model) | Watneeds Output: Yearly green and blue water, precipitation, runoff and deep percolation fluxes for 26 main crops | POLIMI | Global (10 km resolution) | 2000; 2016 | AWESOME | Good | 2 | tif, asc | Crop, water type, year | Data depending on croplands data availability; as of Oct. 22 (2020) only year 2000 croplands are available at the global scale |
| World or at least MED Area | Watneeds (crop model) | Watneeds Output: Monthly green and blue water, precipitation, runoff and deep percolation fluxes maps for 4 main crops (namely wheat, rice, maize and sugarcane) | POLIMI | Global (10 km resolution) | 2000; 2017 | AWESOME | Good | 2 | tif, asc | Crop, water type, year | Data depending on croplands data availability. At the moment only year 2000 croplands are available at global scale |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------|------------------------|--|-------------------|------------------|-------------------|--|---------|------------------|-------------|--|-------|
| Egypt | Population | Key demographic indicators for different region, subregion, country or area and for different periods | AUEB | Worldwide | 1950-2100 | UN World Population Prospects 2019 | Good | 2, 3 | xlsx, csv | Prospect acronym, variable acronym, version, variable name | |
| Egypt | Population - SSP | Projections of SSP population, urbanization, and GDP projections | AUEB | Worldwide | various | International Institute for Applied Systems Analysis (IIASA) | Good | 2, 3 | xlsx, csv | | |
| Egypt | Economic drivers - SSP | Capital accumulation, saving rates, relationship between saving rates and investment rates, education, female participation, energy, total factor productivity | AUEB | | 1980-2100 | CEPII | Good | 2, 3 | xlsx, csv | | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|----------|--|--|-------------------|---------------------------|-------------------|----------------------------|---------|------------------|-------------|-----------------------|-------------------|
| Egypt | Input/Output (IO) tables with matching environmental and social satellite accounts | 720-line item environmental indicators covering GHG emissions, labour inputs, air pollution, energy use, water requirements, land occupation, N and P emissions, primary inputs to agriculture (including 172 crops) | AUEB | | 1990-2015 | KGM & Associates Pty. Ltd. | | 3 | | | |
| MED Area | Macro-economic model | GDP and other economic indicators | YVC&HU | Country or regional level | 2015-2050 | AWESOME | Good | 3 | xls | | Not yet available |
| MED Area | Macro-economic model | Agricultural output and prices, and water use by scenario | YVC&HU | Country or regional level | 2015-2050 | AWESOME | Good | 3 | xls | | Not yet available |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|--|---|---|-------------------|---|---|---|-------------------------------|------------------|-------------|---|---------------------------|
| Nile at different locations (Lake Tana, Roseires, Sennar, AHD, GERD, Tekeze, Upper Atbara and Setit, Khashm El Girba, Jebel Aulia, Merowe) | Hydrography - Hydraulic infrastructure and hydropower station | Reservoir technical details, level to storage tables, releases, withdrawals, demands, power, reservoir operations, evaporation rates, water balance | POLIMI | Nile reservoirs | Existing + planned (mostly monthly constant data) | Papers and technical reports (complete references in the Annex 2; e.g. Wheeler et al. 2016) | | 4 | pdf, xlsx | Table name, reservoir/HP P name, version | Constant/ unique set data |
| Nile at different locations (Victoria, Kyoga, Albert, Torrents, Sobat, Tana, Kessie, Border, Dinder, Rahad, Atbara) | Hydrography - literature data | Historical and stochastic time series: streamflow | POLIMI | Nile gauging station network | 1912-2003 (monthly) | Papers and technical reports (complete references in the Annex 2; e.g. Jeuland and Whittington, 2014) | | 4 | xlsx | Variable name, station name, source, version | Missing data |
| Nile Basin | Hydrography - meso scale model | DAF model simulation and indicators time series | POLIMI | Nile River Basin (from GERD to AHD or Nile Delta) | At least 30 years past + projections until 2050 ? | AWESOME | To evaluate after simulations | 4 | csv, ascii | Variable acronym, station name, pathways, version | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|---------------|--|---|-------------------|------------------|-------------------|---|---------|------------------|-------------|-----------------------|-------------------|
| Egypt, Israel | Soil data - soil properties | Sand parameters (grain size, grain shape, mineral composition) | RWTH | Country | | The Hebrew University of Jerusalem, literature | | 5 | docx, xlsx | | Not yet available |
| Egypt, Israel | Reverse Osmosis (RO) water salinity data | RO saline water source (salinity of influx water [ppt or ppm], amount, salinity and quality of brine per m ³ fresh water, management of brine) | RWTH | Local | Present | Various, e.g. Center for Applied Research on the Environment and Sustainability (CARES) at AUC, RO operators, ministry of the environment, literature | | 5 | docx, xlsx | | Not yet available |
| Egypt | RO energy parameter | RO / saline water source (energy consumption per m ³) | RWTH | Local | Present | Various (e.g. CARES at AUC, RO operators, literature) | | 5 | docx, xlsx | | Not yet available |
| Egypt | Energy data | Photovoltaic (PV) data (technical and economic data: e.g. average | RWTH | Country | Present | Various (e.g. CARES at AUC, literature) | | 5 | docx, xlsx | | Not yet available |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|------------------------|----------------------------------|---|-------------------|------------------|--|--|------------------------------|------------------|-------------|--|-------------------|
| | | energy generation at location x, cost) | | | | | | | | | |
| Egypt | Water balance marine aquaculture | Base data from marine aquacultures | RWTH | Local | Present | Various (e.g. literature, fisheries office, operators) | | 5 | docx, xlsx | | Not yet available |
| Egypt- Case study site | Water consumption | Estimations of the consumption per experiment/ system | ZG | Case study level | Based on the experiments' duration; measured on a weekly basis | AWESOME | To evaluate after experiment | CS | xlsx | Variable estimated, experiment number, specification of time | |
| Egypt- Case study site | Electricity consumption | Estimations of the consumption per experiment/ system | ZG | Case study level | Based on the experiments' duration; measured on a weekly basis | AWESOME | To evaluate after experiment | CS | xlsx | Variable estimated, experiment number, specification of time | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|------------------------|--|--|-------------------|------------------|--|---------|------------------------------|------------------|-------------|--|-------|
| Egypt- Case study site | Environmental factors measurements (air and water Temperature, pH, DO, Relative humidity, EC, Lux) | Measurements of the environmental conditions of all experiment/ system | ZG | Case study level | Based on the experiments' duration; measured 4 times per day | AWESOME | To evaluate after experiment | CS | xlsx | Variable estimated, experiment number, specification of time | |
| Egypt- Case study site | Morphological measurements | Plant morphological data and of plant appearance data (fresh shoot system mass, fresh root system mass, number of leaves, stem diameter, stem length, head fresh weight, head diameter, head dry weight) for all experiment/ system outcomes | ZG | Case study level | Based on the experiments' duration (2-3 samples each time); measured on a weekly basis | AWESOME | To evaluate after experiment | CS | xlsx | Plant ID, experiment number, time | |

| Location | Topic | Description | Reference partner | Spatial coverage | Temporal coverage | Source | Quality | Contributor (WP) | Data format | File name composed by | Notes |
|------------------------|----------------------------|---|-------------------|------------------|------------------------------------|---------|------------------------------|------------------|-------------|---|-------|
| Egypt- Case study site | Harvest gains | Fish and plant production per unit water | ZG + RWTH | Case study level | Based on the experiments' duration | AWESOME | To evaluate after experiment | 5, CS | xlsx | Plant ID, experiment number, time, water expenditure, harvest gains | |
| Egypt- Case study site | Investment cost | The cost of purchasing and building the systems in relation to the production achieved | ZG + RWTH | Case study level | Based on the experiments' duration | AWESOME | To evaluate after experiment | 5, CS | xlsx | System, experiment number, bill of quantities | |
| Egypt- Case study site | RO expenditure and outcome | How water use improves quantitatively if salty water is used in HP or AP before it goes into the RO | RWTH | Case study level | Based on the experiments' duration | AWESOME | To evaluate after experiment | 5 | xlsx | Discharge [m ³], salinity [ppt, ppm] | |
| Egypt- Case study site | PV expenditure and outcome | Quantification of reduced fossil energy consumption (electricity) | RWTH | Case study level | Based on the experiments' duration | AWESOME | To evaluate after experiment | 5 | xlsx | Electricity generation, total electricity consumption | |

ANNEX 2: ADDITIONAL DATA REFERENCES

The references related to the metadata of Annex 1 are reported hereafter:

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