WEMC Reanalysis Working Group – Project Charter

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Introduction

Despite the vast adoption and the routine use of reanalysis datasets for Wind Energy purposes, the communication and knowledge sharing between reanalysis providers and Wind Energy scientists/practitioners remains sporadic and uncoordinated. Discussion with experts in the use of reanalysis data in other electric sector use cases (e.g. solar energy, and power system analysis) found that similar challenges existed for these stakeholders too. This situation poses risks to both Wind Energy projects and broader sector usage (Power Grid and Marine Engineering) of reanalysis data, in the following sense: these disciplines necessarily need reanalysis for their applications, and a change (or drop) in quality/availability of these datasets would be detrimental to their performance In response to this challenge, the IEA Wind Topical Expert Meeting 111 (TEM#111) brought together a wide range of Wind Energy stakeholders (academia, utilities, developers, consultants, data providers) as well as some representatives from the broader power sector to serve the following objectives:

- Improve access and documentation of reanalysis datasets.
- Promote and foster validation and advertise successful applications of reanalysis datasets for Wind Energy, Power Grid and Marine applications, and thereby improve their value.
- Act as a point of contact / collaboration forum between reanalysis providers and the Wind Energy communities.
- Work with other sector stakeholders prevent silos and make sure efforts are coordinated.

The TEM#111 proceedings https://iea-wind.org/task11/tems/ include up-to-date information about what reanalysis datasets are and are likely to evolve, as well as state of the art use cases from the Wind Energy and Grid Planning sectors.

The follow-up actions discussed during the TEM fall in two categories:

- "Within wind": actions relevant primarily for wind energy use cases, this includes validation work, gathering of user inputs, improvements of models
- "Beyond wind": actions which aim at promoting a fair and proper use of reanalysis not only for wind, but also for grid planning applications and non-wind stakeholders. Global reanalysis providers from ECMWF, NOAA and NASA clearly expressed the need to coordinate this effort not only from the Wind Energy perspective.

Acknowledging the need for coordination beyond Wind Energy and including other Power Systems, the "beyond wind" workstream is then in search for a host organisation outside of Wind Energy. Several options have been evaluated:

- The IEA at a global level
- The website https://reanalyses.org/.
- The Copernicus Energy Hub: https://energy.hub.copernicus.eu/
- WMO's Task Team on Climate Reanalysis, https://community.wmo.int/en/meetings/tt-cliren-task-team-climate-reanalysis currently headed by Arun Kumar.
- WMO's Study Group on Integrated Energy Services (SG-ENE) https://community.wmo.int/en/activity-areas/sercom/SG-Energy, https://energymeteorology.info/
- The World Energy & Meteorology Council (WEMC) https://www.wemcouncil.org/wp/

Following a discussion between the team TEM#111, Alberto Troccoli (WEMC) and Carlo Buontempo (ECMWF), WEMC emerged as the most suitable candidate. In effect:

- WEMC are interested in hosting a TEM#111 reanalysis advocacy sub-group
- WEMC is the organisation which is the closest to industry practitioners (i.e. energy meteorologists/engineers, project developers etc)
- The head of WEMC, Alberto Troccoli, is directly involved in the above-mentioned WMO working groups
- WEMC organises a biennal conference, the International Conference on Energy & Meteorology, and has a wide outreach (including general public)

Goals

The goals of the "beyond wind" TEM#111 workstream are described below in terms of desired outcome. The term "reanalysis group" indicates a group of people working with a specific reanalysis, for instance the ECMWF reanalysis group, or the DWD reanalysis group.

1) Collection of user input and feedback	
Current situation	*Desired outcome*
While recent initiatives such as the ERA6 user workshop or NOAA's Subseasonal and Seasonal Applications Workshop are clear improvements, in practice the inclusion of end-users in the definition of next generation reanalyses datasets is still in its infancy. Industry practitioners are used, for commercial projects, to provide feedback and suggestions via simple tools such as comment sheets. To be effective, these comments need to be very specific and often detailed. This represents a lot of information to process, see for instance the WRAG ERA5 feedback document. Today, reanalysis groups do not have the resources for processing, addressing and managing the implementation of these suggestions. This results often in any comments and feedback being left unaddressed, and user requirements just being repeated from one reanalysis generation to another one. Also, many reanalysis groups do not know how to address their users and where to locate them. This leads to many reanalysis datasets (regional reanalysis in particular) to be produced without consulting key users.	Global and regional reanalysis groups know where to find wind- and power system planning user feedback and requirements: these requirements and feedback are systematically documented on a webpage, and contact details are clearly identified. The list of upcoming reanalysis datasets and "hearing periods" for user requirements are listed on the same webpage. Users and reanalysis groups are regularly kept up to date about the above, via for ex. social media.
2.1) Validation using sector specific in-situ measurements	
Current situation	*Desired outcome*
Validation of reanalysis datasets takes place in commercial work (wind farm projects for instance), or in the scientific literature. The in-situ measurement datasets used for the validation vary greatly in quality and quantity and are not always publicly available. This information is very rarely brought to the attention of reanalysis groups, and most often hardly processed and used for future reanalyses.	Reanalysis datasets are validated, for the purpose of wind energy- and power system planning, using high-quality, well documented, publicly available datasets at so-called "super sites". Examples of super sites for offshore wind energy are: ➢ Floating LiDARs in the Dutch North Sea (RVO) and the New York Bight (NYSERDA)

	➢ Met masts FINO1-2-3 (BSH), Dogger Bank West and East (Marine Data Exchange) Super sites should primarily be created from the measurement datasets documented on the WRAG wiki.
2.2) Incorporation of electric sector meteorological data into reanalysis products	
Current situation	*Desired outcome*
Almost never done, and yet this data provides atmospheric representation at some of the remotest and least sampled points.	Desired outcome: Through advocacy, education, and pilot projects, demonstrate the value of adding meteorological data from renewable energy plants to reanalysis data inflows.
3) Fair and proper use of reanalysis for Wind Energy and Power System Modelling	
Current situation	*Desired outcome*
Reanalysis datasets are freely available and used by many in academia and industry for a wide range of purposes. The level of demands on data documentation, processing (if any), validation and accuracy vary greatly between these purposes. For many specific applications of reanalysis data to the energy sector caution is required, as reanalysis data may not be representative of all the atmospheric features important to the application. Examples are the design of offshore farms, and wind and solar farms in areas of complex topography, as well as almost any grid study (capacity expansion, resource adequacy, renewables integration etc) that needs to resolve atmospheric features at high spatial and temporal fidelity. In many cases, the results of these analysis need be certified by an accredited third party. Today, there exist no specific guideline as to the level of documentation, traceability, validation of reanalysis datasets used for such large-scale infrastructure projects. Not having a basic list of requirements poses a problem for unexperienced practitioners, as well as reanalysis group which do not have a clear idea of what the data are used for, and what these demands are.	For critical applications which require certification, or with large scale implications for infrastructure planning, there exist a guideline stating minimum requirements for reanalysis datasets, regarding documentation, traceability, validation, data processing and usage. Such a guideline is freely available on the internet, and has been reviewed by at least two leading certification bodies in respective wind/solar/grid sub-sectors.

4) Advocacy	
Current situation	*Desired outcome*
Advocacy for reanalysis does not take place at user level, most advocacy efforts (for future reanalyses, or for maintaining existing datasets) takes place without much involvement of end users. Punctual, sporadic “user stories” are sometimes asked for.	There exists a strong, well identified expert user group reanalysis data, which acts as a voice for most end users in wind energy and power system planning. This expert group participate to advocacy work when required/relevant, for institutions which require it, either for global- or regional reanalysis.

Work packages and deliverables

In practice, the following work packages for a WEMC Reanalysis Expert Group are proposed.

Work Package	Actions and deliverables
Collection of user inputs (Addresses goal #1)	The expert group facilitates the collection of user inputs and feedback by reanalysis groups. This includes: ➢ Keeping a list of up-to-date reanalysis in the making, including "hearing periods", user input surveys and contact details. This list should be regularly shared with end-users and always available on the internet. ➢ Support during collection of user input, via online meetings/workshops and polls. ➢ Follow-ups and facilitation of user input intake.
Validation (Addresses goal #2)	The expert group facilitates the validation of reanalysis datasets using high quality, publicly available in-situ measurements. This includes: ➢ Keeping a list of measurement datasets available for such validations ➢ Support during validation exercises, via online meetings/workshops and polls. ➢ Follow-ups and facilitation of user input intake.
Publication of guideline (Addresses goal #3)	The expert group issues a guideline providing minimum requirements for critical applications which require certification, or with large scale implications for infrastructure planning, regarding documentation, traceability, validation, data processing and usage. Such a guideline is freely available on the internet and has been reviewed by at least two leading certification bodies in Wind Energy. This is done including groups such as NextGenEC.
Advocacy (Addresses goal #4)	The expert group participates to high-level user consultations regarding reanalysis applications, conferences, public event where advocacy work is required

Team and resources

The expert group should consist of:

- The core TEM#111 organizational team: Rémi Gandoin (C2Wind), Justin Sharp (EPRI), Julia Gottschall (Fraunhofer IWES), Rogier Floors (DTU Wind), Jacob Tornfeldt Sørensen (DHI)
- Additional experts (up to 5), co-opted by the above members. We will seek to have experts from solar, hydro, as well as other sectors.

Expected commitment from the expert group:

- One online meeting (1-2h) every three months.
- Participation to the work packages (1 to 2 days per month in average).