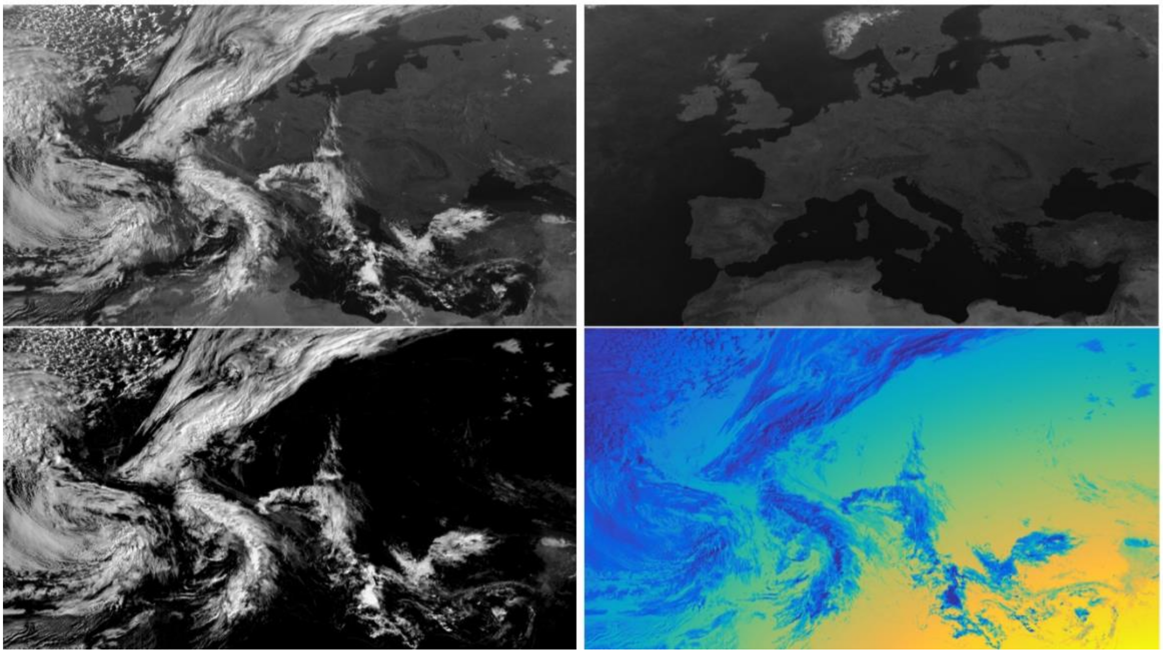
Gridded Renewable Nowcasting Demonstration over South Australia

LESSONS LEARNT REPORT No: 1



Forecasting cloud cover and irradiance from raw satellite imagery

PROJECT DETAILS

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Reporting Period	April – June 2020

This Project received funding from ARENA as part of ARENA's Advancing Renewables Program.

INTRODUCTION

Solcast is a global solar data services company specialising in satellite-based measurement and forecasting of solar irradiance and solar production, with offices in Sydney, Glasgow and Canberra. Our vision is a solar future - we're dedicated to developing the data and tools needed to plan, construct, operate and manage solar power systems across the world. The Solcast API is trusted by more than 7,000 users, with data for over 1,000,000 locations around the globe.

Formed in early 2016, Solcast is the culmination of several years of work by co-founders James Luffman and Dr Nick Engerer and their team, who saw tremendous opportunity to approach solar modelling and forecasting from their perspectives as meteorologists working with the electricity sector.

In this ARENA funded project, Solcast aims to enhance existing weather forecast services by developing a proof of concept demonstration of a forecasting tool which will track and predict renewable output in real time. Solcast's forecasting tool will aim to predict up to six hours ahead in five-minute increments, distributed into 1-2km grids across SA.

Solcast will track the real-time evolution of weather systems over SA and forecast the positions and characteristics of cloud cover, as well as improve predictions of wind-speeds at the wind turbine nacelles (above ground) enabling energy generation to be forecast with greater accuracy. The forecasts will also focus on six hour ahead forecasting to provide more accurate information for grid operation and enhanced management of generation, energy storage, and demand response.

Solcast will utilise a range of data sets and data streams, including historical surface meteorological measurement data and wind and solar farm weather data, to develop high quality forecasts. These forecasts will be shared via project partners, Weatherzone and Tesla Asia Pacific, to be assessed and used by the Australian Energy Market Operator (AEMO), the local distribution network operator (SA Power Networks), and generator asset operators.

KEY LEARNINGS

It is important to note, that the Project is in the very early stages of delivery, with the available 'Lessons Learnt' equally nascent. While we expect rich learning outcomes to emerge as Project partners access and evaluate Project data, at this stage, our available Lessons Learnt are only able to comment on the Project set-up and deliverable of very early stage milestones.

Lesson learnt No. 1: Project planning and implications

Category: Logistical

Objective: Create the environment necessary for successful project execution.

Before pitching to ARENA, this Project was ~1 year in planning. This was critical to ensure a well-designed project that:

a) presents Project Outcomes and Outputs that align with the goals of the ARENA Advancing Renewables Program,
b) delivers Outputs which satisfy known market needs for next generation short-term forecasting, and
c) is technically feasible and fundamentally sound

Critical items that led to the success of this stage of the Project were;

1. Deep market engagement with a wide variety of potential partners, to form an understand of the different use cases of the technology and its applications.
2. Developing and maintaining close industry relationships, to align research and development activities with the needs of industry.
3. Engaging and collaborating with partners throughout the design and application to ARENA process, facilitating communication channels in both directions for updates and feedback.
4. Selecting a range of partners that have broad coverage across the critical areas of the power system, including the grid operator, network operators, gentailers, and asset manager/owners.
5. Recruitment of staff that have the necessary skillsets to undertake such a project, including meteorologists, data scientists, software engineers, and project management.
6. Aligning internal system roadmaps around the data infrastructure required for the project, an activity that needs to be continually reviewed to allow flexibility in system infrastructure to facilitate a wide variety of unknown future projects.

Lesson learnt No. 2: Installed capacity of rooftop solar

Category: Technical

Objective: Determine the spatial distribution of installed distributed >30MW solar PV capacity across South Australia

The Project gathered installed capacity information for distributed >30MW solar PV installations from four sources: the South Australian low voltage network South Australia Power Network, the Clean Energy Regulator (CER), Australian PV Institute (APVI), and AEMO. Capacity information was gathered for all generators <30MW (all generators >30MW, and AEMO listed generators <30MW, are treated separately).

Early analysis has demonstrated data variability between sources for <100kW systems to be negligible. However, for the 100kW to 30MW installations there was more variance in the data sets. This is fairly well understood by the industry, owing to a lack of centralised data, with challenges including omission of this category by the CER, and the update intervals for installation data which result in differences in data update lag. This is consistent with Solcast's discussions with AEMO on the difficulty in visibility and forecasting for these assets.

The data was explored in groups or "bins" of different solar PV system sizes to identify where the differences between each data set occurred. Ultimately the Project selected a single data source for each bin, with consideration paid to data age, difference from Solcast internal modelling, and accessibility. As with all Solcast modelling of distributed solar resources, the data is updated daily with a historical trend applied. Filling this knowledge gap has proven fairly easy through this strategy of employing multiple sources for solar PV installation data organised by solar PV system capacity size. A robust and functional, full representative solar PV installation dataset has now been assembled by the Project.

Implications for future projects

There is no single source of truth in rooftop installed solar PV capacity for any energy market. Thankfully with the various sources of information available, a statistically representative dataset can be assembled. This highlights the value of having multiple sources of Distributed Energy Resources (DER) registrations in order to build technologies that enhance their visibility. The arrival of the future DER registry NEM wide will be a welcome addition for future DER focussed projects in Australia.

Lesson learnt No. 3: Contracting with AEMO

Category: Logistical

Objective: Negotiating a complex contract with AEMO

This Project required an extensive contract agreement with AEMO. While the contract is confidential, some lessons can be shared with the wider energy community. The most involved part of the process was appropriately scoping the contents of the contract, with close collaboration required between Solcast and AEMO, to balance Project outcomes with organisation priorities, system design, and legal review.

Implications for future projects

There are a few important implications from this for future projects.

1. Allowing sufficient time for legal review,
2. Creating buy-in from senior staff early, and
3. Critically, allowing enough flexibility in the Project plan to accommodate any necessary changes.

Lesson learnt No. 4: Data flexibility

Category: Technical

Objective: Designing a system to achieve flexible data transfer to partners.

For this Project to be successful, significant amounts of data need to be transferred in and out of Solcast modelling and forecasting systems, including several key data feeds from internal AEMO systems which have not previously been able to be proved externally. Significant scoping work is underway between Solcast and AEMO to pass the requisite data from AEMO to Solcast. Generally operational data is transferred between organisations using HTTP (HyperText Transfer Protocol) or FTP (File Transfer Protocol), with considerations made in regards to the following (non-exhaustive) list:

1. Generally, HTTP is more responsive for small files, but FTP can be engineered to support large data transfers.
2. Many firewalls drop outbound connections which are not to ports 80 or 443 (HTTP & HTTPS). This can make integration into operational systems more complex, or prone to operational issues.
3. HTTP allows for greater flexibility in being able to transfer metadata, client specific responses, and more ways for authentication.
4. FTP integration is sometimes required by larger organisations who utilise legacy systems.

Implications for future projects

System design has flow on effects to Project partners, who must integrate the operational data feed into their existing system. Before committing to a file transfer protocol, organisations should engage with users of the prospective data to understand their systems requirements, and select a design appropriate to cover a wide array of unique systems. This is particularly import when designing a system to receive or send data to AEMO, given the complexity and required robustness of their operational systems.