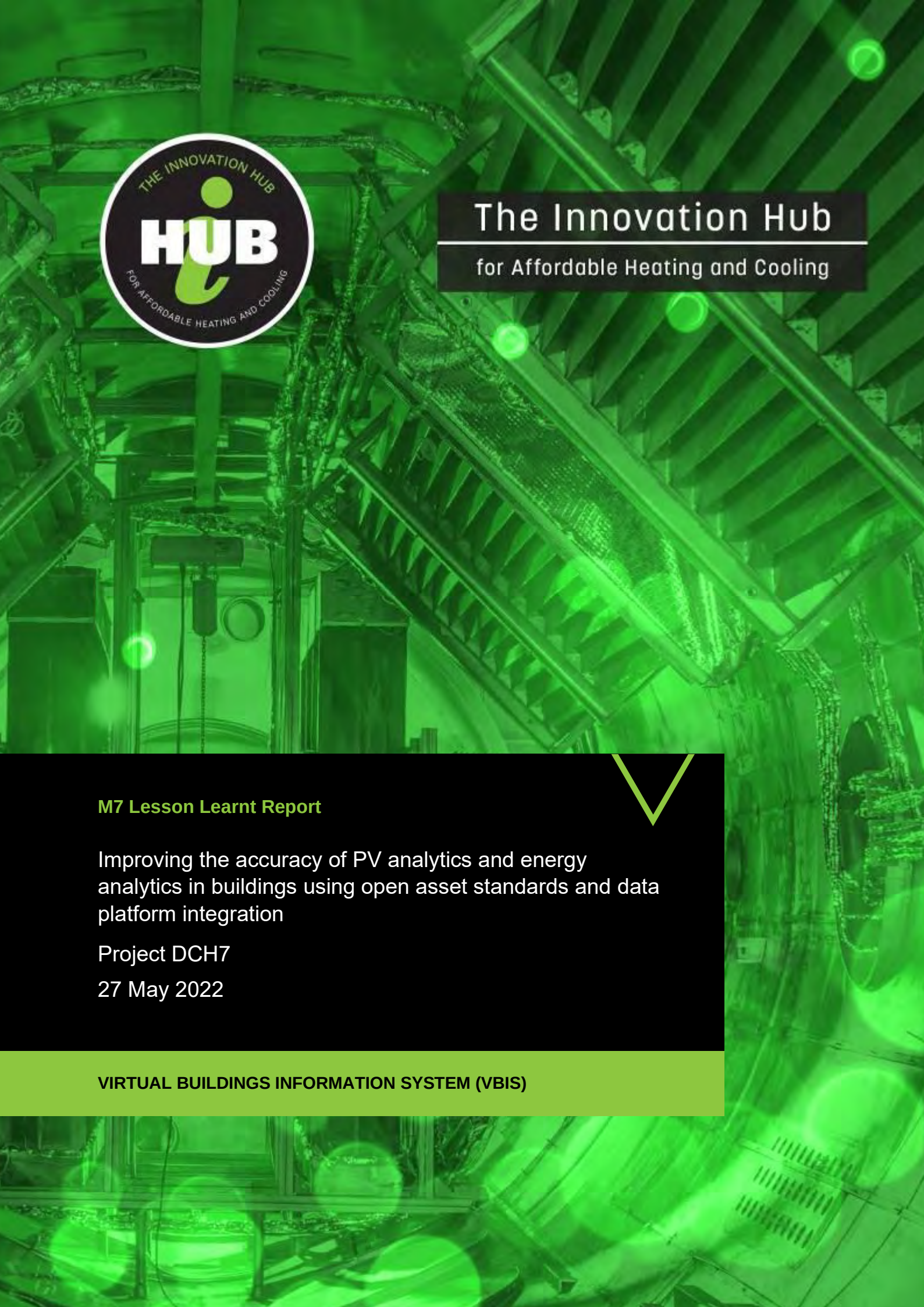

M7 Lesson Learnt Report

Improving the accuracy of PV analytics and energy analytics in buildings using open asset standards and data platform integration

Project DCH7

27 May 2022

VIRTUAL BUILDINGS INFORMATION SYSTEM (VBIS)

About i-Hub

The Innovation Hub for Affordable Heating and Cooling (i-Hub) is an initiative led by the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) in conjunction with CSIRO, Queensland University of Technology (QUT), the University of Melbourne and the University of Wollongong and supported by Australian Renewable Energy Agency (ARENA) to facilitate the heating, ventilation, air conditioning and refrigeration (HVAC&R) industry's transition to a low emissions future, stimulate jobs growth, and showcase HVAC&R innovation in buildings.

The objective of i-Hub is to support the broader HVAC&R industry with knowledge dissemination, skills-development and capacity-building. By facilitating a collaborative approach to innovation, i-Hub brings together leading universities, researchers, consultants, building owners and equipment manufacturers to create a connected research and development community in Australia.

This Project received funding from ARENA as part of ARENA's Advancing Renewables Program.
The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

Primary Project Partner

i-Hub Lessons Learnt Report

Guidance notes for completion of the Lessons Learnt Report:

- This report is intended to be made public.
- Please use plain English, minimise jargon or unnecessary technical terms.
- Please use your organisation's branding for the report.
- The report should meet your organisation's publishing standards.
- Please use one template per each major lesson learnt and include as many as are relevant for your sub-Project. If what you learnt is more technical, this is the section to include technical information.
- The content of these Lessons Learnt Reports can be compiled (and updated, where necessary) for inclusion in the (public) Project Knowledge Sharing Report, for submission at the completion of your sub-Project.

Lead organisation	**VIRTUAL BUILDINGS INFORMATION SYSTEM (VBIS)**		
Sub-Project number	DCH 7		
Sub-Project commencement date	06 May, 2021	Completion date	27 May, 2022
Report date	27 May, 2022		
Contact name	T.K Wang		
Position in organisation	Account Manager		
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Lessons learnt

Lesson learnt #1	Critical Path Resourcing and Technical Support					
Category	Logistical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

This project provided the opportunity to develop several firsts. This included the first project that used non CSIRO staff to on-board data into the DCH model as well as the first project to develop mass re-deployable applications. Given the number of parallel activities required to be tested and operational at the same time, co-ordination of resources to ensure critical path tasks are completed became critical.

It was only discovered late in the project deployment that several critical development tasks were dependant on a few (one or two) key resources or that any technical issues could only be resolved by a single resource that was not always available. The same resources were also critical resources required on different DCH projects as well. This led to increased pressure to ensure DCH project would still make progress by completing the required tasks in time for other dependant activities to proceed.

Please describe what you would do differently next time and how this would help. What are the implications for future Projects?

While it was difficult to anticipate the issues the project team would face given this project was the first of its kind (akin to the team building the plane while we are flying it), should similar projects be run again, sufficient float should be allowed within the project to account for key resource availability delays. Critical resources (or tasks which can only be completed by one person) should be identified so that any foreseeable works scheduled accordingly.

If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.

While the certain tasks could only be completed by one person, with adequate documentation on model building, model querying and application interfaces, some of the fault finding and issue resolution could be completed by others to remove potential bottlenecks within the implementation schedule.

Until the industry becomes better versed in model building and model querying, Data Clearing House will also need to continue to provide support to industry while competency is being developed.

Lesson learnt #2 Application Development with Models

Category	Technical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

Application developers typically ingest data for use within the analytics algorithms. This process typically focuses on manually configuring applications to point to the required data point. A lot of this is done with experience and intuition from the engineer implementing the system.

When attempting to retrieve data from a data model, consideration must be given on how a query should be structured such that the data models can consistently provide accurate and precise information.

The team in this project experienced this when trying to develop the BRICK queries to be used in the applications. Application developers had requested information (which is normally obtained through site inspections, drawings etc.) which initially would appear to be bespoke to certain types of buildings/sites. Working with modelling specialists however, it was possible to uncover the purpose behind why certain types of information had been requested and formulate standard queries that could be applied to different buildings to ensure consistent query responses. This consistency is critical in trying to implement portable applications.

A few examples of questions which developers have asked, interpretation of what is really being requested, and how to get that information from the BRICK model is provided shown below.

Original Question	Interpretation	BRICK based query process
How many PV panels were installed?	For each solar inverter, what is the number of PV panels connected to it.	Find all solar inverters. Then find PV panels connected to each inverter. In the BRICK modelling context "PV panels" could be modelled as a hierarchy of PVArrays and/or leaf node PVPanels. Mostly you want an aggregation of area, rated output, orientation etc of all PV connected to the inverter. These things could be modelled as metadata on PVarrays or as metadata on PVPanels so the Query needs to ask for both and correctly determine which to use.
Are those PV panels size the same?	For each solar inverter, are all the panels connected to it the same size	Are the PV panels connected to an inverter all the same size. This sort of query in BRICK is not possible, however what is the size of each panel connected is, so the application logic needs to determine if they are all the same size.
What's the size of those PV panel?	For each solar inverter, what is the total area in square meters of the PV panels connected to it.	Similar to above, this sort of query is not directly possible in BRICK, so the application logic needs to ask for (or query) the set of sizes of the set of panels connected and aggregate the result.

Please describe what you would do differently next time and how this would help. What are the implications for future Projects?
As a number of work streams were being completed at the same time, it was difficult to anticipate how the system would respond to the requested information. Due to the project schedule, application developers had to build applications while the model and the query functionality was being developed. Similar to the previous lessons learnt, having adequate documentation and worked examples early in the application design stage would have assisted application developers to code in a more compatible way that would have supported model querying. This would have reduced the effort required to translate algorithms which would have already been developed.
If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.
BRICK model querying and building applications based on database queries is still not widespread and will require continuous support from subject matter experts until this method of application development is more widely adopted.