An update on Activity C1 design tools and models, Task 65 Solar Cooling Sunbelt Regions

Lu Aye*, Nayrana Daborer-Prado,
Daniel Neyer and Uli Jakob

2021 Asia-Pacific Solar Research Conference,
Sydney, 16-17 December 2021

Acknowledgements

- "I acknowledge the Traditional Custodians of country throughout Australia and their connections to land, sea and community. I pay my respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today."

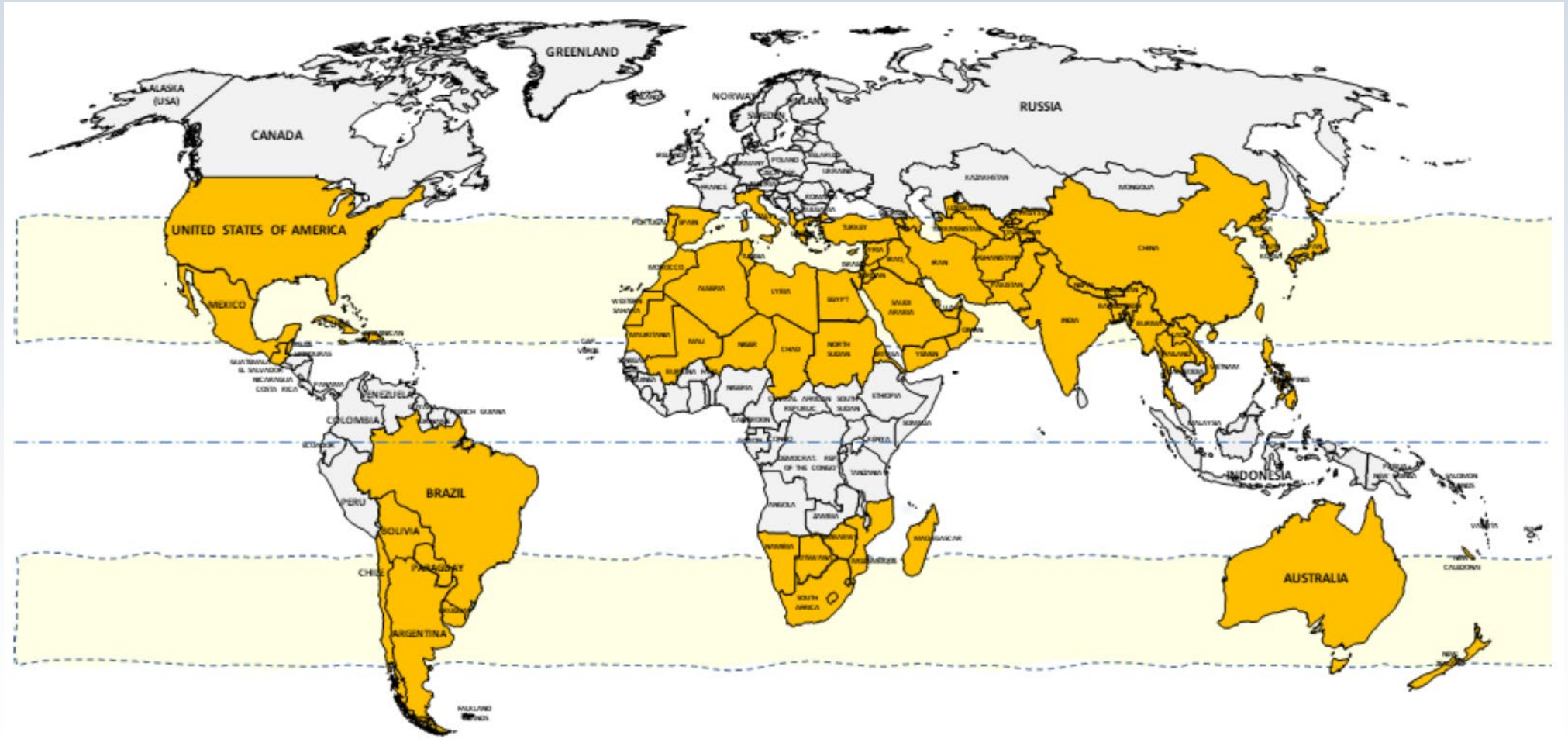
- The funding provided from the Australian Renewable Energy Agency (ARENA) and the supports from the Australian Photovoltaic Institute (APVI) and the University of Melbourne (UoM) are acknowledged.
- The funding of Austrian participation at the IEA SHC Task65 (FFG Project No. 883011) through the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is gratefully acknowledged.
- This work has partially received funding from the German Federal Ministry for Economic Affairs and Energy (BMWi/PtJ) under grant agreement No. FKZ 03ETW024B (SorptionTakeOff).

IEA SHC Task 65 Solar Cooling Sunbelt Regions

https://task65.iea-shc.org/

The main aim of the global IEA Solar Heating and Cooling research platform Task 65: Solar Cooling for the Sunbelt Regions (July 2020 – June 2024) is development of innovations for affordable, safe and reliable cooling systems for sunbelt regions worldwide (Jakob, 2020).

Sunbelt Regions



Subtask C: Assessment and Tools General Objectives:

- Update/merging of useful tools for design & assessment,
- Establishing/adapting of assessment method and benchmarking (incl. reference system in different locations),
- Create common database for technical, environmental and economic assessment for the participating countries,
- Analyses of Subtask B results and benchmarking against reference systems and different renewable and solar solutions,
- Sensitivity analyses of high influencing parameters on the technical/economic/environmental assessment.

Sub Task C Activities

- C1: Design tools and models: Activity Leaders: [Nayrana Daborer-Prado (FHOÖ)/Lu Aye (UoM)]
- C2: Database for technical and economic assessment
- C3: Assessment mechanism
- C4: Benchmarking and sensitivity analysis

Activity C1: Design tools and models

The **main objectives:**

- Documentation of the tools and their specific application,
- Provide measured data for validation of the tools, and
- The adaptation of selected ones for sunbelt regions.

Initial **steps**:

- Collection of info/description of Tools/Models among Task 65 Participant
- Literature review
- Matrix of properties/applications/project phases: Tools & Models

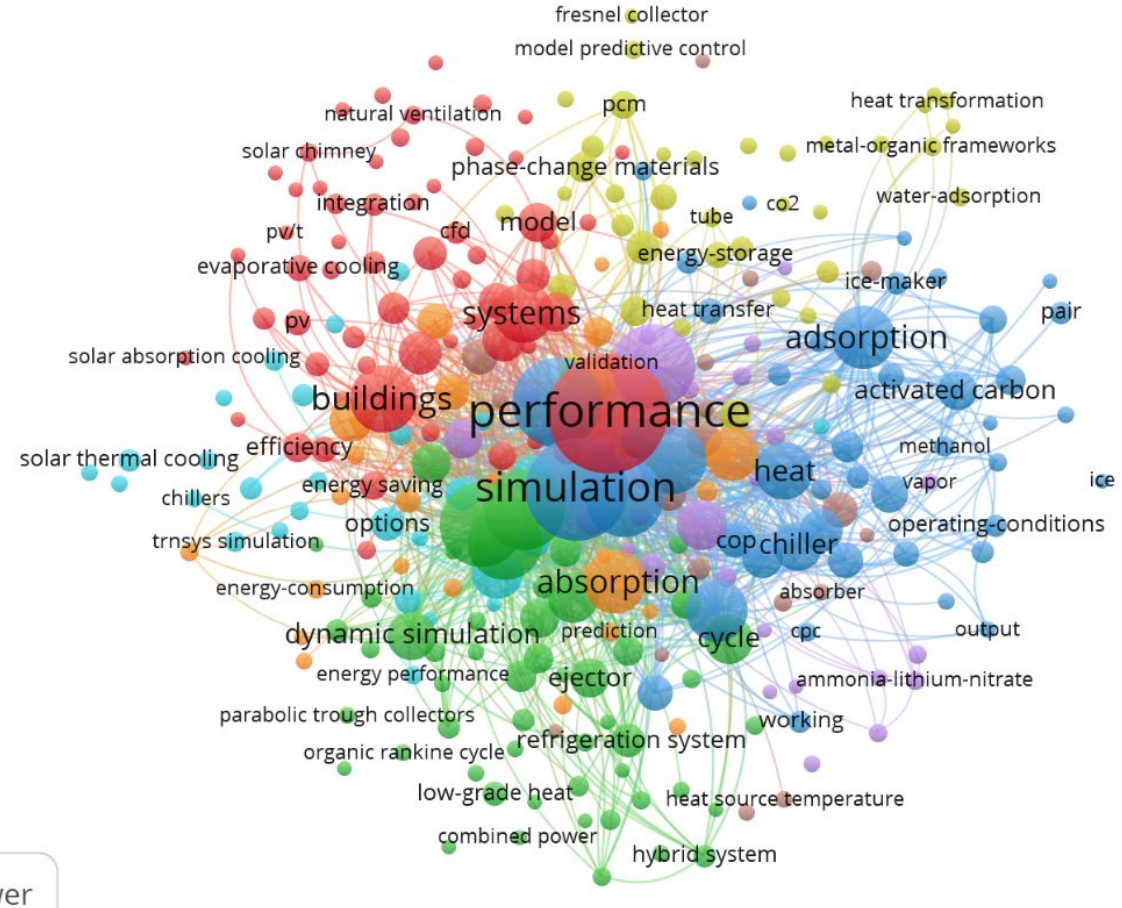
Timeline:

- Survey started in December 2020
- Structured literature review by June 2021
- Milestone draft June 2021

Literature review: WoS search

ALL=("solar cooling" OR "solar refrigeration") 1990-2021⇒1216 articles

keyword co-occurrence analysis



VOSviewer

- Minimun = 5 occurrence
- 'Model' clustered with 'performance' and 'systems' linked with 'simulation'.
- 'trnsys simulation' is the only software included

Software tools applied in solar cooling system research

No.	Software tool	Reference
1	TRNSYS	(Uckan & Yousif, 2021)
2	MATLAB, EES	(Tashtoush & Nayfeh, 2020)
3	TRNSYS	(Mehmood, Maximov, Chalmers, & Friedrich, 2020)
4	TRNSYS	(Boero & Agyenim, 2020)
5	Meteonorm	(Alahmer, Wang, & Alam, 2020)
6	EES	(Al-Nimr, Tashtoush, & Hasan, 2020)
7	TRNSYS, MATLAB	(Aboelmaaref et al.)
8	EES, Ebsilon	(Tashtoush & Algharbawi, 2019)
9	TRNSYS	(Plytaria, Bellos, Tzivanidis, & Antonopoulos, 2019)
10	gPROMS	(Harraz, Freeman, Wang, Mac Dowell, & Markides, 2019)
11	TRNSYS	(Figaj, Szubel, Przenzak, & Filipowicz, 2019)
12	Sage	(Langdon-Arms, Gschwendtner, & Neumaier, 2018)
13	IES	(Hassabou & Khan, 2018)
14	TRNSYS	(Franchini, Brumana, & Perdichizzi, 2018)
15	EES	(Adibi, 2018)
16	EES	(Porumb, Porumb, & Balan, 2017)
17	EnergyPlus	(Ma, Saha, Miller, & Guan, 2017)
18	Sage	(Langdon-Arms, Gschwendtner, & Neumaier, 2017)
19	TRNSYS	(Brumana, Franchini, & Perdichizzi, 2017)
20	TRNSYS	(Vasta, Palomba, Frazzica, Di Bella, & Freni, 2016)
21	FLUENT	(Kalkan & Dagtekin, 2016)
22	TRNSYS	(Wang & Dennis, 2015)
23	TRNSYS	(Vasta, Palomba, Frazzica, Costa, & Freni, 2015)
24	TRNSYS, EES	(Tashtoush, Alshare, & Al-Rifai, 2015)
25	TRNSYS	(Lugo & Garcia-Valladares, 2015)
26	TRNSYS	(Gomez-Moreno, Palomar-Carnicero, & Cruz-Peragon, 2015)
27	IPSEpro	(Abdulrahim & Darwish, 2015)
28	TRNSYS	(Buonomano, Calise, & Ferruzzi, 2013)
29	TRNSYS	(Baniyounes, Rasul, & Khan, 2013)
30	TRNSYS	(Thomas & Andre, 2012)
31	TRNSYS	(Calise, 2011)

Proforma for solar cooling system design software tools

Component-> Purpose	Solar collector	Cooling technology	Distribution	Storage
Technical				
Financial				
Sizing				
Simulation				

Conclusions

- IEA SHC Task 65 Subtask C and the activities have been briefly described.
- The initial findings from the available literature on the software tools applied in solar cooling research also have been presented.
- TRNSYS is the most widely applied software tool relevant to solar cooling system design reported in the academic literature.
- The next step is to complete the collection of the data on design software tools utilised in the industry for practical installations.
- The analysis, results, and findings will be disseminated in a report, at the completion of the activity, to be published by the IEA.

The End.

Contact: lua@unimelb.edu.au