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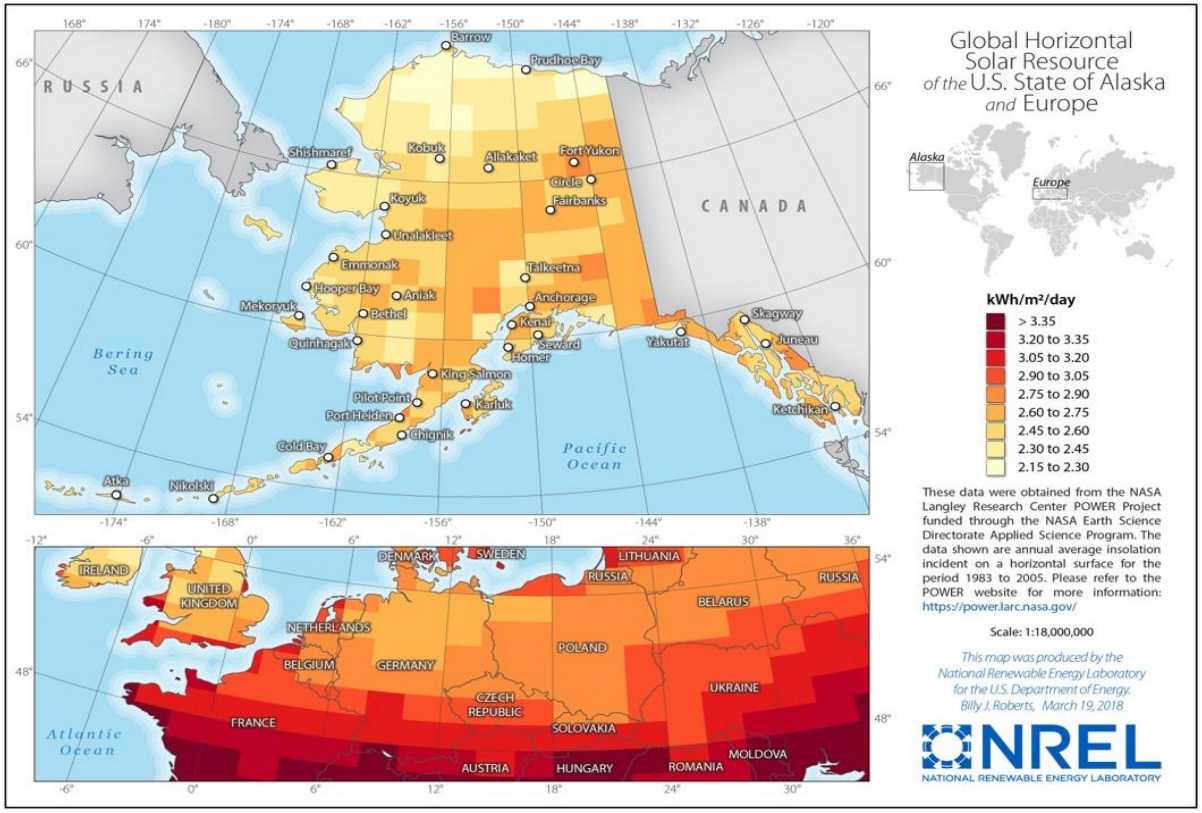
Snow Losses in PV Arrays at High Latitudes

Erin Whitney, Alaska Center for Energy and Power, University of Alaska Fairbanks

Task 13 Focus Workshop ~ 30 September 2021 ~ Freiburg/Fraunhofer ISE

The sun does shine in Alaska…



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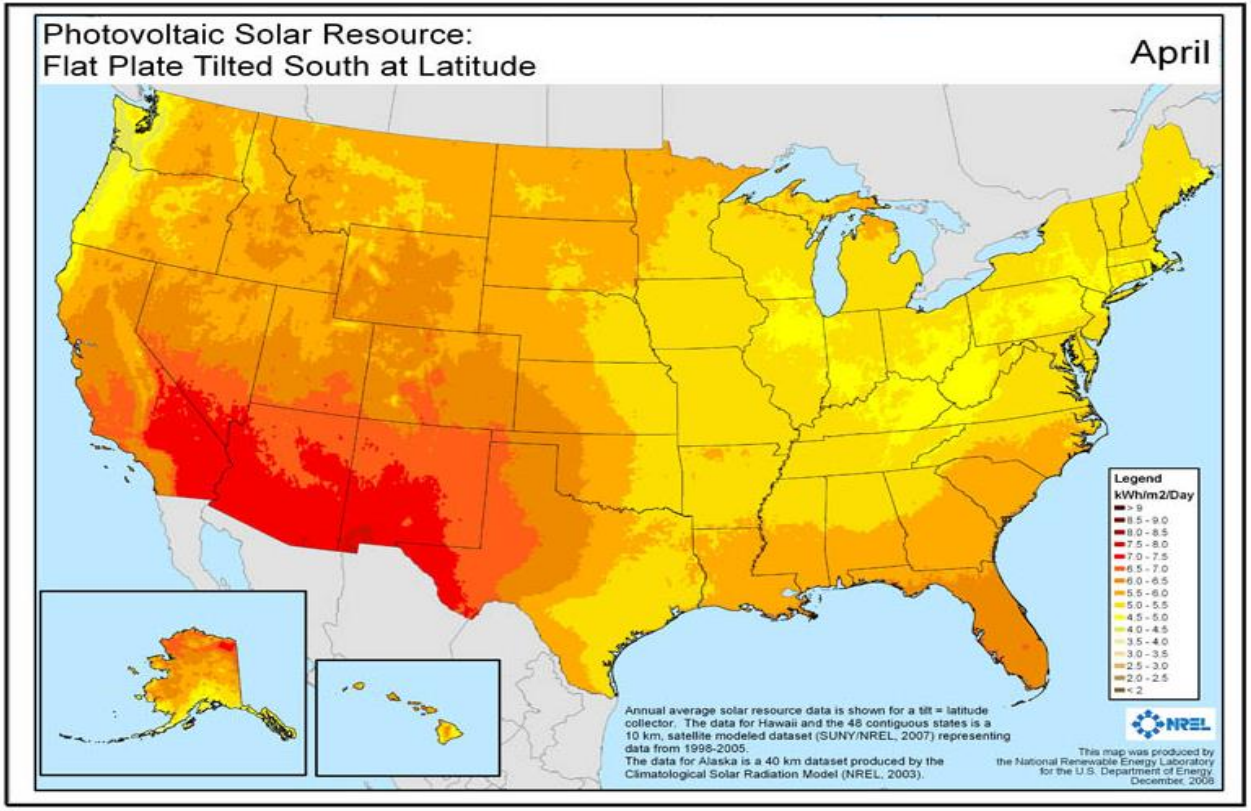
The sun does shine in Alaska…



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Alaska geography

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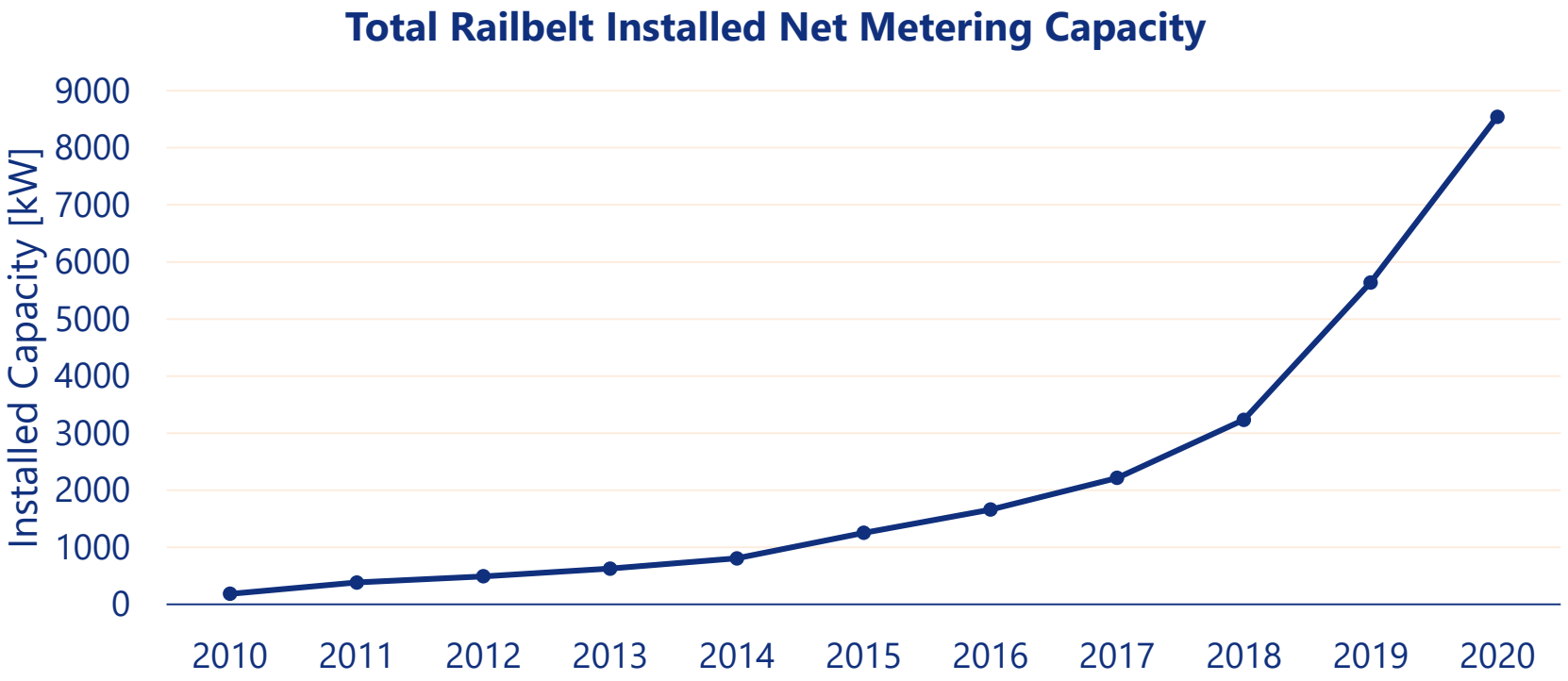
Rapid growth in Alaska solar installations (*Railbelt*)



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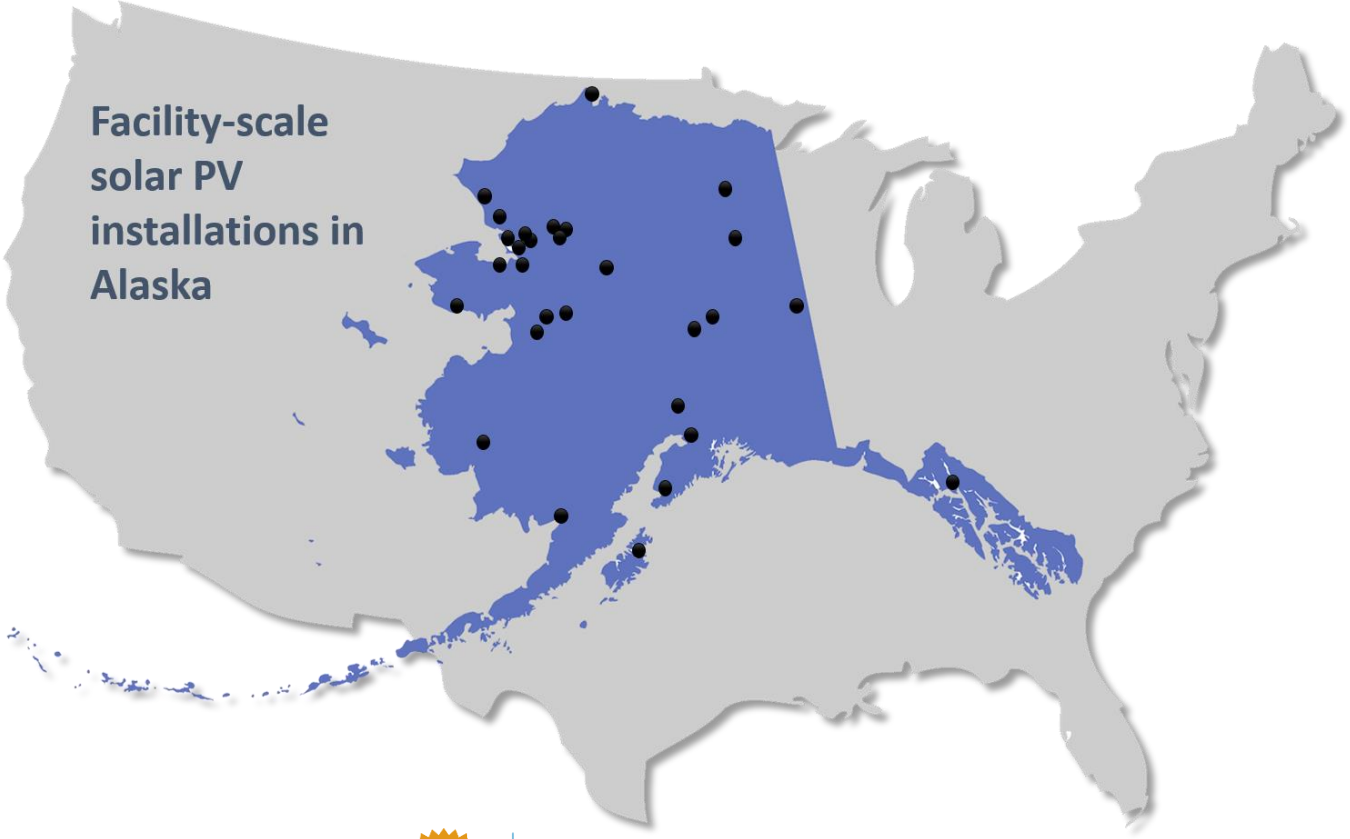
Rapid growth in Alaska solar installations (*rural*)



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Rural Alaska solar PV installations

Deering Water Tower

Shungnak

Photo credits: ACEP

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Larger Alaska solar PV installations

Fairbanks
~500 kW

Golden Valley Electric Association (“GVEA”)

Photo credit: GVEA

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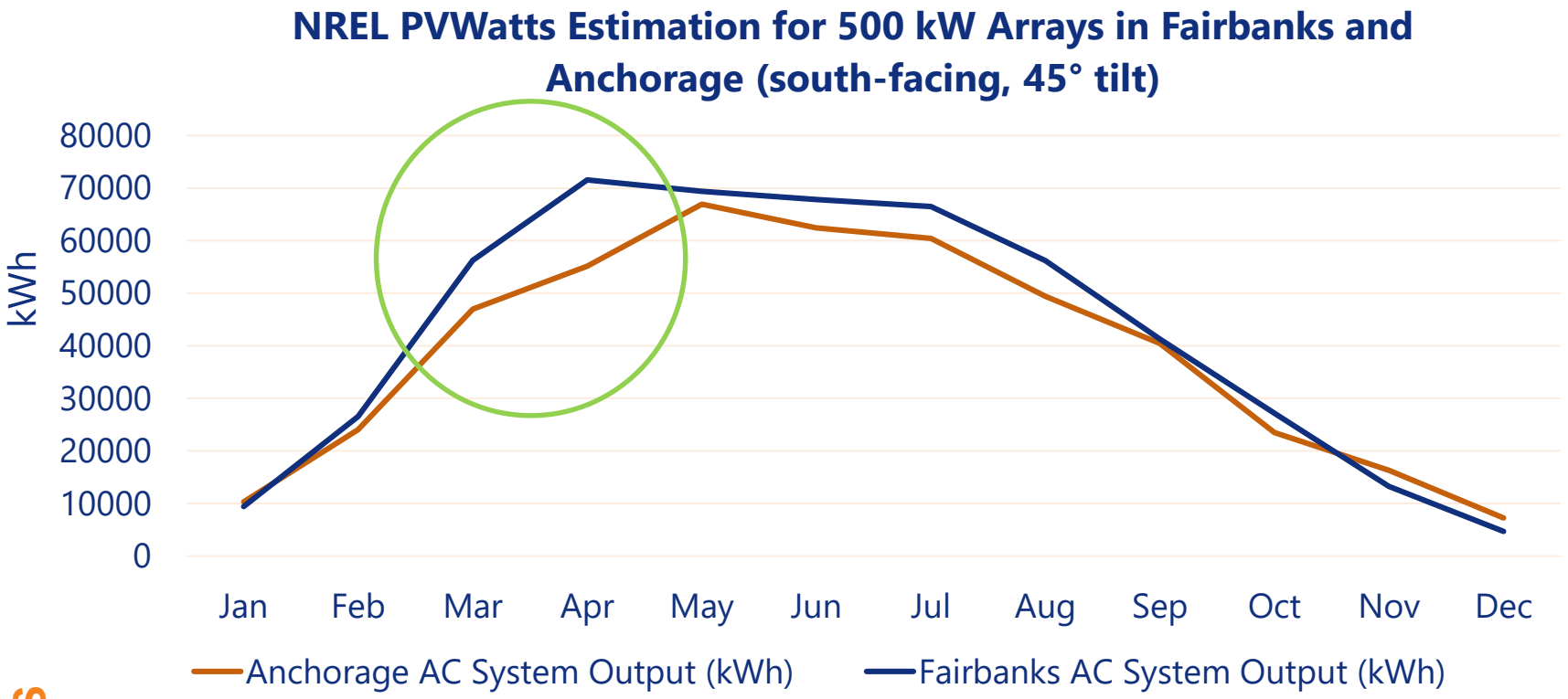
But it snows in Alaska…

Photo credit: ACEP

Snow coverage in March and April has an impact



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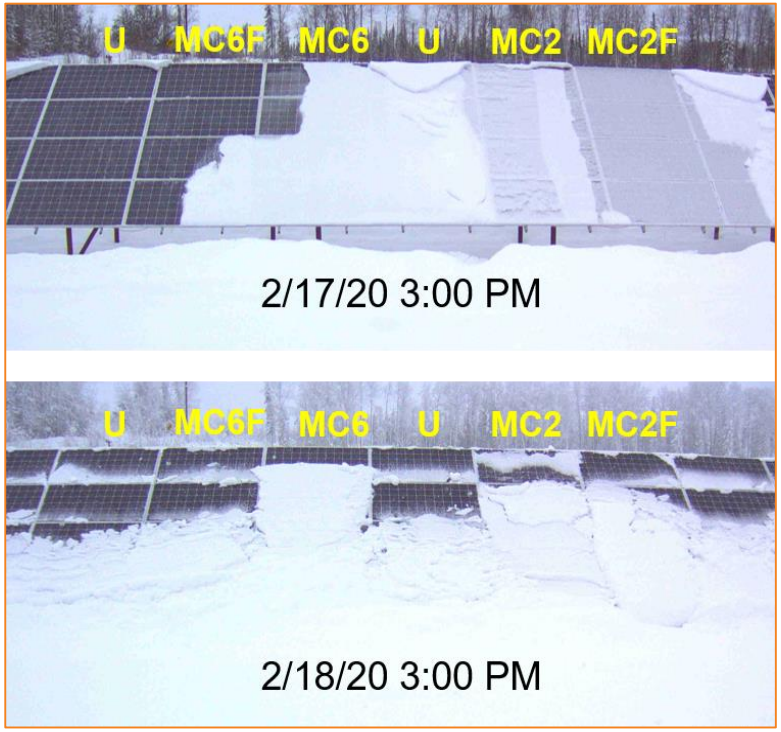
Snow loss mitigation strategies

- Physical clearing
- Snow shedding coatings
- Panel heating
- Vertical panels

All approaches must be considered with respect to cost.

Physical clearing



Snow overload, shedding arrested.

Focus on clearing panels a few times during spring months.

Remove snow berm under the low edge of south-facing arrays.

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Module-level power electronics

- String inverters may be a disadvantage for solar PV arrays at high latitudes, since snow coverage of one panel wipes out production for the whole string.
- Module-level power electronics may become a best practice for arrays in snowy climates to optimize output. (Alaska example: Kotzebue uses DC optimizers for its panels.)

Module heating

- Work in progress, but the Norwegians (Innos) have already done it!

Photo credit:
PV Magazine International
(18 March 2020)

Vertical panels

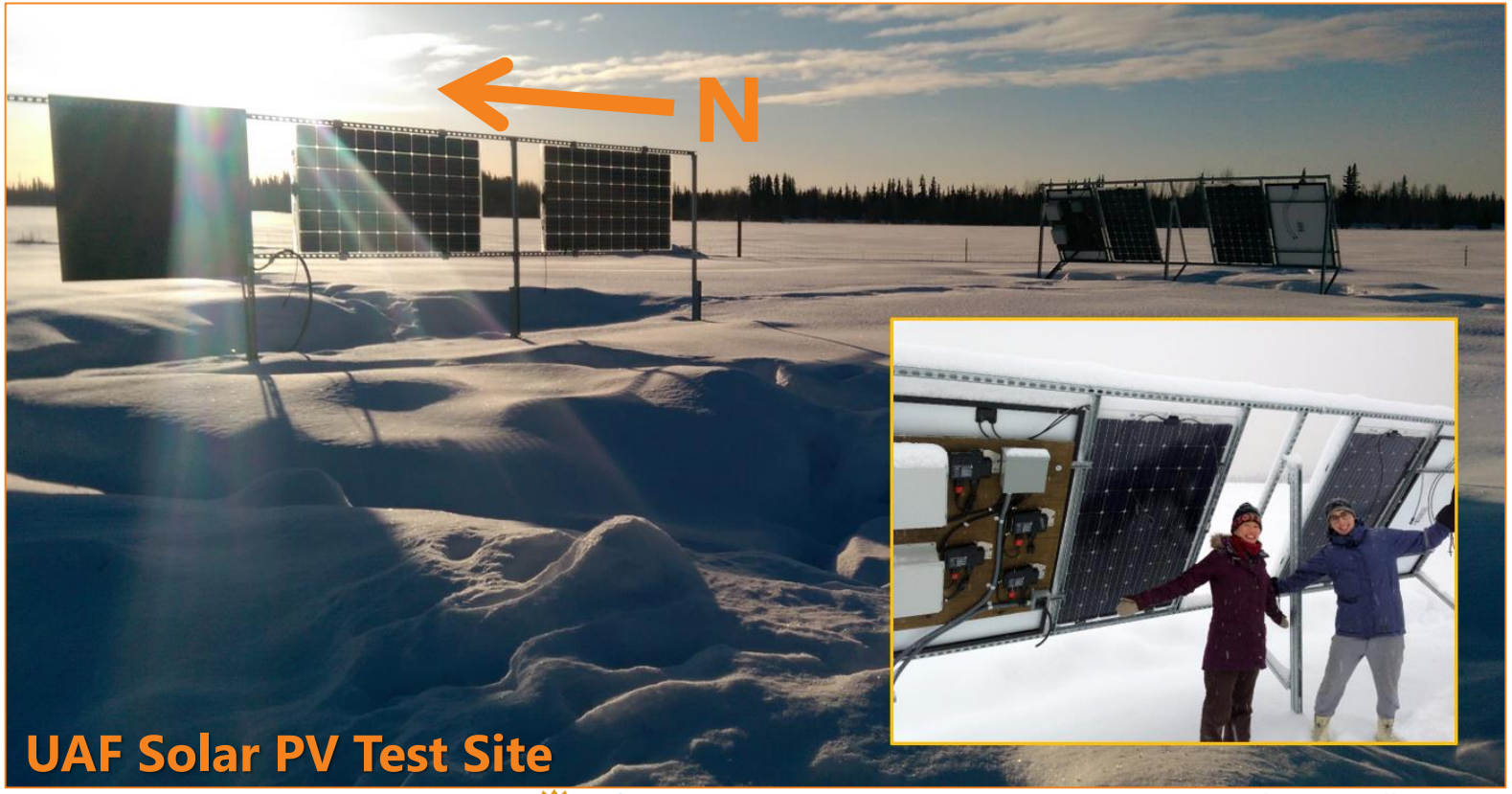
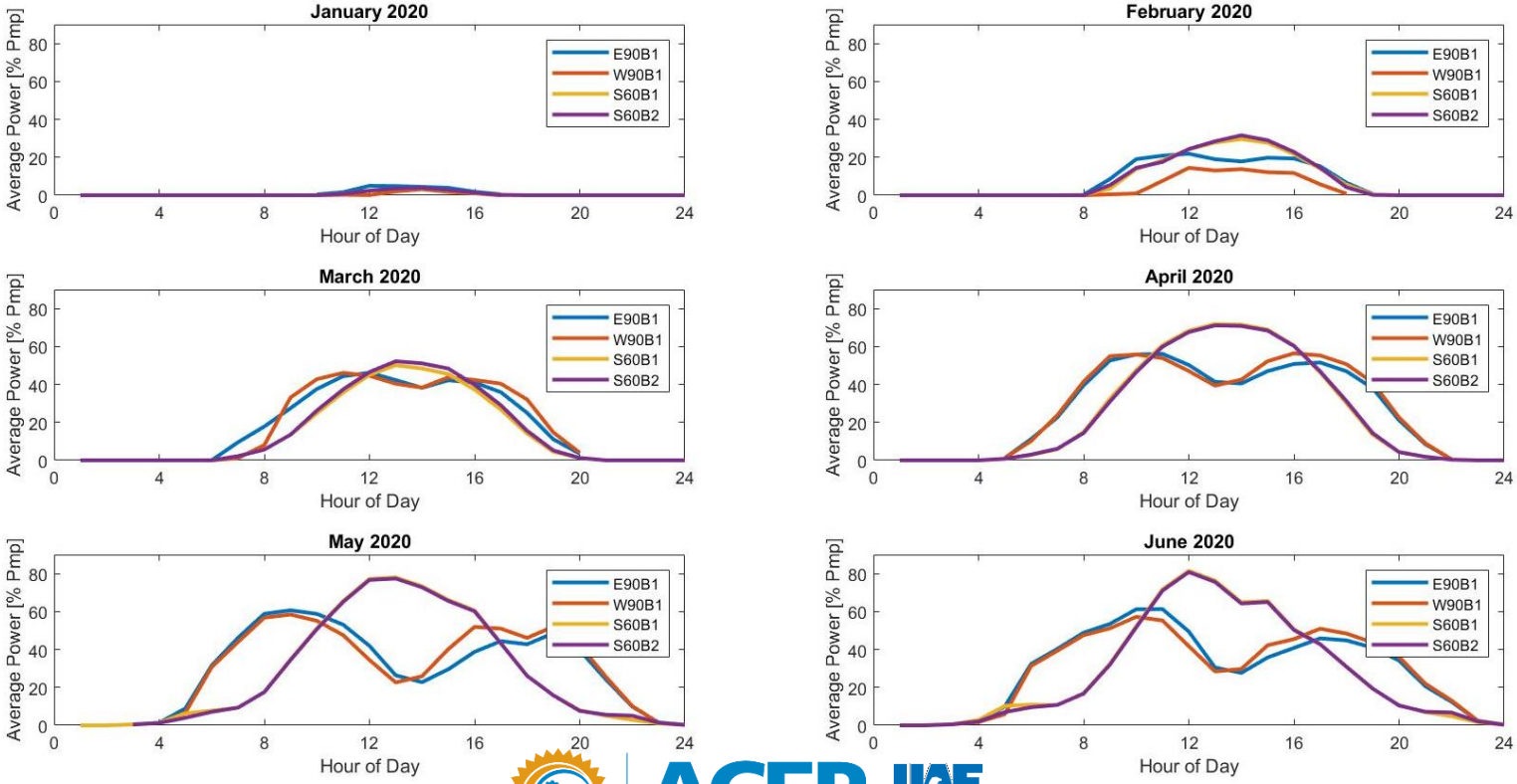


Photo credits: ACEP

Vertical east-west bifacial modules

Pike, C., Whitney, E., Wilber, M., Stein, J.S. “Field Performance of South-Facing and East-West Facing Bifacial Modules in the Arctic.” *MDPI Energies,* 14, 1210 (2021). https://doi.org/10.3390/en14041210.



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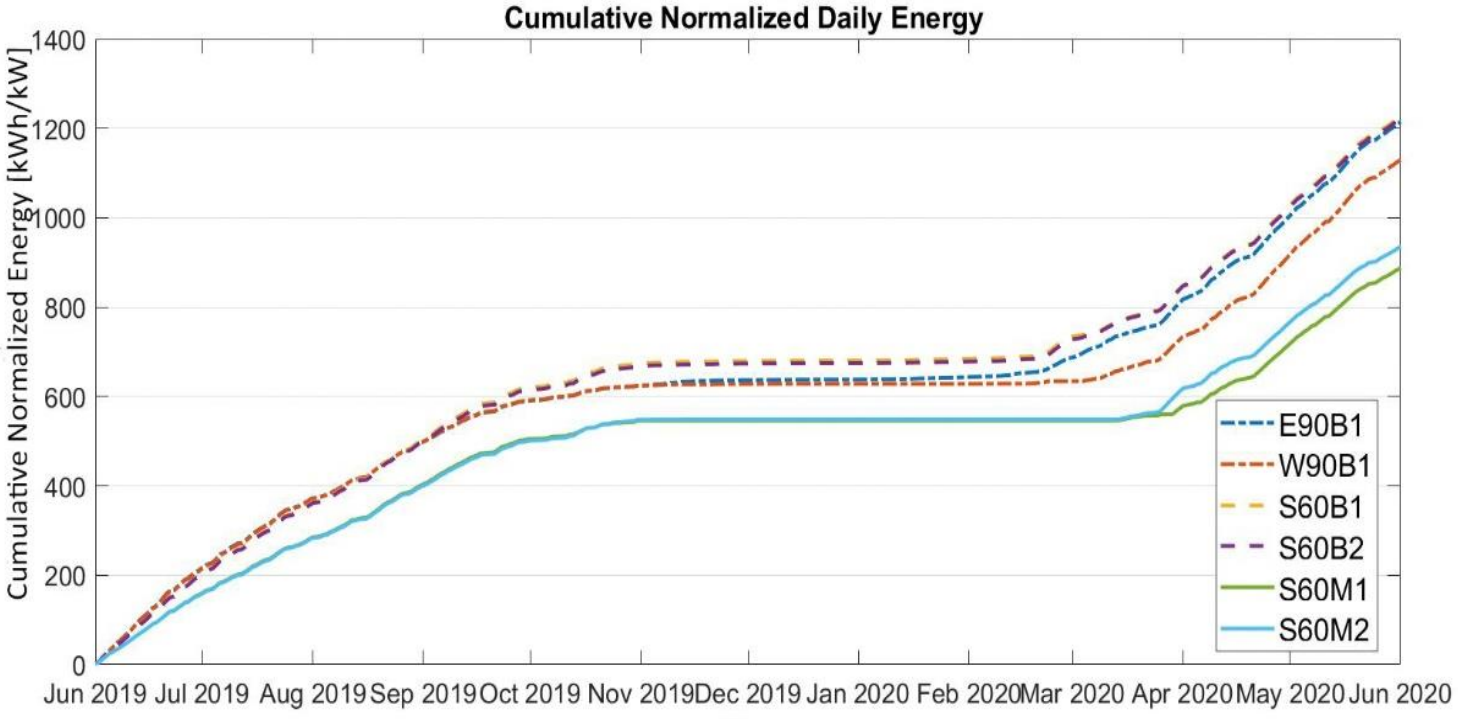

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Conclusions

- At high latitudes, snow coverage is a significant impact on production, especially during the spring months.
- As solar PV installations increase at high latitudes, snow coverage becomes a serious consideration.
- Strategies may include physical clearing, snow shedding coatings, heating, or vertical configurations of panels, and all have to be balanced against cost considerations.
- Module-level power electronics may maximize string production when some modules are partially covered.
- Reliance on private large PV array partners to test these strategies is a challenge.

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