What is Agrivoltaics?

Agrivoltaics is the dual use of land for the purpose of agriculture and solar photovoltaic-based electricity generation. The integration is carried out to enable the photovoltaic (PV) devices to generate renewable energy while not impeding agricultural production.

Most importantly, several studies on a wide variety of food crops including basil, broccoli, celery, chiltepin peppers, corn, maize, lettuce, pasture grass, potatoes, salad, spinach, tomatoes, and wheat have demonstrated that **agrivoltaics can increases crop yield**!

Based on the design, agrivoltaics can broadly be classified into a few types:

1. *Between the row* in which vertical or tracking PV arrays are installed between rows of crops.
2. *PV greenhouses:* in which the roof and walls of greenhouses are replaced with semi-transparent PV
3. *Ground*-mounted integrated in which crops are grown beneath semi-transparent PV
4. *Stilt mounted:* systems in which the height of the PV racks is increased and they are arranged strategically at intervals to allow a certain amount of sunlight to pass through them

Agrivoltaics offers multiple advantages including: reduced greenhouse gas emissions, improved economy and environment, water conservation, augmented crop productivity, higher land use efficiency, mitigation of crop damage caused by strong winds, enhanced PV system performance, mitigation of soil erosion, reversed desertification, reduced agricultural displacement for energy, facilitation of local food cultivation, improved human health from decrease in pollution, hedge against inflation, provision of energy for computing, potential to produce on-farm nitrogen fertilizer, renewable fuels including hydrogen and anhydrous ammonia as well as increased profitability per unit area.

Between-the-row agrivoltaics

Greenhouse agrivoltaics

Semi-transparent agrivoltaics

Stilt-mounted agrivoltaics

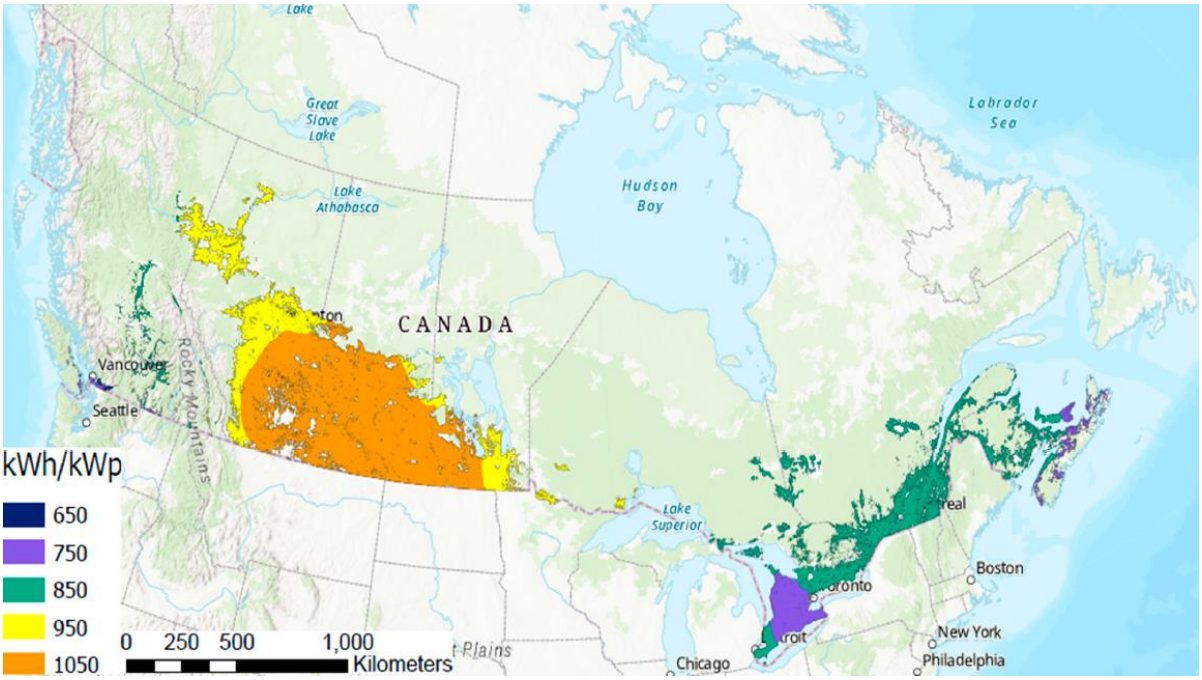
Agrivoltaics offers a dual revenue stream – one by selling the agricultural produce and the other by selling electricity or offsetting the electrical needs.

Agrivoltaics can also been extremely successful in Canada being integrated into lamb and sheep grazing. This combination is the greenest method of raising animals according to life cycle analysis (Handler & Pearce, 2022).

Canada has immense agrivoltaic potential. A study by Jamil et al. has concluded that between a quarter to more than one third of Canada's electrical energy needs can be provided solely by agrivoltaics using only 1% of current agricultural lands. The fraction of agricultural land in each province that can be used to decarbonize the grid in that province is less than 1% for all provinces, except for Alberta, British Columbia and the Maritimes.

Sheep Agrivoltaics

R.Handler J. M. Pearce, Greener Sheep: Life Cycle Analysis of Integrated Sheep Agrivoltaic Systems, *Cleaner Energy Systems*, 3, 2022, 00036, https://doi.org/10.1016/j.cles.2022.100036



Conventional PV potential (kWh/kWp) of south-facing, vertically oriented arrays in agricultural land across Canada.

Jamil, U., Bonnington, A. and Pearce, J.M., 2023. The agrivoltaic potential of Canada. *Sustainability*, *15*(4), p.3228. https://doi.org/10.3390/su15043228

Such studies indicate that agrivoltaics could be a major contributor to renewable electricity generation and enable the energy sector of the world, and particularly that of Canada, free of greenhouse gas emissions. The potential of agrivoltaic-based solar energy generation in Canada far surpasses existing electricity requirements and can, thus, be used to electrify and decarbonize transportation & heating sector as well.