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Degraded Agricultural Land: Siting Considerations for Renewable Energy in Ukraine

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August 25, 2026



Topics - Siting Renewable Energy (RE) in Ukraine

1. RE Developers' Siting Criteria

- Wind vs Solar PV
- Site Optimization

2. Mapping Studies of Ukraine

- Solar and wind resource levels
- Agricultural and degraded agricultural lands

3. Trade-offs and Considerations

RE Project – Assume Somewhat Decentralized Generation Model

Project Capacity of 10s to 100s of MW, created by private company (IPPs) conceptualizes and designs the project, possibly builds and operates



10-50+ wind turbines (dual land use) connected by roads and buried cables, ~150 – 200 m height, + ancillary equipment + O&M facility



Fenced area of ground-mounted solar PV panels + ancillary equipment + O&M facility

~25-year “life”

Multiple Scales to Consider in RE Project Siting

Regional Scale

Understand:

- Load centers, regional needs
- Ecosystem and geography
- General wind/solar resources
- Power market drivers

Sub-Regional Scale

Understand:

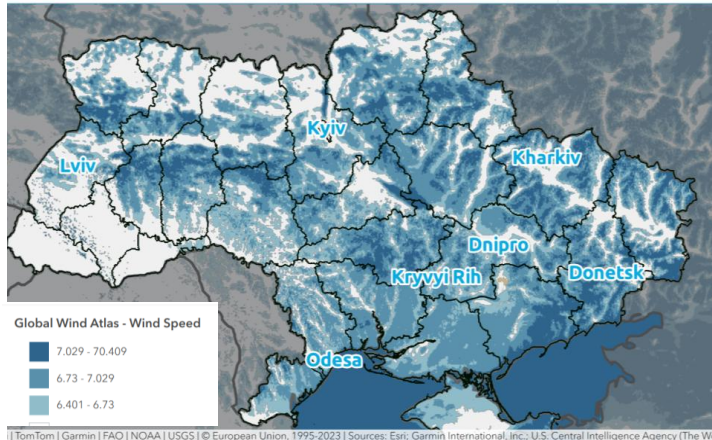
- Transmission access and capacity
- Land use patterns
- Wind resource characterization/patterns
- Protected areas & migration corridors

Local (Project) Scale

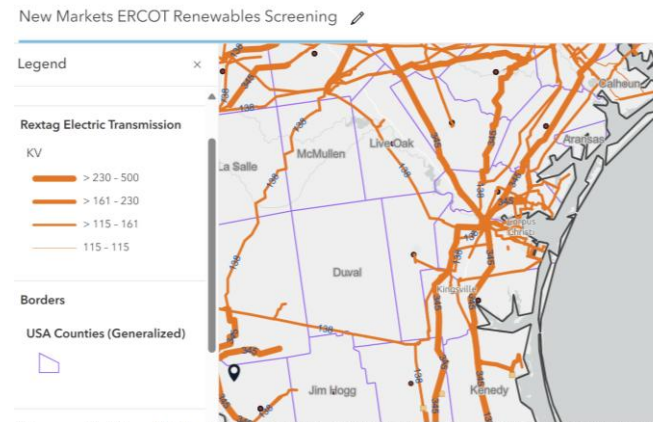
Understand:

- Land ownership, “patchiness”, local support
- Constructability (slope, floods, geology, etc)
- Environmental & social features
- Road access and grid

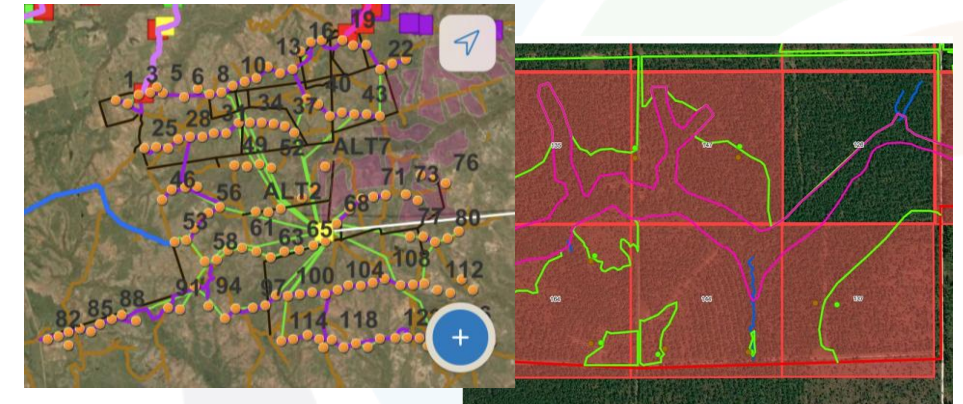
e.g., West/Central/South/East



e.g., Oblast Level



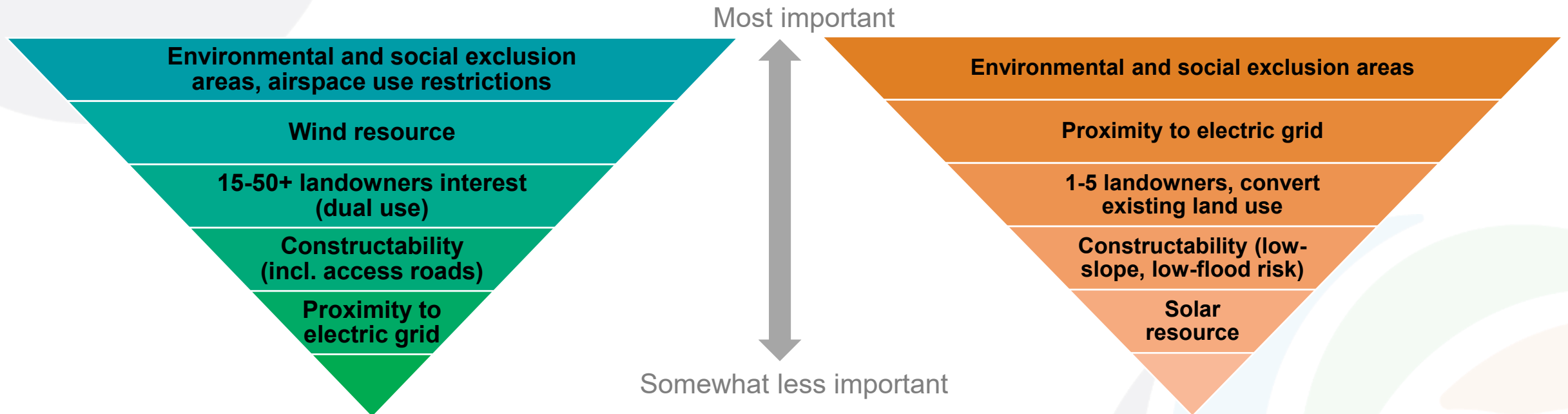
e.g., Project site level



Differences in Siting Criteria for Wind vs Solar Projects

Windfarm siting - driven by wind resource and critical mass of landowner interest

Solar PV siting - driven by availability of suitable contiguous land and proximity to grid



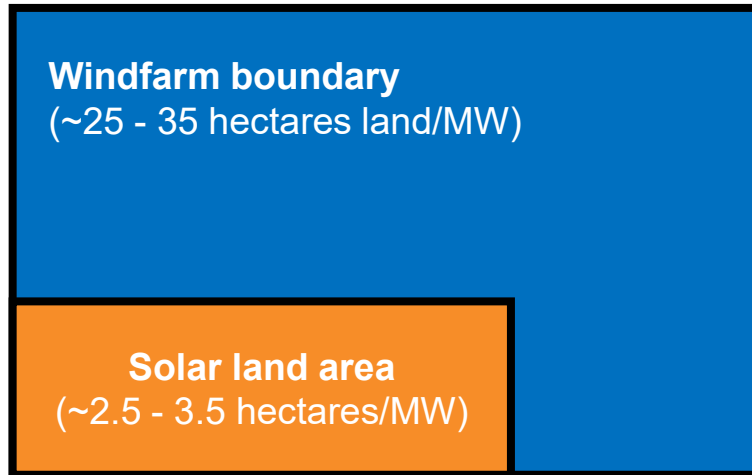
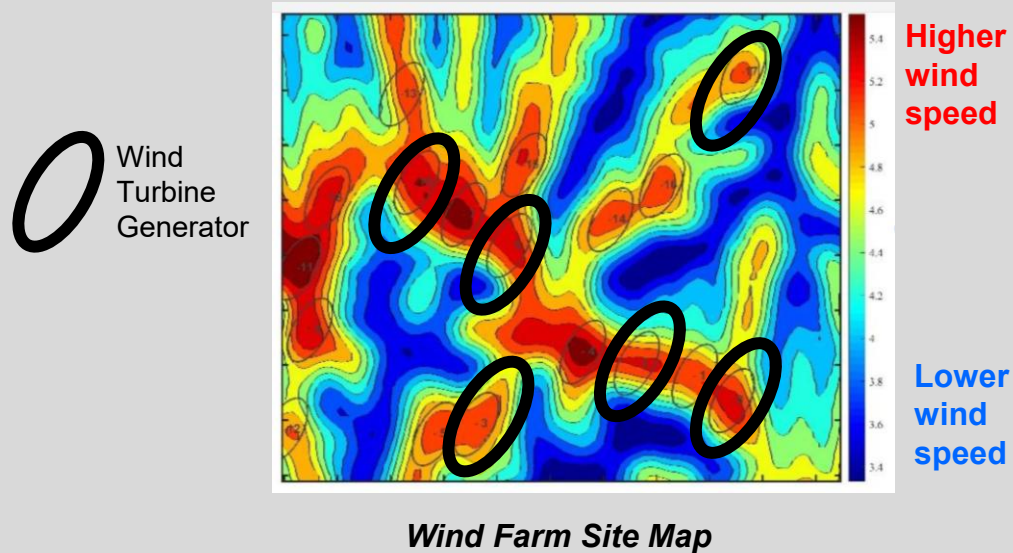
- Differences between wind and solar siting have been recognized in **Renewable Acceleration Areas (RAAs) designation by EU countries – technology specific**
- RAAs steer projects away from **sensitive areas** (and hopefully still allow them to access enough promising areas to get **economical projects** – wind resource, adequate scale of land)

Developing wind projects requires access to as much land as possible to optimize wind turbine layout and reduce cost/MWh.

Optimizing Wind Site Output (MWh)

Developers optimize a site by:

- Testing ~50-100 combinations of **turbine locations**, models, and hub heights to **best capture** the wind
- Balancing **wake effects** (turbines too close together) with **road/cabling costs** (turbines too far apart)



- **5-10x more land** per MW is “needed” for wind vs solar
- For a 100 MW Capacity Project
 - **Wind:** 25-30 Wind Turbines (WTGs) over 3,000 hectares
 - **Solar:** Rows of solar panels over 300 hectares
- **> 90% of the current land use** within windfarm “boundaries” can continue (crops or grazing animals)

2. Mapping Studies of Ukraine

Windfarm compatibility with agricultural use in Ukraine



Ukrainian Wind Energy Association at the “10th International Forum of Agrarian Innovations” (June 2026):

“Business opportunities for selling **surplus electricity** on the wholesale market, creating **local “energy islands”** for neighboring communities, and providing power system **flexibility** services to the Transmission System Operator (TSO).”

[Wind Energy Development in the Agricultural Sector in the Focus of the “Nove Zernyatko 2026” Forum - UWEA](#)

Land Studies in Ukraine cover Regional to Local Scales

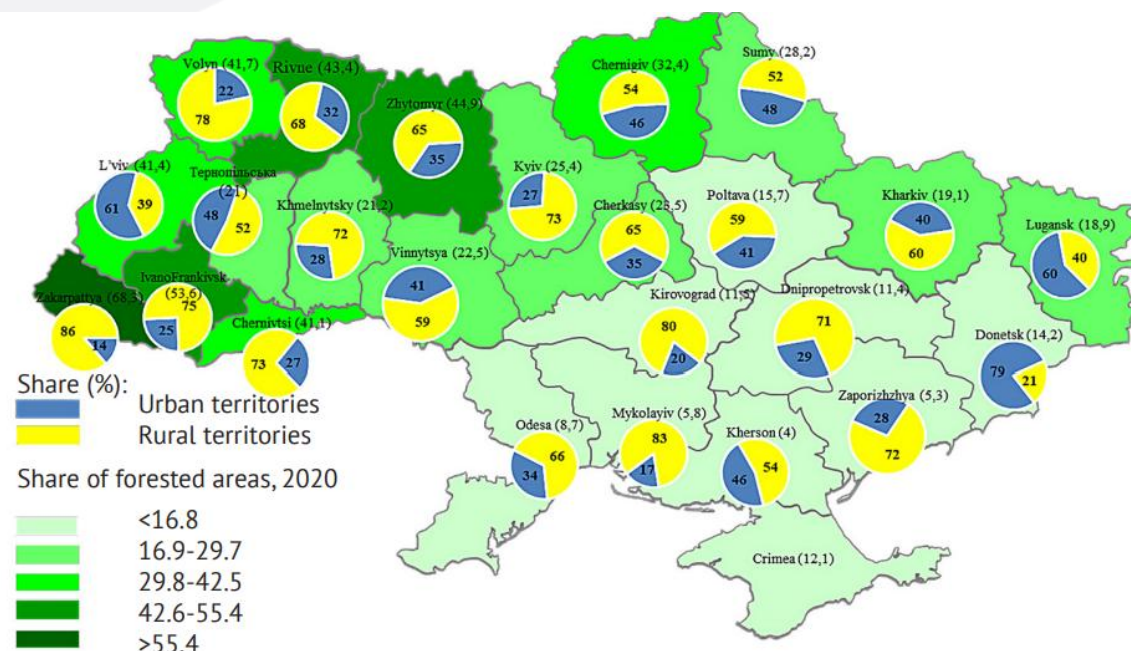
Regional Scale – for strategic planning, consider **overall availability** of suitable RE land types by oblast, for example:

Rural areas (68% of Ukraine) vs **urban areas** (32% of Ukraine)

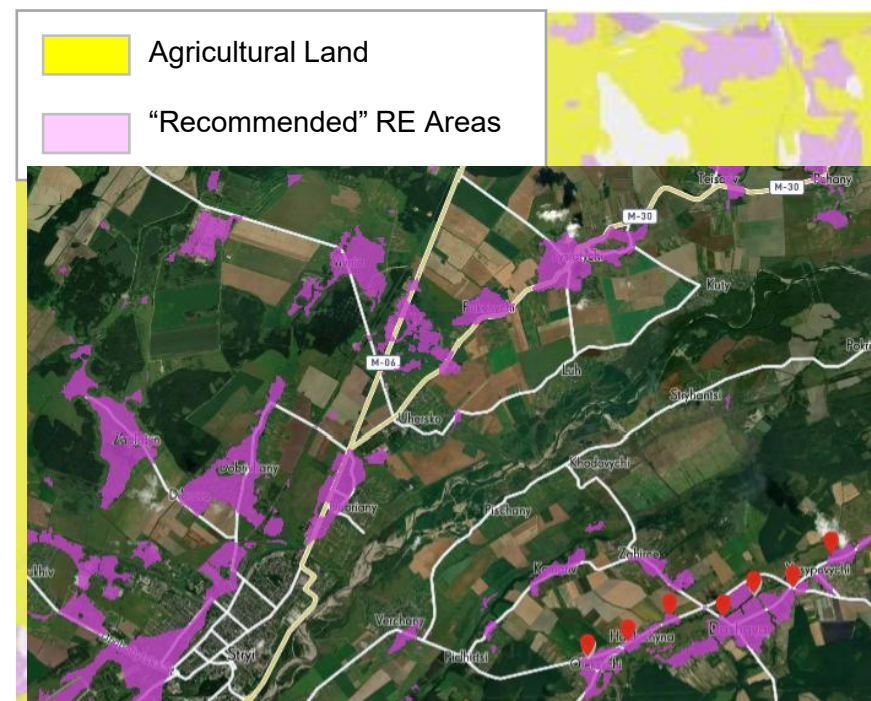
A 2020 study found that 70% of rural areas are cultivated, while 30% of urban areas are cultivated across Ukraine

Local Scale – for detailed planning, consider how **connected** or **fragmented** the patches of suitable RE land are, for example:

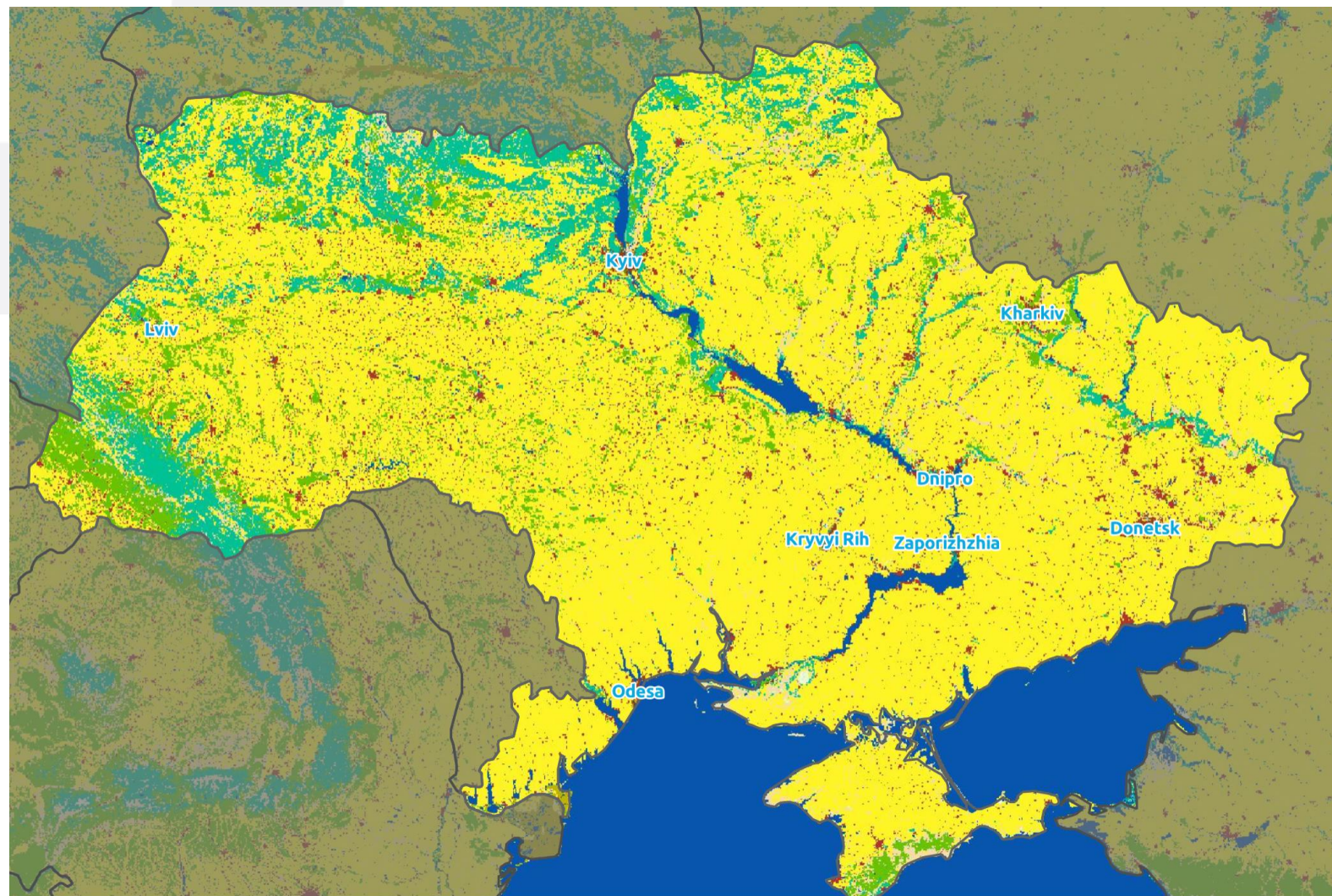
Excluding agricultural land from allowable RE siting can result in locally fragmented available sites (shown below in **pink**), which could discourage RE project investors



Analysis of Rural Areas of Ukraine on the Basis of ESA WorldCover 2020



Unofficial Data on Agricultural Lands: Satellite-Based Estimates



European Space Agency Climate Change Initiative - Land Cover 2018

- Mostly Cropland
- Grassland, Scrub, or Shrub
- Artificial Surface or Urban Area
- Surface Water
- Mostly Deciduous Forest
- Mostly Needleleaf/Evergreen Forest

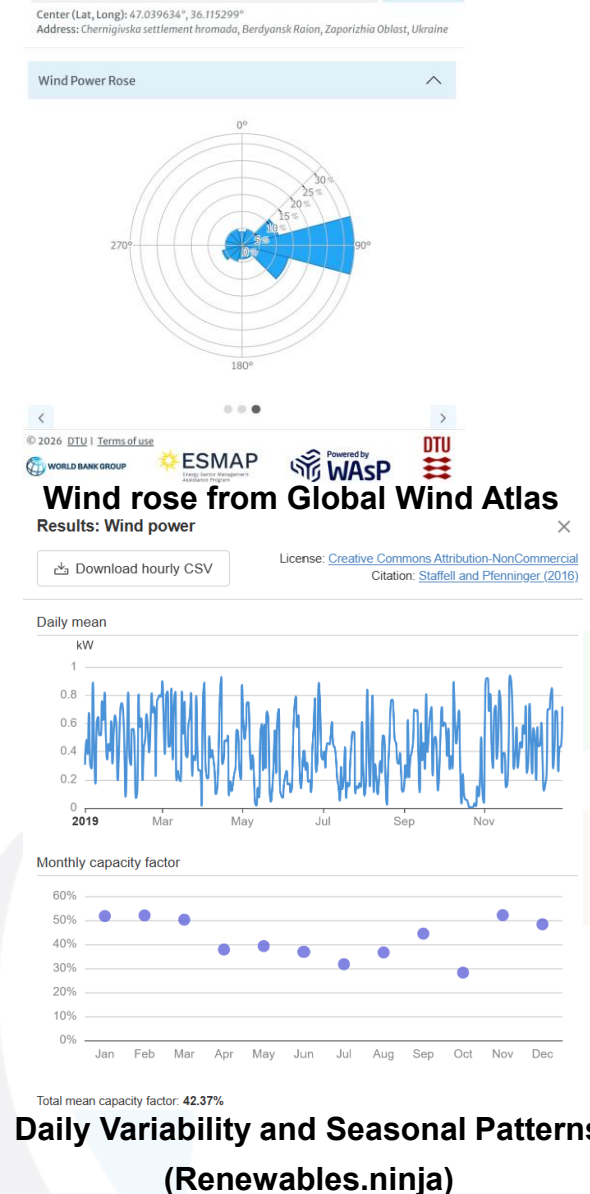
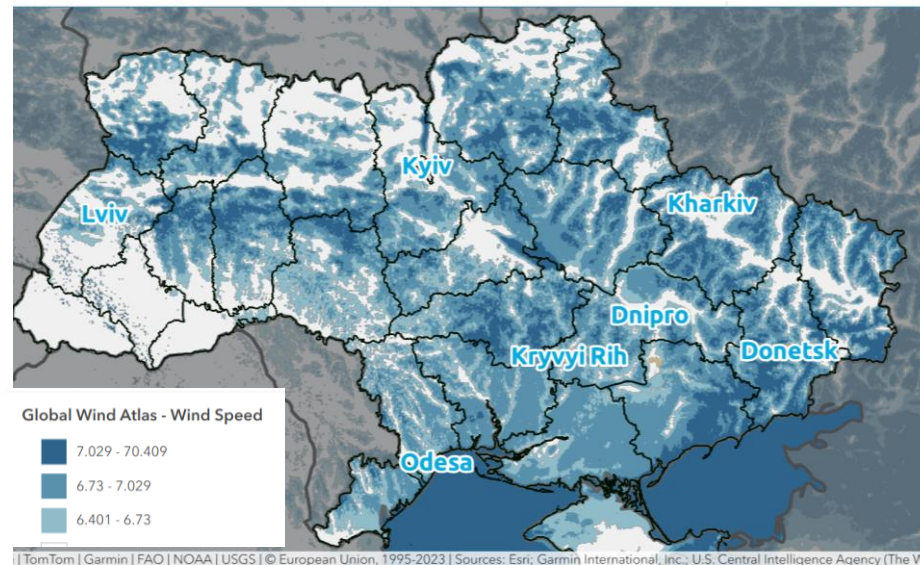
Source: [ESA WorldCover 2020](#)

AAA | USGS | © European Union, 1995-2023 | Sources: Esri; Garmin International, Inc.; U.S. Central Intelligence Agency (The World Factbook); National Geographic Society

Mapping & Characterizing Wind Resource

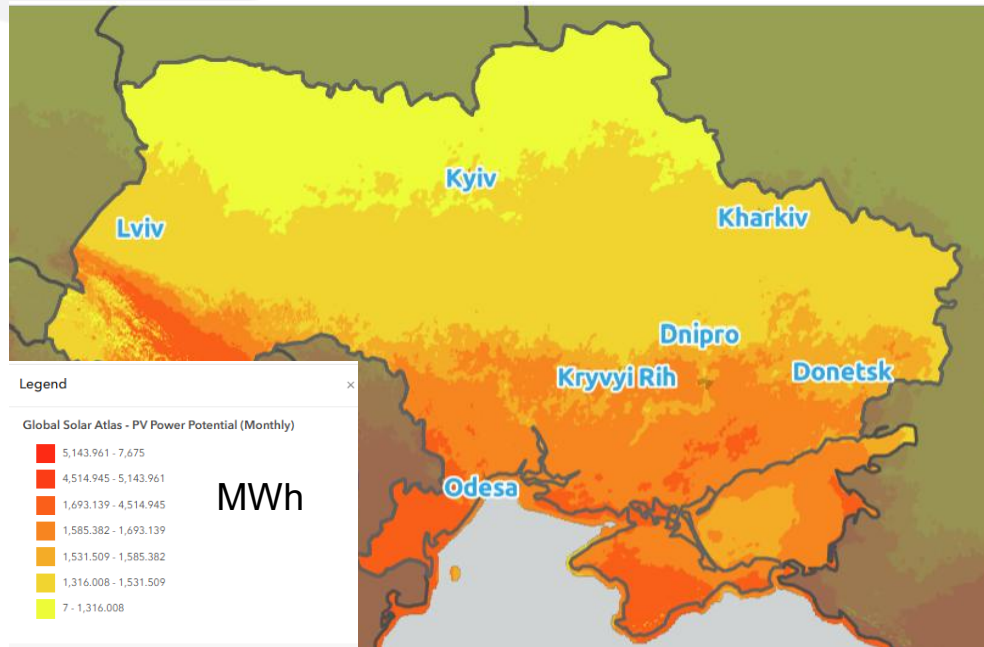
- Global Wind Atlas - Indicative resource levels – tells you where to install wind resource monitors (not bankable data)
 - At 100 m hub height, 10% windiest areas – annual average wind speed of **7.2 m/s**
 - If possible to site wind turbines on accessible ridge top with slightly higher wind (**7.5 m/s**), energy output would increase ~13%
- Consideration of RAAs and suitable land types should reflect viable wind resource,
 - E.g., Portugal focusing RAAs for wind in the north
- **Multi-year measurements on potential project sites** still typically required to characterize wind resource at different heights, shear, variability, and seasonal patterns (on schedule critical path)

Annual Average
Wind Speed
(Global Wind
Atlas, 100 m hub
height)



Solar Resource

- Onsite resource measurements for solar are often required but a shorter time series (at least 1 year) is often adequate, **less urgent**
- Informs project design, battery sizing and operation mode



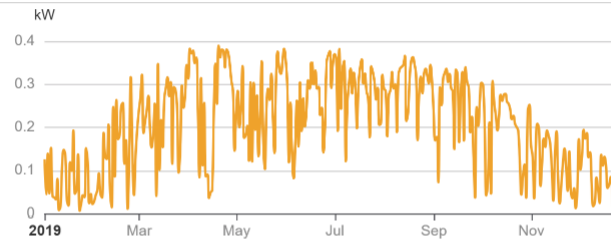
Annual PV Power Potential from Global Solar Atlas

Results: Solar photovoltaic power (PV)

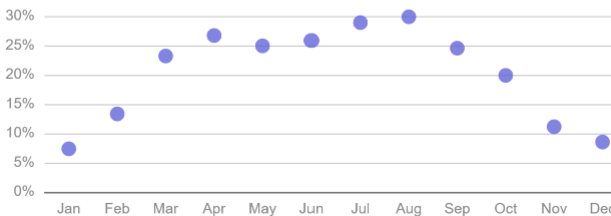
Download hourly CSV

License: [Creative Commons Attribution-NonCommercial](#)
Citation: [Pfenninger and Staffell \(2016\)](#)

Daily mean

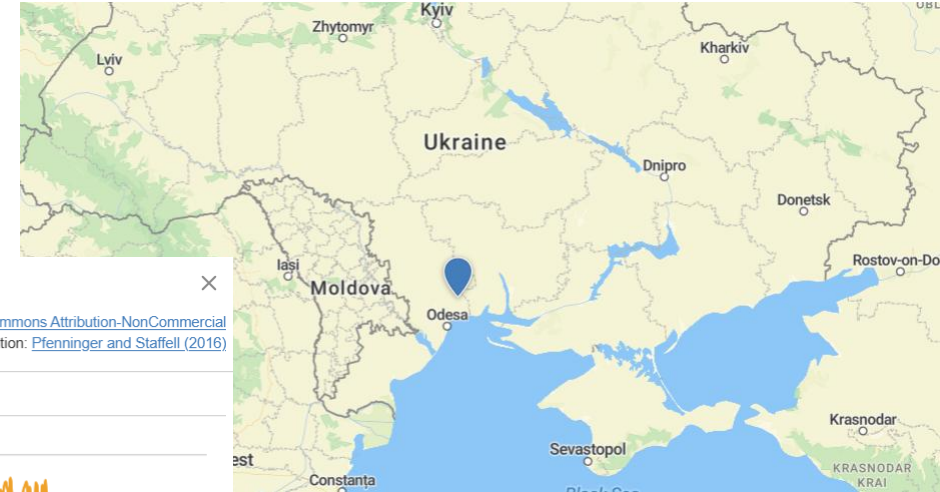


Monthly capacity factor



Total mean capacity factor: 20.40%

Seasonal patterns from Renewables.ninja



Source: Vortex, 2019 Analysis for World Bank

3. Trade-offs and Considerations

Trade-offs between agriculture and energy mainly apply for solar



For wind, dual use with agriculture is the norm.

The status of the agricultural land (degraded or productive) is less important for wind siting.



For solar, there is a trade-off between uses. Solar PV brings new possibilities for shaded crops and sheep grazing for vegetation management.

Prioritizing degraded agricultural land over productive land for solar siting makes sense.

Wind Optimization and Dual Land Use with Agriculture



Hybrid Wind + Solar (+Storage) – Portugal, Finland, US



Big River Renewable Energy

Gilliam County, Oregon

Installed capacity: 500 MW Wind & Solar + 500 MW Energy Storage

Commercial operation: 2030

Homes powered: 193,000 Oregon homes¹



Big River Renewable Energy is a proposed wind, solar, and energy storage project in northern Gilliam County.

US: Planned 500 MW wind farm, 500 MW solar farm + BESS



Finland: 350 MW, 49-turbine Puutionsaari wind farm, 100 MWp solar farm



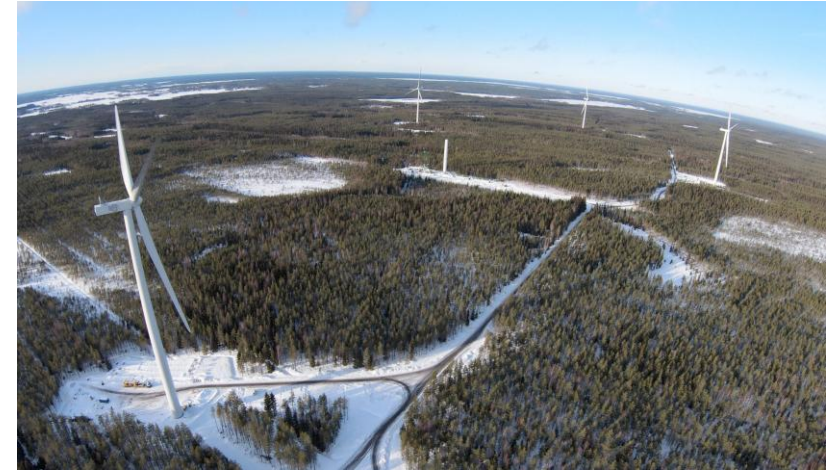
US: Operational Hybrid Helena Wind and Sparta Solar Co-Located Project (Orsted)

[OR Big River Fact Sheet.pdf](#)

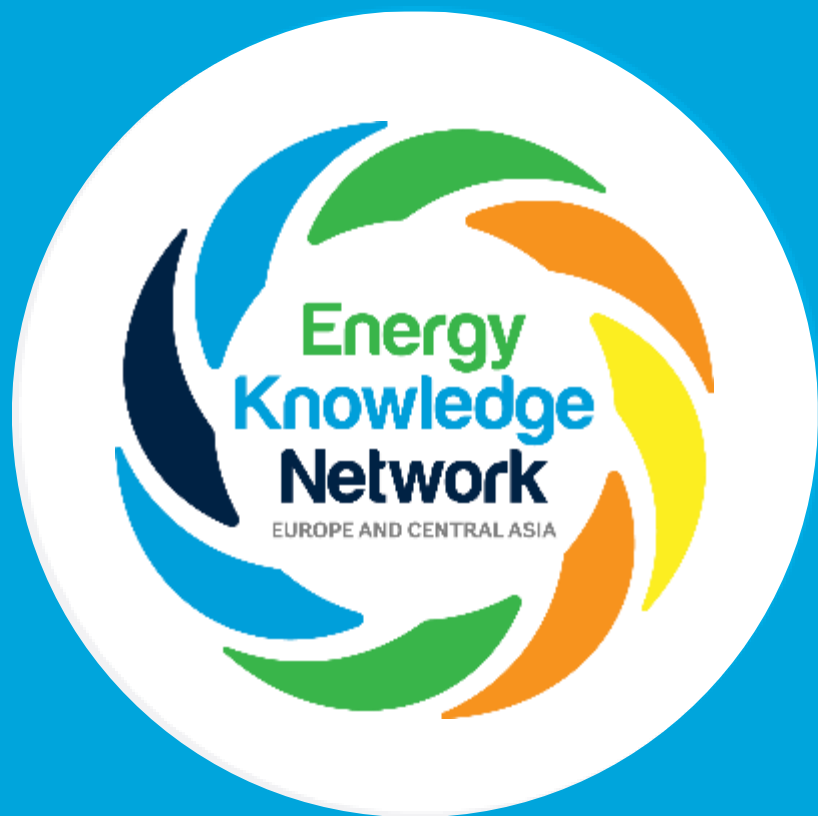
[One of the largest projects of its kind in Europe: VSB Finland begins implementation of 450 MW hybrid project | VSB Group](#)

Takeaways

- Developer flexibility for land access (within limits) de-risks projects and reduces energy costs – consider for designation of RAAs
 - Resolving siting issues and **starting multi-year wind resource measurement campaigns** on potential utility scale sites could enable faster project development
- Agricultural and Degraded Agricultural Lands
 - Solar farms could be limited to degraded agricultural lands
 - Wind farms can co-exist with productive or degraded agricultural land.
 - Requiring reclassification of land type increases risk for project developers
- Datasets
 - Quantifying the benefits of allowing RE projects on Degraded Agricultural Lands requires quality recent datasets
 - Cross-checking with areas of greatest need and available transmission capacity would inform a cost-benefit analysis



[Credit: Ilmatar Finland](#)



THANK YOU

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