# Potential of agrivoltaics in the Central-Eastern Europe

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# What is agri-PV?

Agri-PV combines agriculture with solar electricity generation, enhancing crop quality and yield, optimizing land use, and providing bill savings or additional revenues for farmers.

**Improved microclimate conditions**
Shade and temperature regulation, frost protection

**Optimised water usage and efficient irrigation**
Reduced evaporation and soil moisture retention

**Protection from extreme weather events**
Shielding crops from strong winds, hail and excessive rainfall

**Reduced pest and disease pressure**
Supports integrated pest management strategies

**Clean electricity**
For farmers' self-consumption or additional revenues

# The case for agri-PV

01

Agri-PV can increase crop yields by up to **16%**. Land is used more **efficiently** thanks to combined electricity and food production.

02

Central Europe countries could deploy **39 GW** of agri-PV above shade benefitting crops. Vertical solar panels between cereals can add **141 GW**.

03

Central Europe could produce **191 TWh** of clean power from agri-PV, almost tripling the current renewable electricity generation (73 TWh).

# The case for agri-PV

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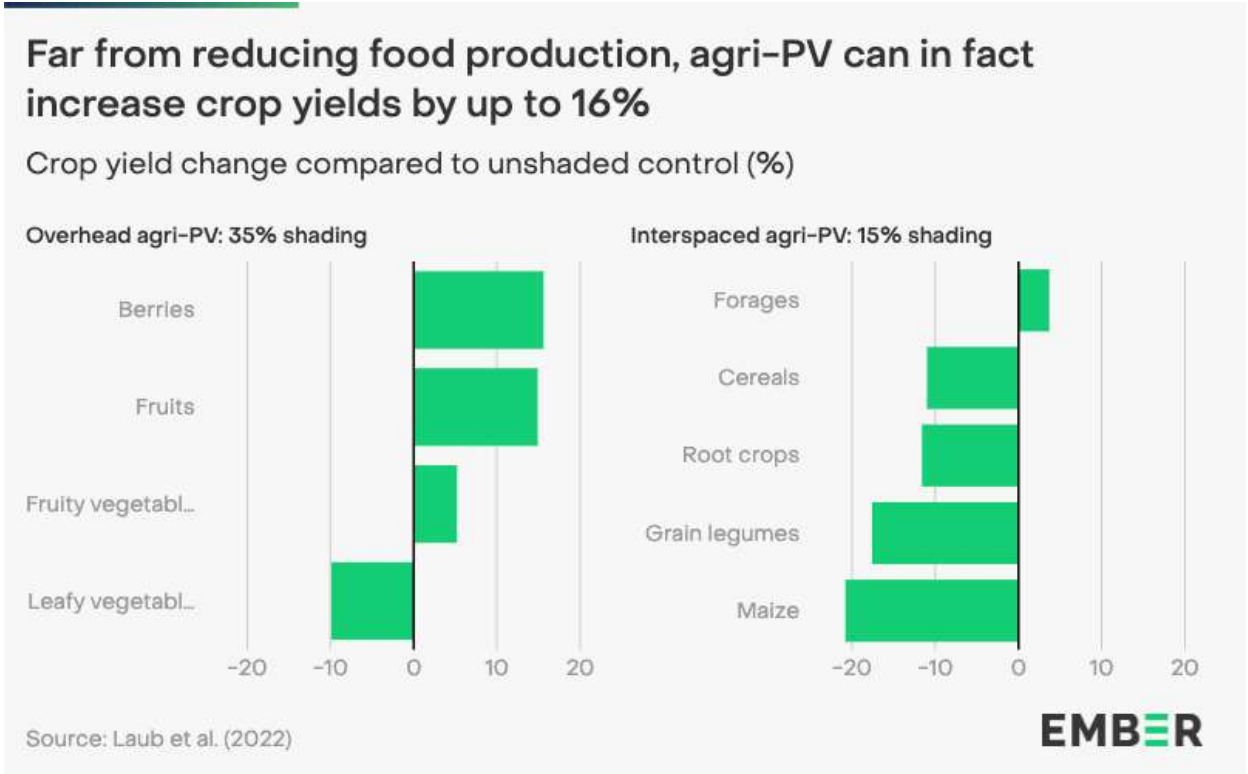


Based on a metastudy of 613 papers.

# Interspaced agri-PV

25% solar + 83–113% crops = 108–123% total land use efficiency

Suitable for...

- **Root vegetables** — Carrots, radishes, beets, turnips
- **Cereals** — Wheat, oat, barley
- **Forages** — Grasses

# Overhead agri-PV

63% solar + 90–116% crops = 153–178% total land use efficiency

Suitable for...

- **Fruits** — Apples, apricots, grapes
- **Leafy greens** — Lettuce, spinach, kale, arugula
- **Fruity vegetables** — Cucumbers, peppers, tomatoes
- **Berries** — Strawberries, raspberries

# The case for agri-PV

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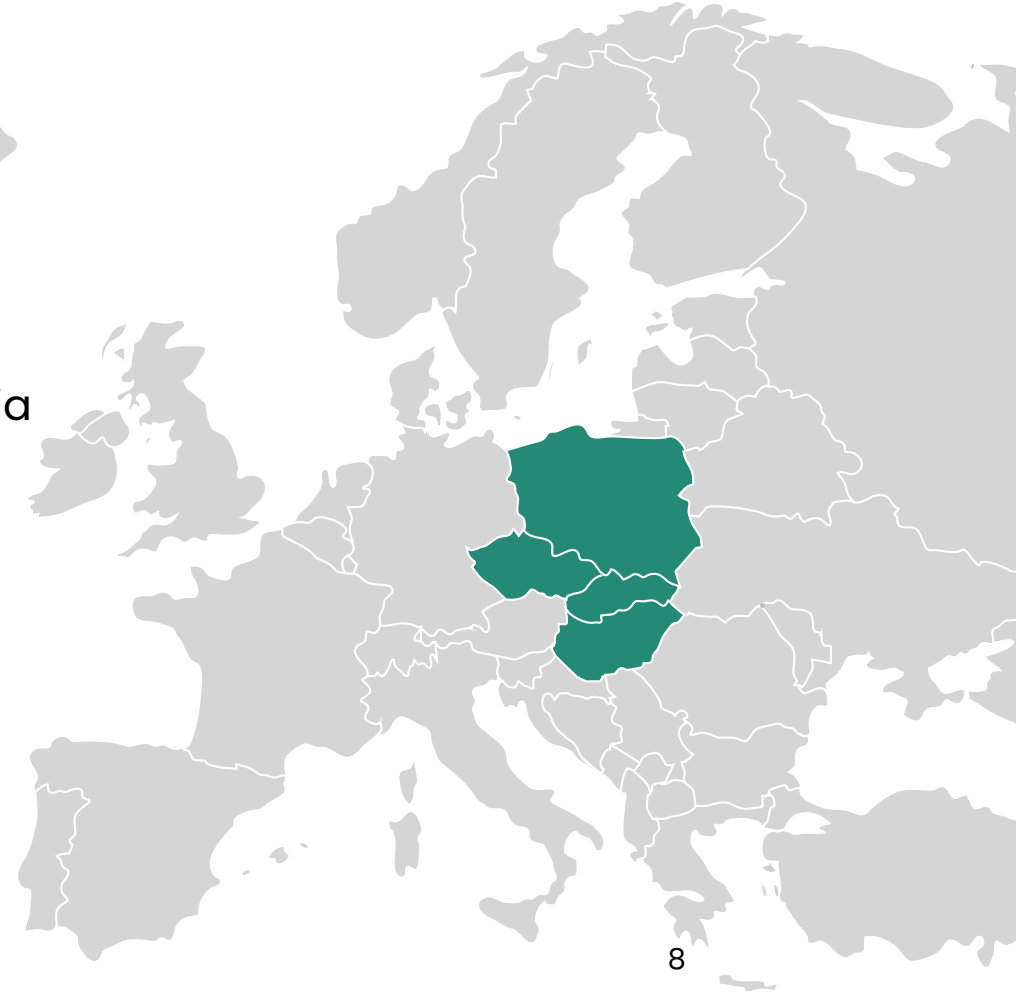
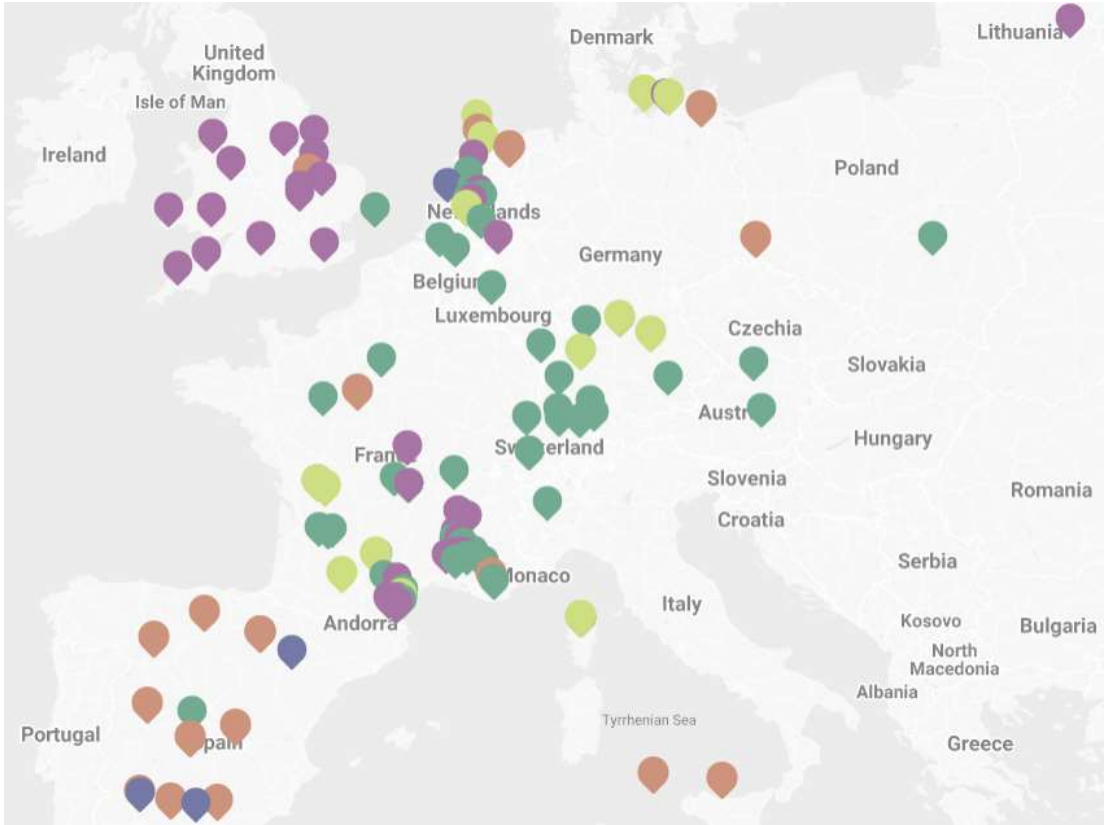
# Visegrad group

- ➔ Czechia, Hungary, Poland Slovakia
- ➔ 19 % of the EU’s arable land
- ➔ 20% of wheat
- ➔ 29% of oats
- ➔ 37% of rye
- ➔ 57% of berries



Agrisolar plants across Europe

map by SolarPower Europe



# Arable land occupies 30-40% of all area in V4 countries



This opens up vast potential for agri-PV


Source: Ember

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# But not all arable land can be used for agri-PV

Buffer zones around roads, power lines or settlements are necessary


Source: Ember

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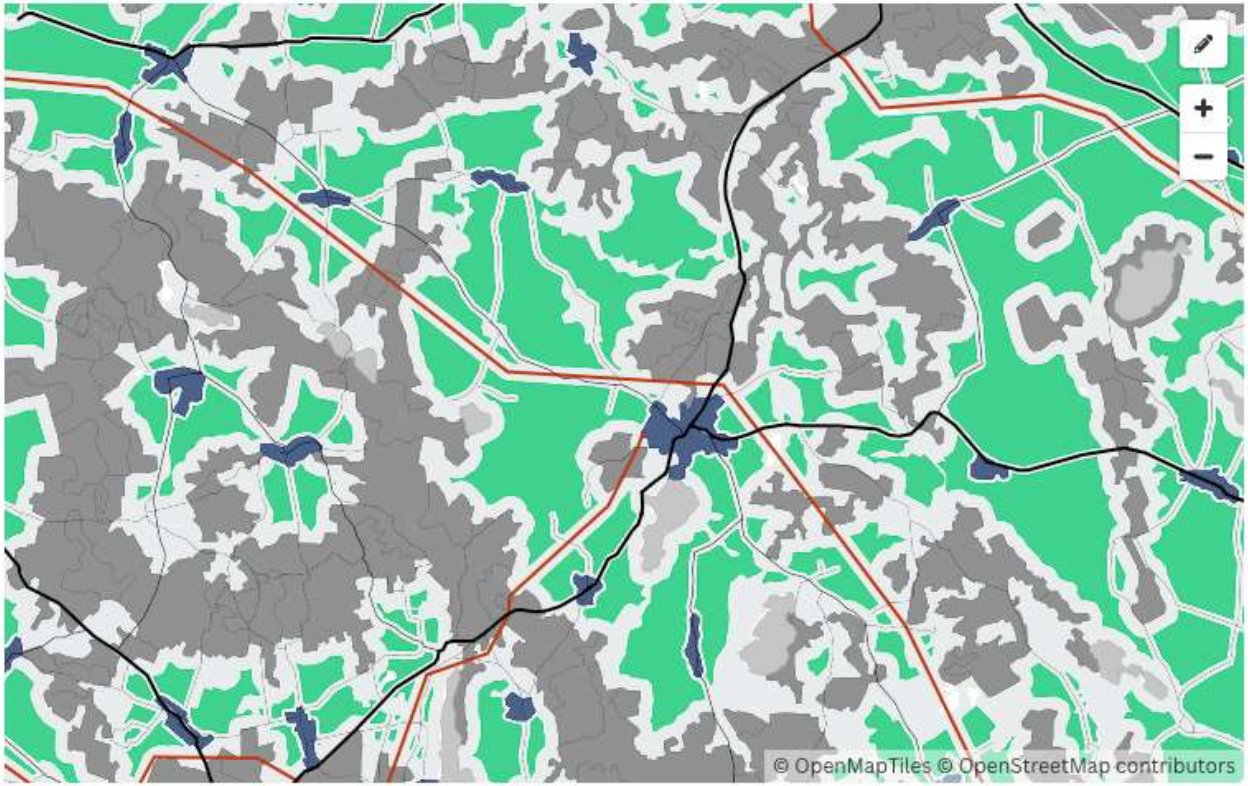
## Further exclusions are related to forests or water



Buffer zones for these span between 300m and 1000m




Source: Ember

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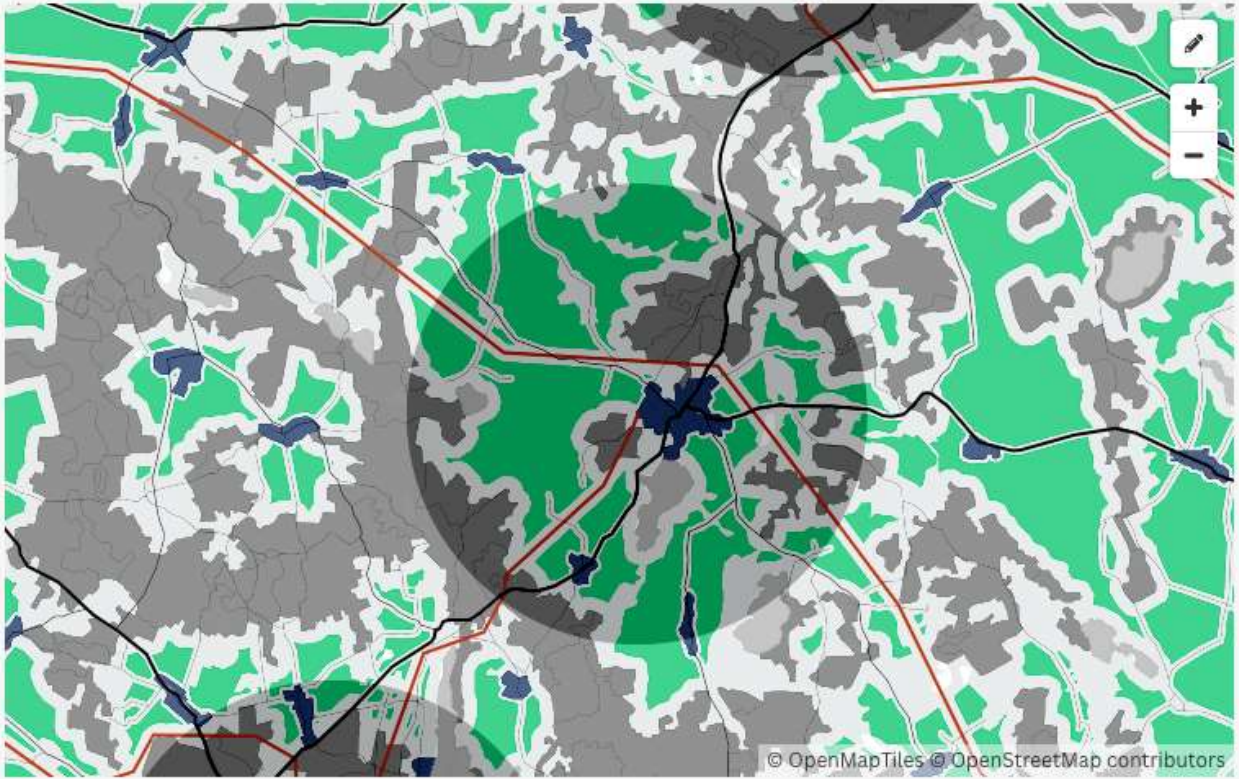
# A key factor is the proximity of grid connection



Most attractive land is close to connection points - substations




Source: Ember

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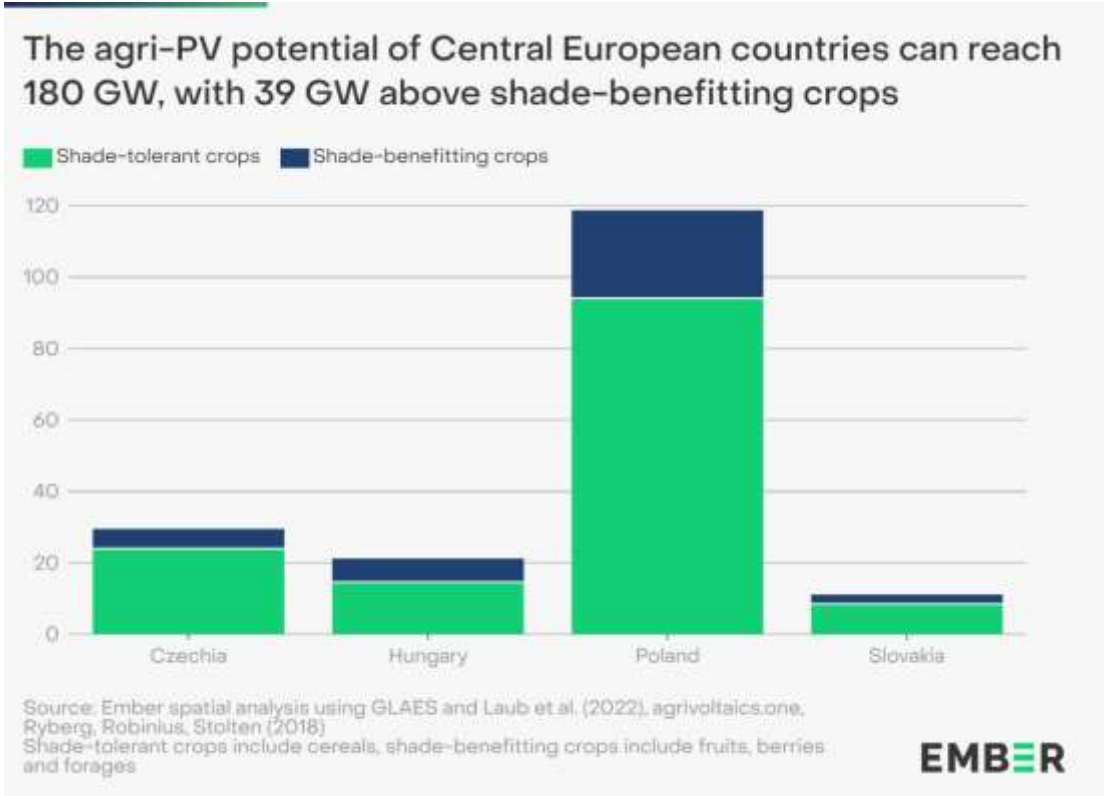


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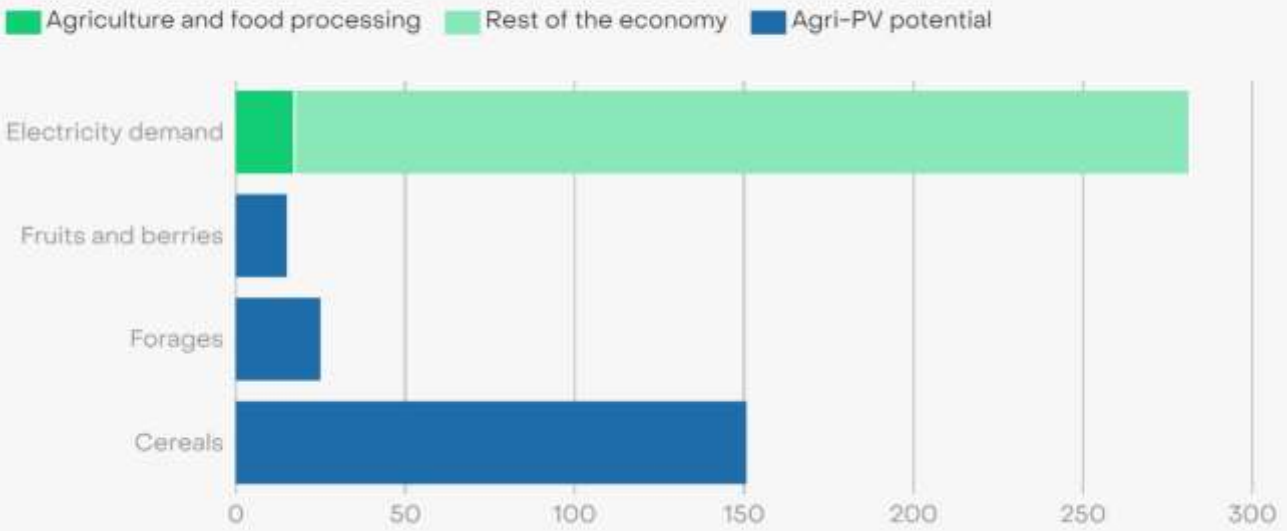
# The case for agri-PV

03

Central Europe could produce **191 TWh** of clean power from agri-PV, almost tripling the current renewable electricity generation (73 TWh).

## Using just 9% of agri-PV potential is enough to cover the power demand of farming in Central Europe

Electricity demand and agri-PV generation potential in Czechia, Hungary, Poland and Slovakia (TWh)




Source: Ember spatial analysis using GLAES and atlite: Hofmann, Hampp, Neumann, Brown, Hörsch (2021), Ryberg, Robinius, Stolten (2018), Eurostat

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# Legislation as the key

- No EU-wide definition
- Agricultural land needs to remain eligible for agricultural subsidies
- Efficient spatial planning
- Simplification of permitting and grid connection procedures

| Country | Definition | Reference |
|---|---|---|
| France | Photovoltaic installations compatible with the exercise of an agricultural activity. An installation will only be recognised as agrivoltaic if it offers at least one of services: improvement of agronomic potential and impact, adaptation to climate change, protection against climatic hazards, improvement of animal welfare. | Decree No. 2024-318 |
| Germany | Agri-PV is a multifunctional land use configuration on one and the same agricultural land area where solar power generation is integrated into an agricultural activity. | DIN SPEC 91434 , DLR |
| Italy | Agrivoltaic system - adopts solutions aimed at preserving the continuity of agricultural and pastoral farming activities, on installation site. Advanced agrivoltaic system - innovative integrative solutions with the assembly of the PV (with rotation and monitoring systems). | Official guidelines |
| Netherlands | No legal definition but municipalities allow the projects that can serve as the protection for the crops. As long as the area for the agricultural function does not change, the installation of solar panels has no consequences for agricultural rights. | JRC |
| Czechia | Agrivoltaics is "building for agriculture" – possibility to place on "agricultural areas" in zoning plans. | Regulation 334/1992 Call |
| Slovakia | no legal definition or official guidelines | |
| Poland | no legal definition or official guidelines | |
| Hungary | no legal definition or official guidelines | |

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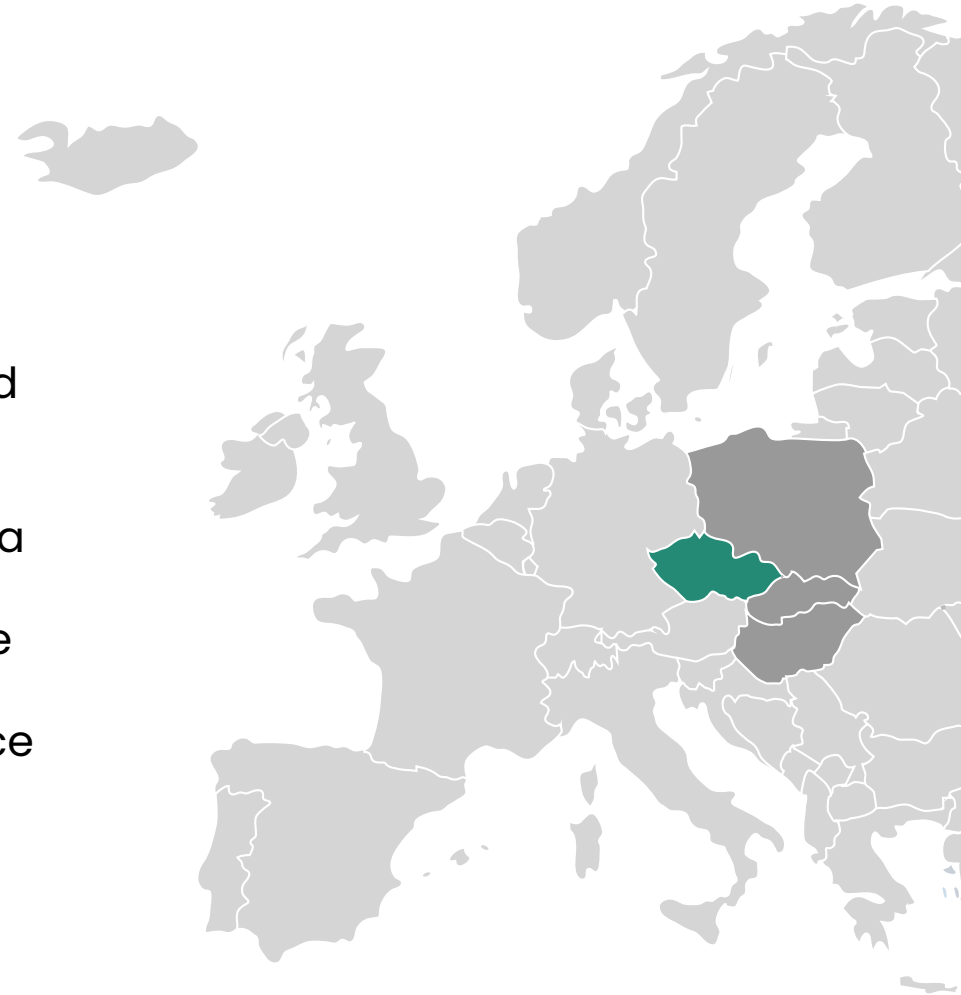
# The Czech approach

- ➔ Building on agricultural legislation
- ➔ Amendment to the Agricultural Land Fund Protection Act
- ➔ No need to change the land designation and the zoning plan of a given area
- ➔ Agrivoltaics is always in compliance with “character of the area”
- ➔ No more than 10% of the total surface
- ➔ No minimum yield requirement



# Current state of the legislation

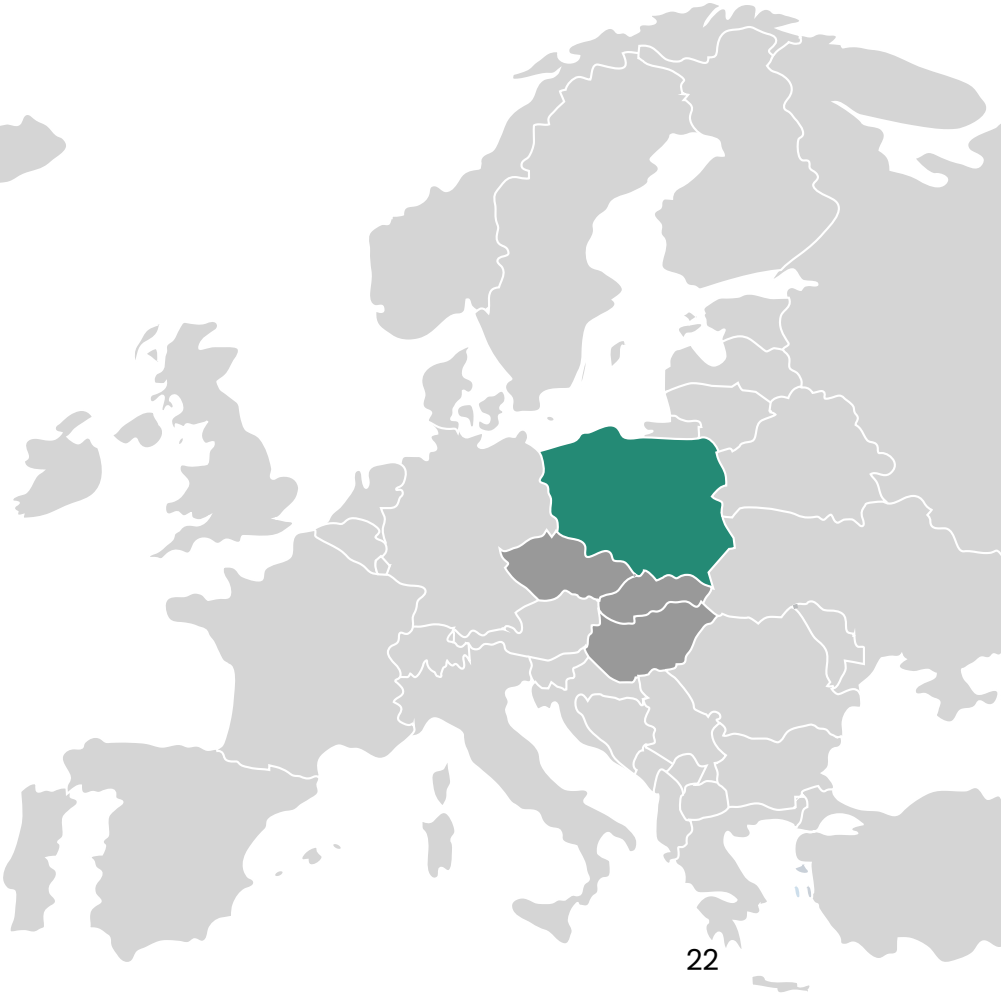
- Excludes vertical systems
- Allowed only in orchards, hopyards and vineyards
- Secondary regulation being prepared

| Capacity (GW) | Arable land | | | | Fruits and berries | Pastures | Shade benefit (Fruits and berries + pastures) | Shade tolerance (Arable land) | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Barley | Oats | Rye | | | | | |
| **Czechia** | 15.9 | 6.5 | 0.9 | 0.6 | 1.1 | 4.3 | 5.5 | 24.0 | 29.5 |
| **Hungary** | 10.9 | 3.0 | 0.3 | 0.4 | 3.4 | 3.3 | 6.6 | 14.6 | 21.2 |
| **Poland** | 44.8 | 12.7 | 18.5 | 18.1 | 11.4 | 13.3 | 24.6 | 94.1 | 118.8 |
| **Slovakia** | 5.9 | 2.2 | 0.2 | 0.2 | 0.2 | 2.4 | 2.6 | 8.5 | 11.1 |
| | | | | | | | | | |
| **Total** | 77.5 | 24.4 | 20.0 | 19.3 | 16.1 | 23.3 | 39 | 141 | 180 |

- Cutting the potential agri-PV capacity by 96%
- Missing out on 21 TWh of clean electricity

# Polish case study

- ➔ traditional wheat production estimated to be generating net losses in 2024
- ➔ annual revenues from 1 hectare of agri-PV can be **12 to 15 times higher** (€20k to €26k) than from wheat crops alone (€1,7k)
- ➔ an annual profit of €1268 per hectare is possible from combined electricity and wheat sales
- ➔ depending on the electricity price (average 2023 auction price)



# Who's next?

- Czechia as a regional lead
- Pilot projects in Poland
- Other technologies also ready

But:

- Legislative changes needed
- Supportive policy framework needed

# Thank you!

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