Agrivoltaics

Technology, Regulations, News

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FACULTY OF ELECTRICAL ENGINEERING CTU IN PRAGUE

CZECH SOLAR ASSOCIATION
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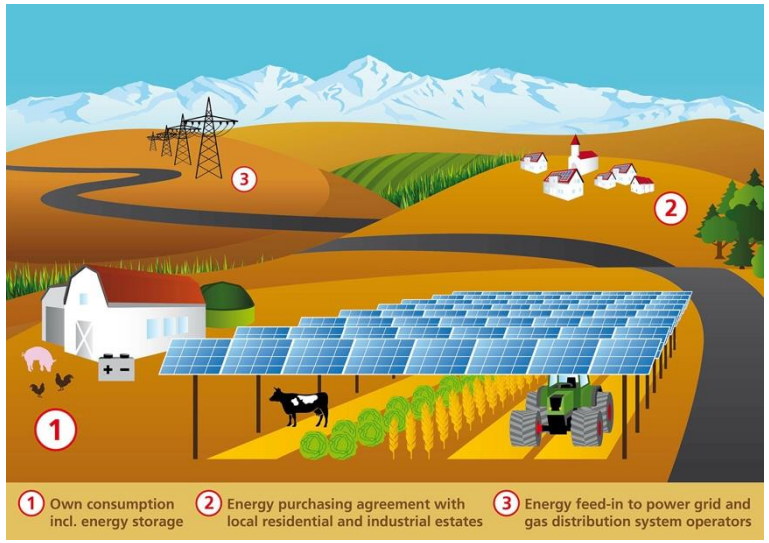
Outline

1. Background – solar sector
2. Introduction to agrivoltaic systems
3. Pilot projects in Europe
4. CZ x AT (energy, electricity mix, …)
5. Regulation for agrivoltaics in Czechia



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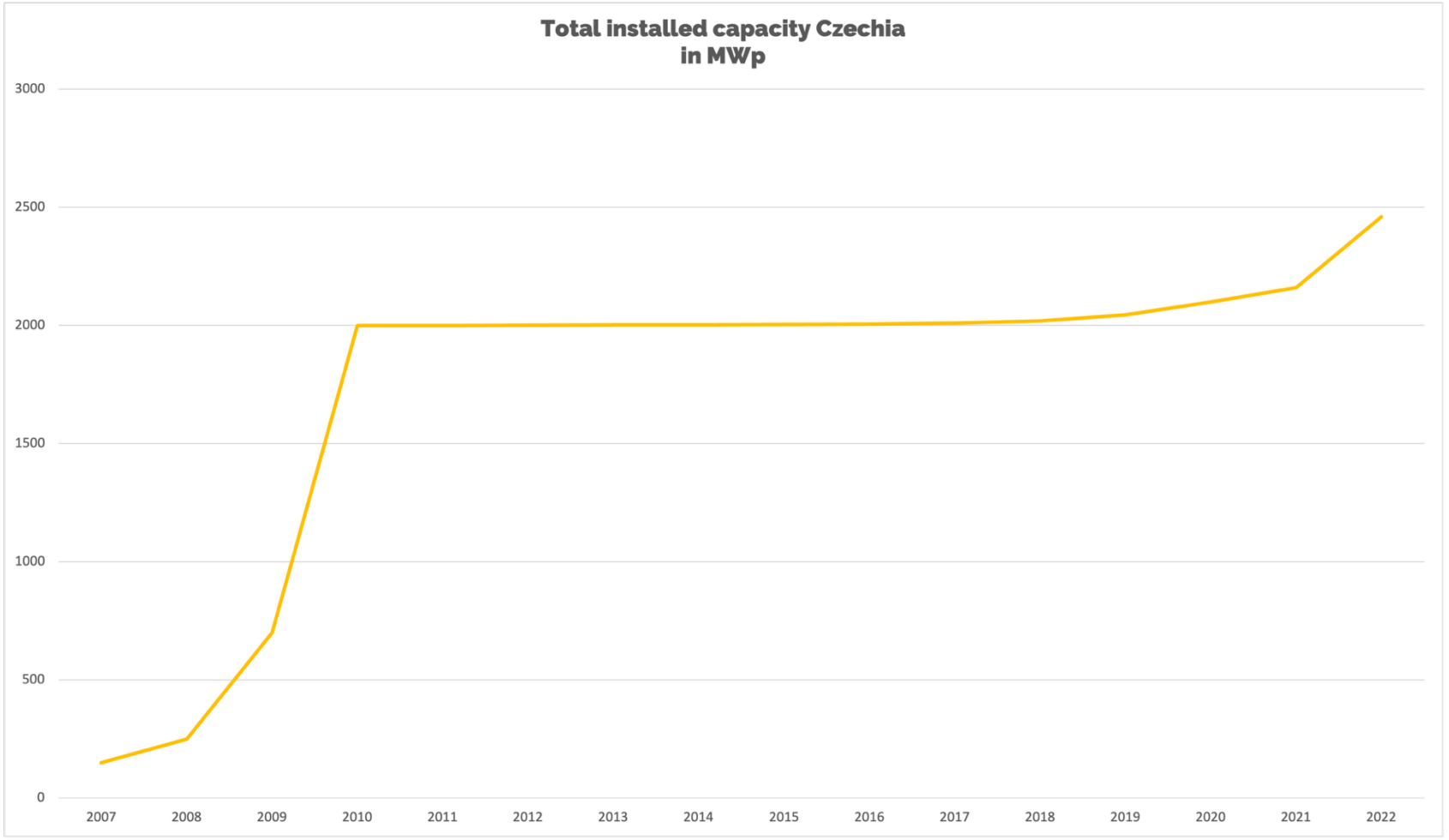
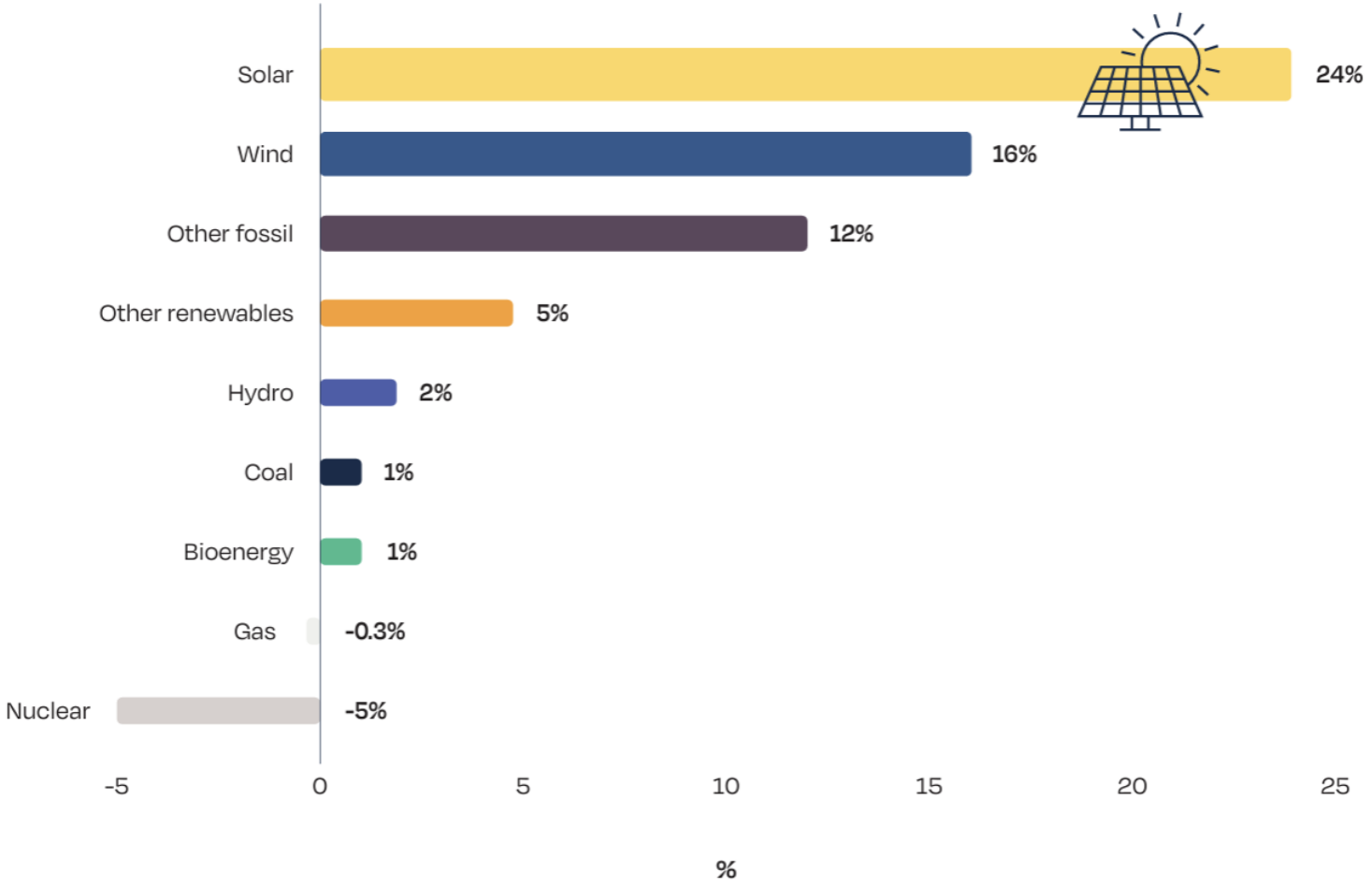

Total installed capacity Czechia
in MWp
3000
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

Background

FIGURE 3 ELECTRICITY GENERATION GROWTH RATE FROM 2021 TO 2022, BY TECHNOLOGY



SOURCE: Ember (2023).

Background


Legend
Watt/capita in 2022
(Watt/capita) in 2021
Australia
1ST
1,191 (1,048) Watt/capita
Netherlands
2ND
1,029 (801) Watt/capita
Germany
3RD
815 (727) Watt/capita
Denmark
4TH
713(424) Watt/capita
Japan
5TH
677 (621) Watt/capita
Belgium
6TH
667 (585) Watt/capita
Estonia
7TH
601 (404) Watt/capita
Spain
8TH
572 (400) Watt/capita
Switzerland
9TH
535 (422) Watt/capita
Greece
10TH
531 (397) Watt/capita
114 (27) Watt/capita

Types of agrivoltaic systems

- The main division of agrivoltaic installations is in vertical and horizontal forms
- Mainly are used bifacial photovoltaic panels
- Horizontal agrivoltaic system – south oriented panels or east-west “roofs” oriented with panels – protection role
- Vertical agrivoltaic system – east-west oriented “fences” – less then 10 % of land for technology

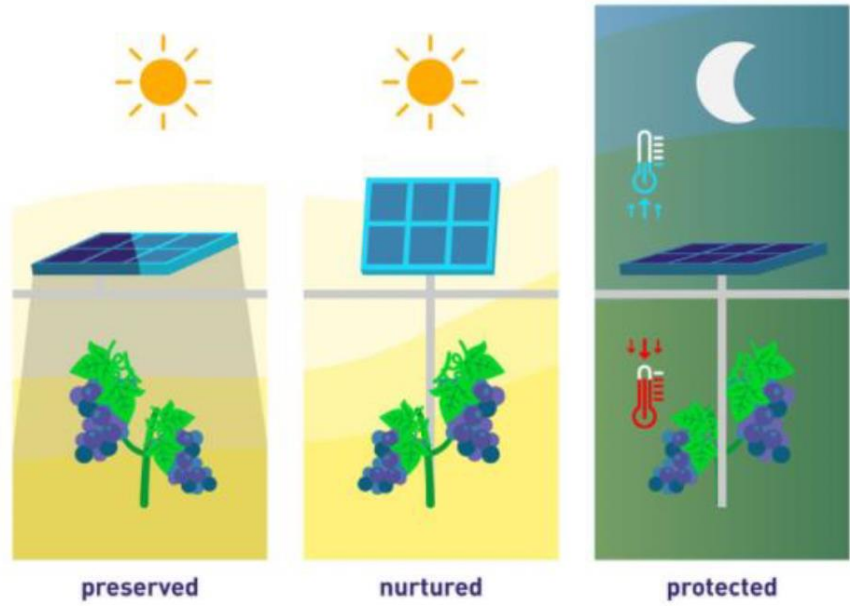
Multiple benefits of agrivoltaic system

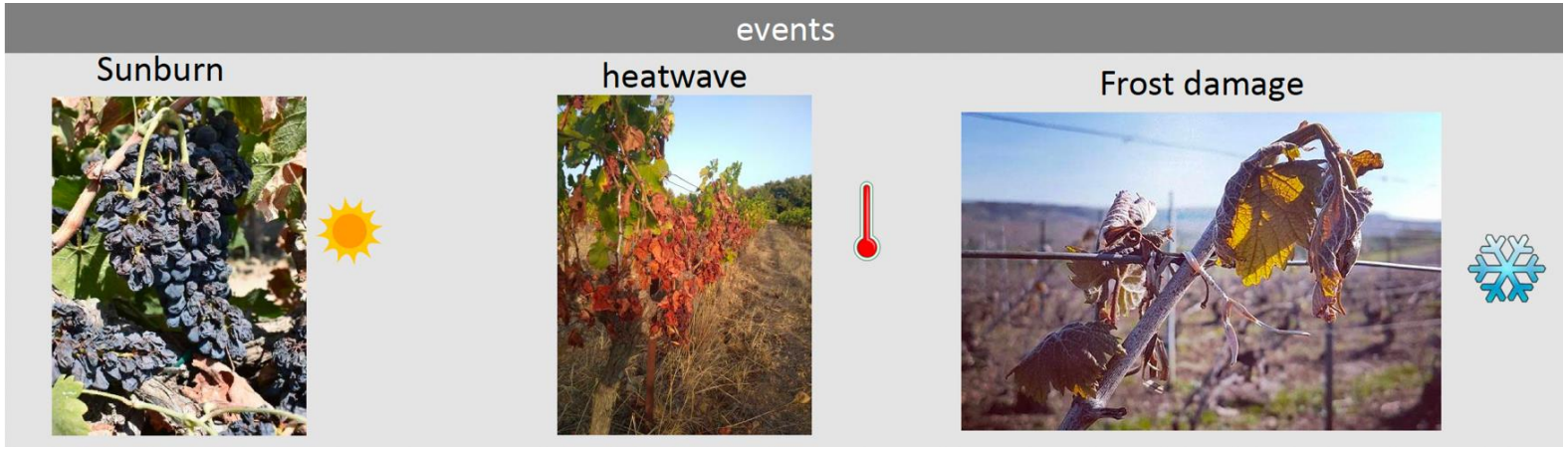
- Technical – e.g. distributed electricity production
- Economic - decrease electricity costs and bring additional economic profit/savings for farmers
- Social - sector development and local employment increase
- Environmental - agrivoltaics systems produce “green” electricity, improve soil conditions,

  improve conditions for planting crops

Production protection

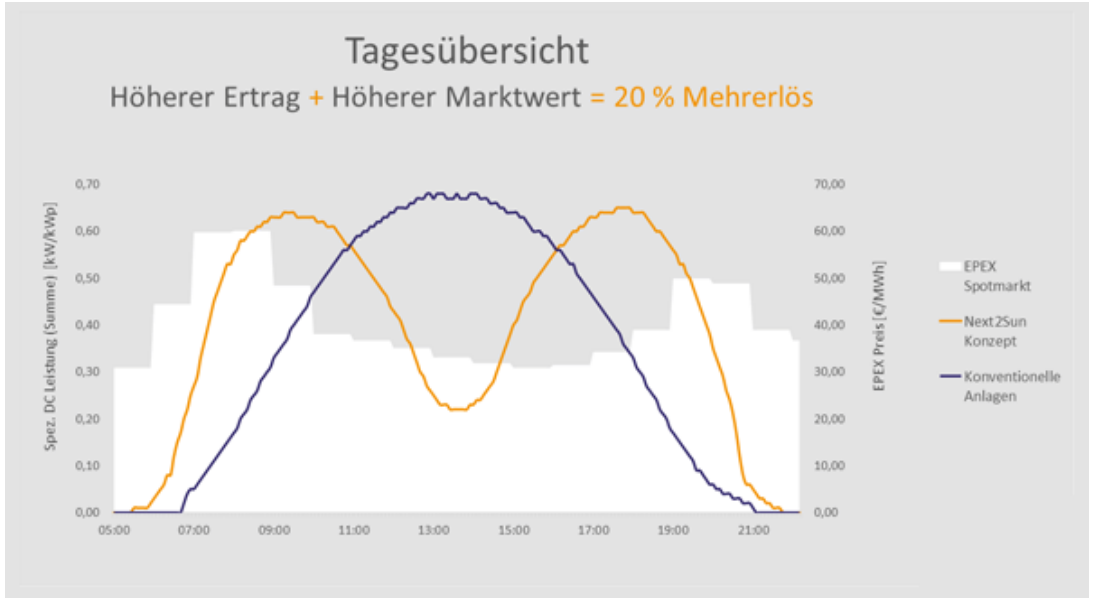
- Physical protection of fruit from heavy rain/hail
- Reducing the pressure of fungal diseases
- Protection against damage from strong direct sunlight
- Protection against spring frosts and high temperatures
- Differences between fixed structures and structures with a tracker





Agrivoltaics – technical aspects

- It depends on the orientation of the panels
- Land slope -> selection of appropriate technology
- A compromise between electricity production and ideal conditions for cultivated crops



Agrivoltaics in France

Sun'Agri

- Vineyards, orchards

Agrivoltaics in France

Agrivoltaics in Italy

- Corn, flax, alfalfa, vegetable
- https://www.youtube.com/watch?v=CTxudB8sYqg

- Shading 11 % → 50 %

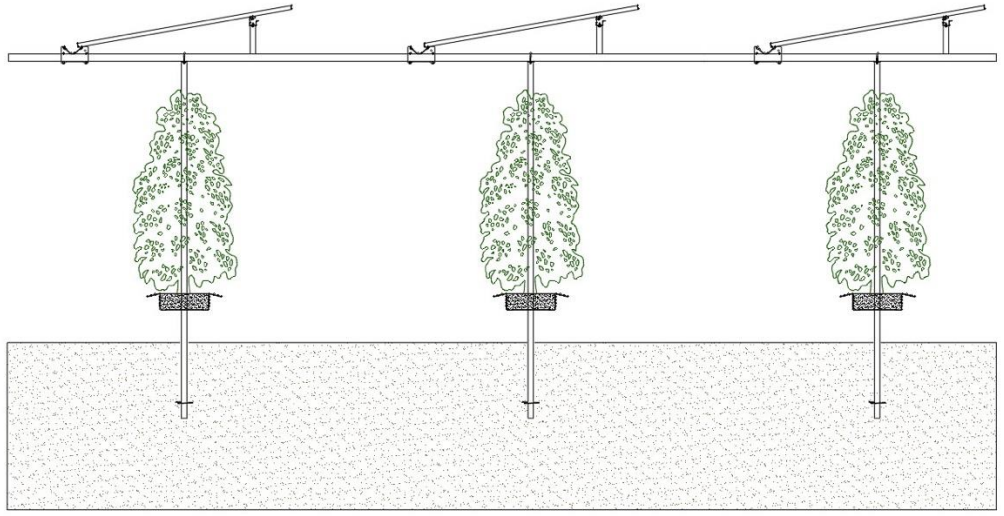
Agrivoltaics in Holland

- Blueberries, raspberries, strawberries, cherry, red currant

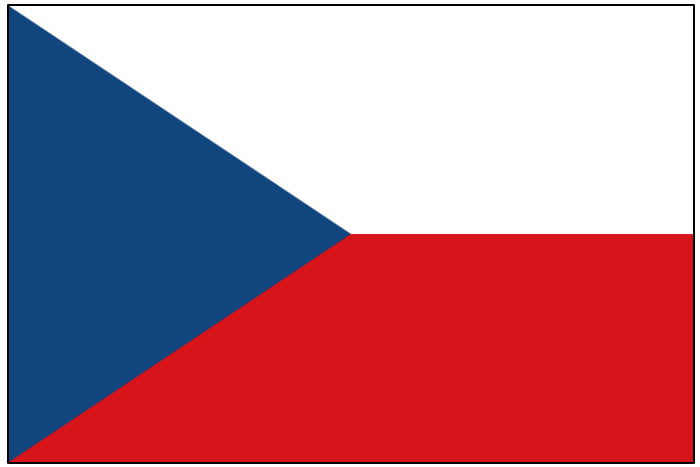
Agrivoltaics in Holland

Holland – GreenMeteor technical solution

- Irrigation and rainwater retention - a solution from the Green Meteor company - manufactures structures for fruit growing, also solves irrigation systems
  - Water use – retention capacity or direct drainage to plants at current rainfall



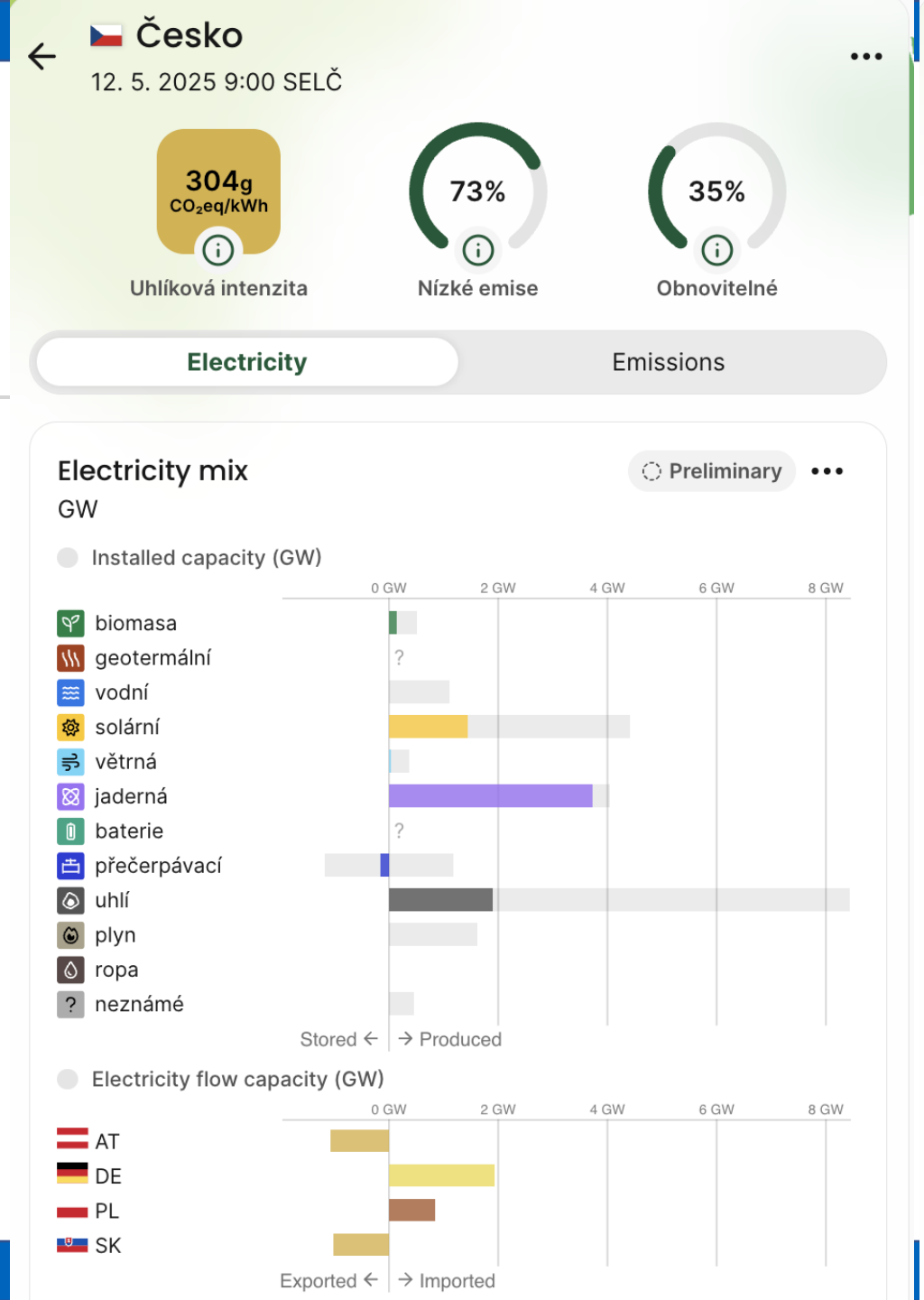
Czechia vs. Austria

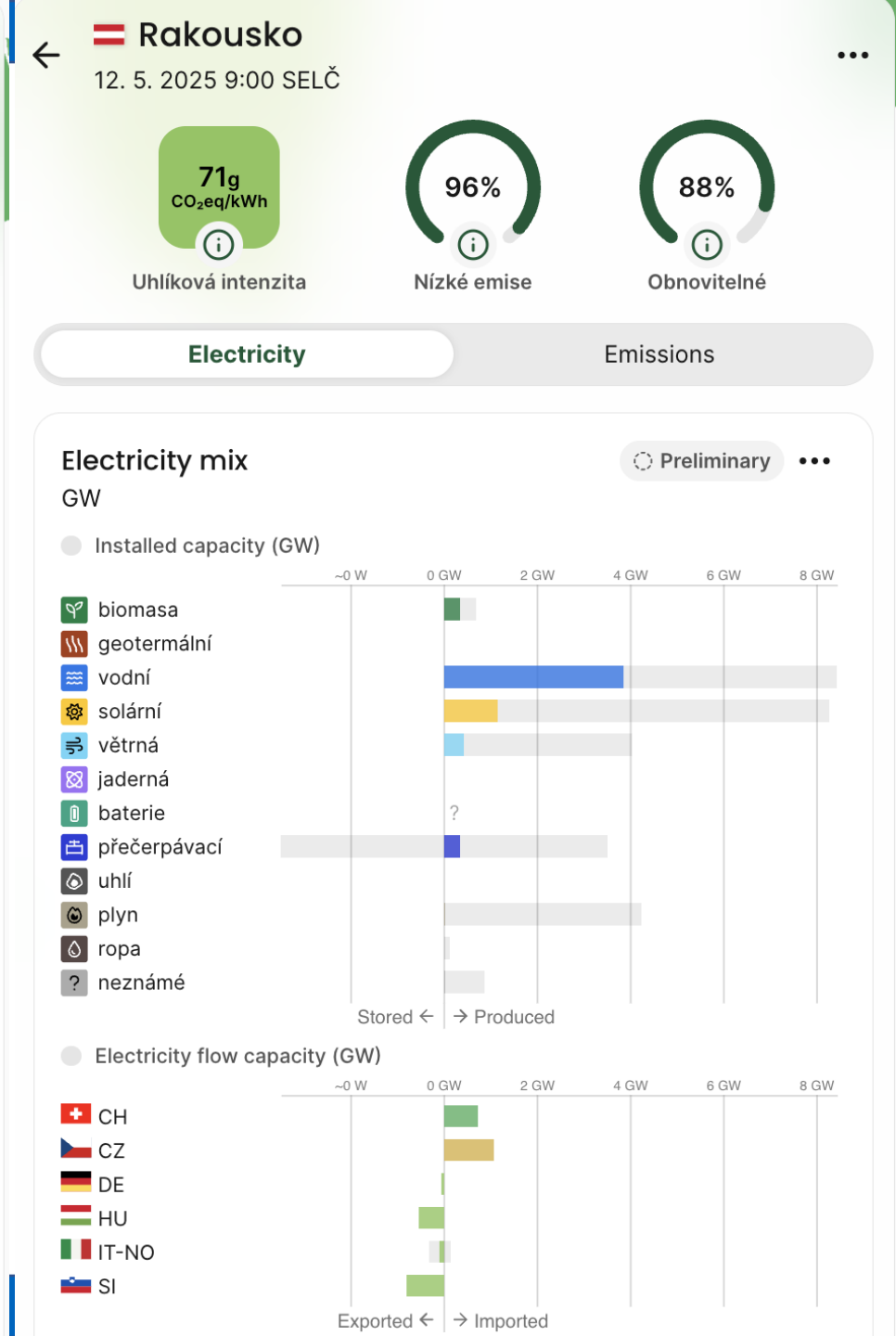


Electricity mix CZ x AT

- Installed capacity
- Actual production
- Import x Export

- 12. 5. 2025 09:00





Agrivoltaics in Austria

Agrivoltaics in Austria

- Grassland, conventional crops

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- Grassland, conventional crops

Agrivoltaics in Austria

- BOKU – university research project
- Wien Energie

Agrivoltaics in Austria – Styria 1 MW

Agrivoltaics in Austria – Salzburg 3 MW

Agrivoltaics in CZ – research project - VÚKOZ

- Agroforestry & conventional crops

Agrivoltaics in CZ – 06/2023

- The first commercial pilot project
- South Moravian region
- Wineyard
- 99 kWp installed power

Legislative framework for agrivoltaics

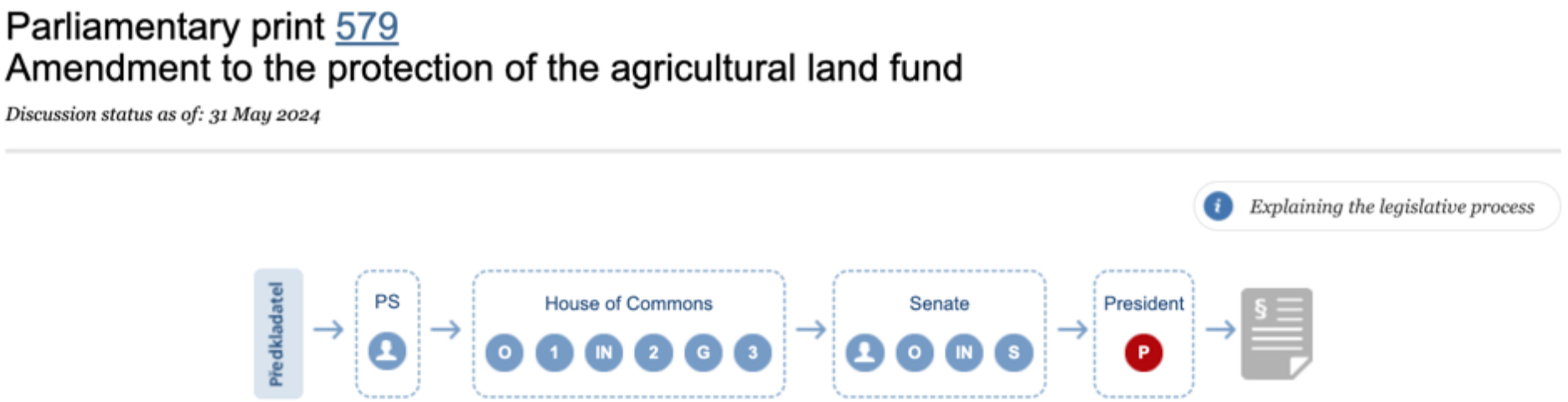
- The core of the concept is similar in all countries: it is a **combination of food production and renewable electricity production**
- A formal global definition doesn't exist till today
- Each country has a different legislative background → Problem to make one definition for all countries
- France tries to make a certification institution, and Germany makes Din Spec norm, Italy and Germany has financial support
- EU suggested member states to create specific regulations for each country

Timeline of agrivoltaics in CZ

- 02/2021 – First debate with Ministry of agriculture about agrivoltaics
- 03/2023 – Interdepartmental comment procedure on draft of regulation
- 11/2023 – 04/2024 – Legislative process in Czech Parliament
- 05/2024 – Regulation in the Czech Senate
- 06/2024 – Secondary regulation Interdepartmental comment procedure
- 07/2024 – Final regulation signed by the president

Czech agrivoltaics regulation

- 29. 5. 2024 Regulation 334/1992 Call. on protection of agricultural land fund(ALF)
- Secondary regulation will go to interdepartmental comment procedure



Regulation 334/1992 Call.

- Regulation 334/1992 Call. on protection of ALF
  → **§ 8a Agrivoltaics definition**

- Important facts:

  → **Removing area from the ALF will not be**
  → **No zoning plans changes – agrivoltaics is "building for agriculture" – possibility to place on "agricultural areas" in zoning plans**
  → **Agrivoltaics is always in compliance with "character of the area" – term from Building regulation**

4. In Article I, point 32, § 8a, paragraph 8 is added, which reads:

"(8) An agrovoltaic electricity production plant is also considered a building for agriculture according to another legal regulation6). The condition of permission for the plan of an agrovoltaic electricity production plant in an undeveloped area according to another legal regulation6) is not its compliance with the character of the area."

Second level regulation - Ordinance

→ Draft of secondary regulation

- **Defines agricultural cultures which will be allowed**
- **Defines the necessary technical equipment**
- **Defines other technical parameters of the agrovoltaic electricity production plant**

- **Very similar to german DIN SPEC – 2,1 m clear height for horizontal systems, aproximatelly 6 metres minimal distance between vertical rows**

Allowed agricultural cultures

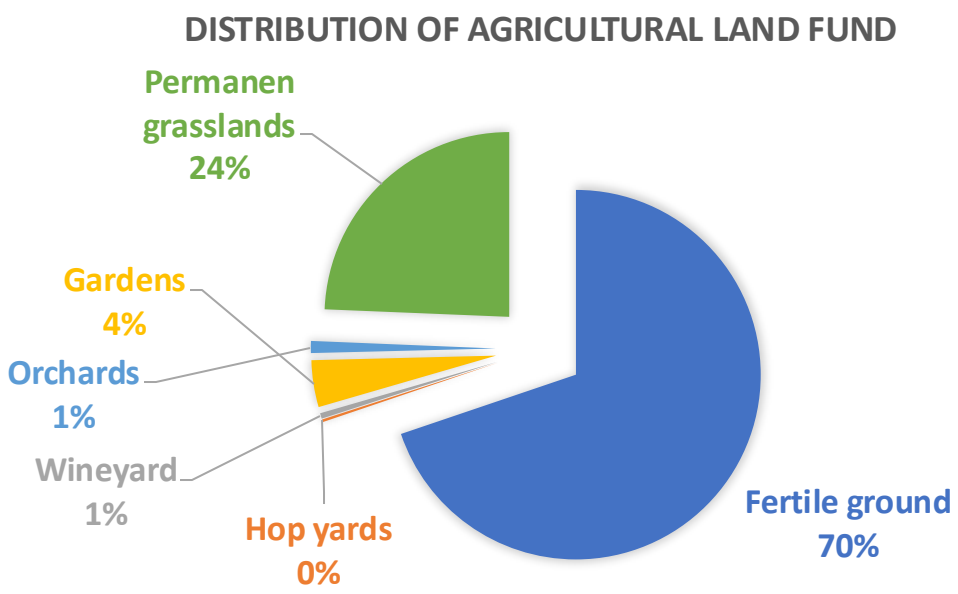
→ The cultures themselves are defined in Government Regulation No. 307/2014 Coll., on determining the details of land use records according to user relationships.

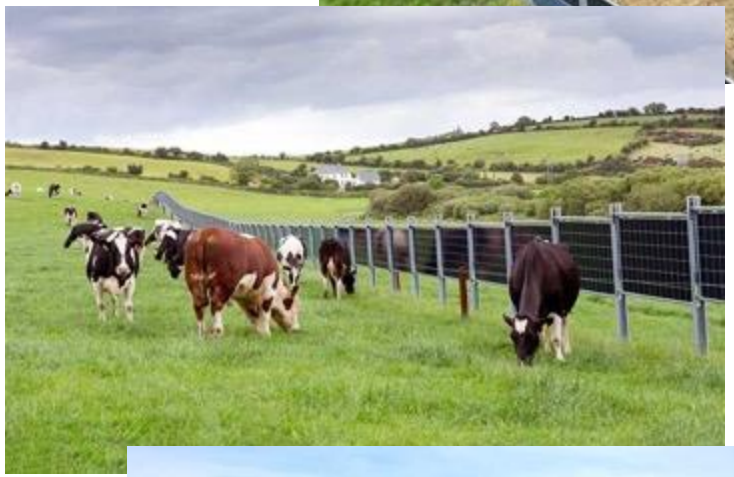
§ 3e Wineyards 15,443.66 ha
§ 3f Hopyards 5,234.79 ha
§ 3g Orchards 12,755.64 ha
§ 3h Tree nursery 2 135.54 ha
§ 3o Crops in containers 97.08 ha




Opportunities/Barriers

- Permanent cultures– less than 3 % ALF
  Permanen grasslands– 24 % ALF
  Fertile ground– 70 % ALF





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Suggestions/Conclusions

→ Different diagrams of production
→ **Impact on price**

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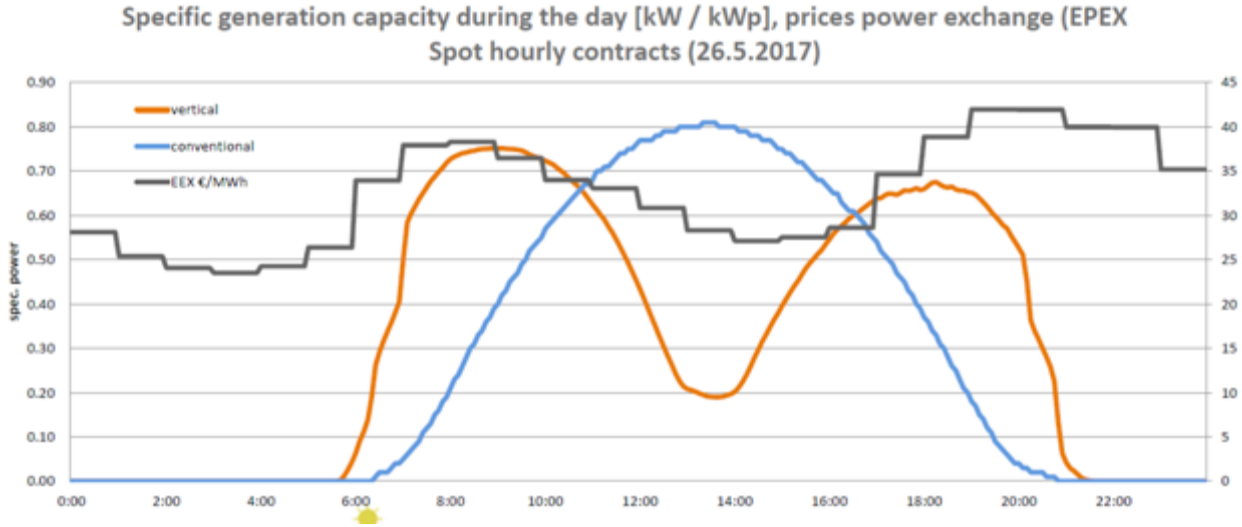
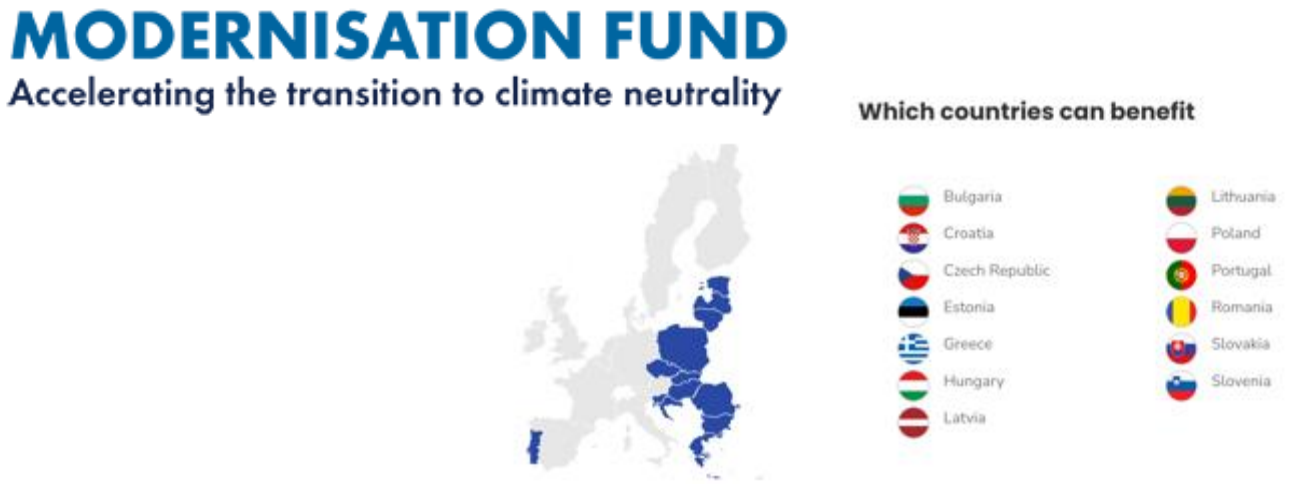


- 32 EUR

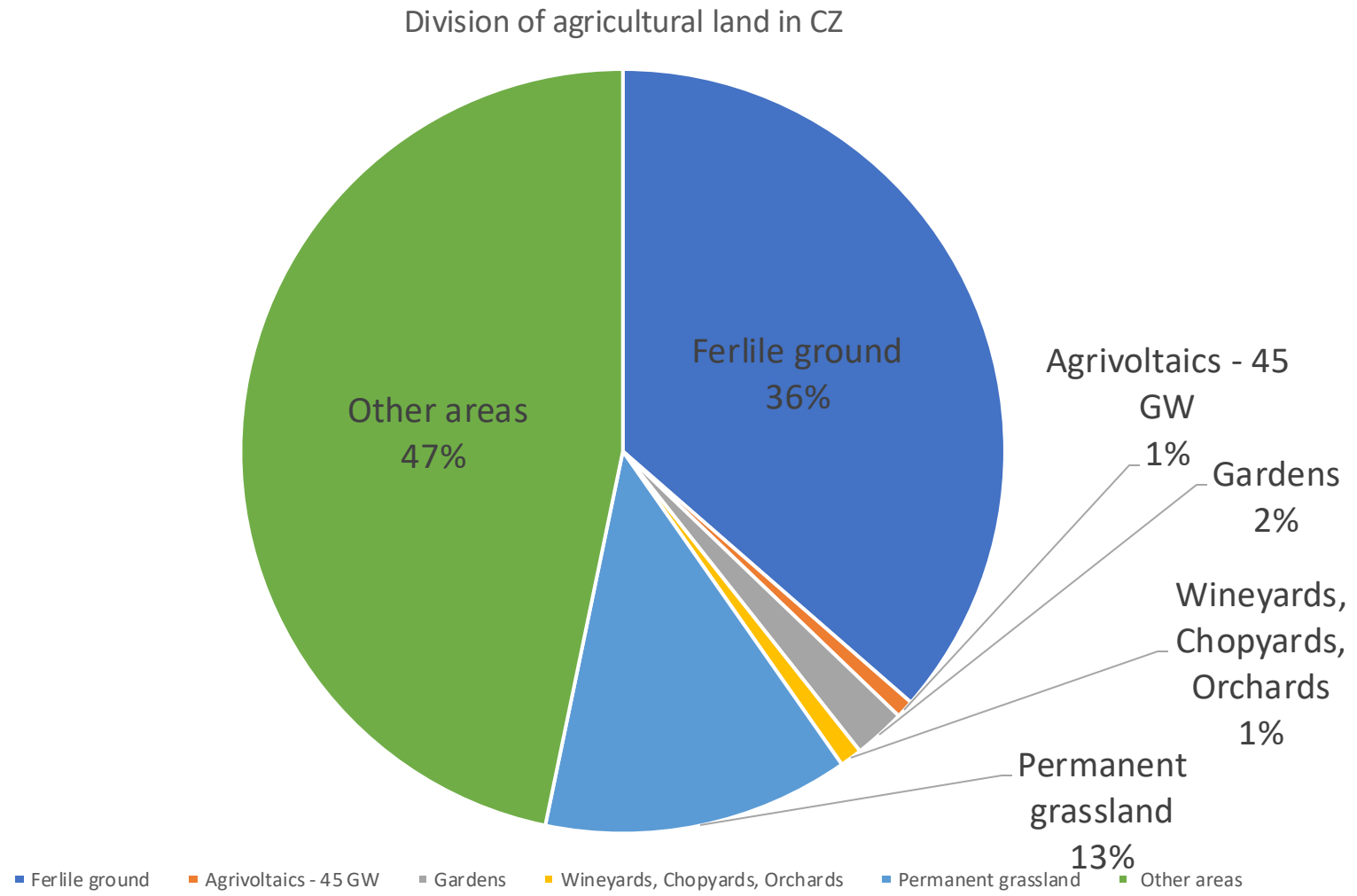
- 138 EUR

Financial support – CEE Region has Modernisation fund

- Investment subsidy in Modernisation fund RES+ 2/2024 – Active now
  - **Bonita I. až V. – You can apply after regulation will be done – till 10/2024**
- Special call for agrivoltaics – 2025



Agrivoltaics in CZ – targets – 45 GW?



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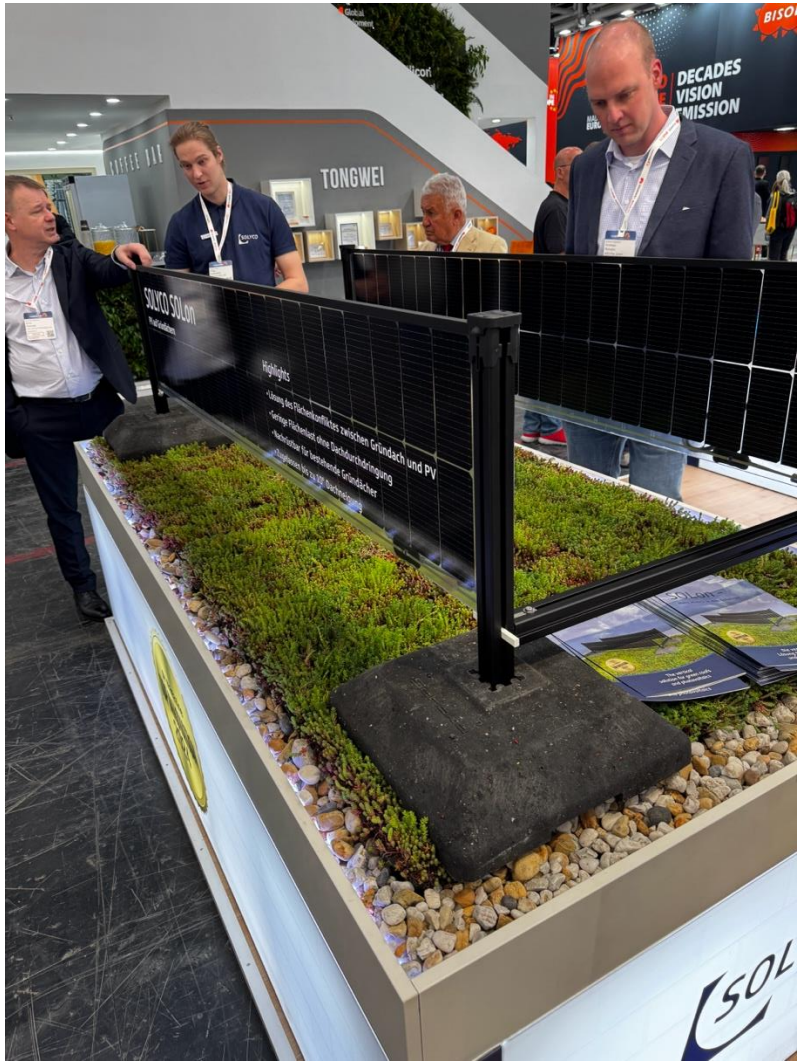

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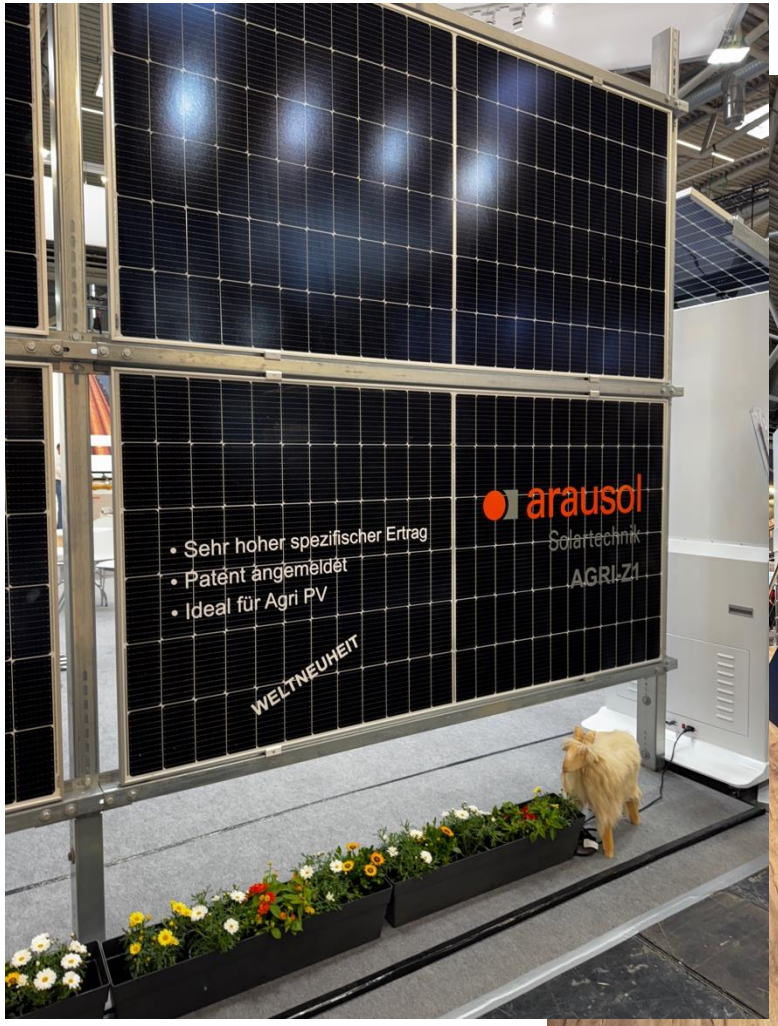
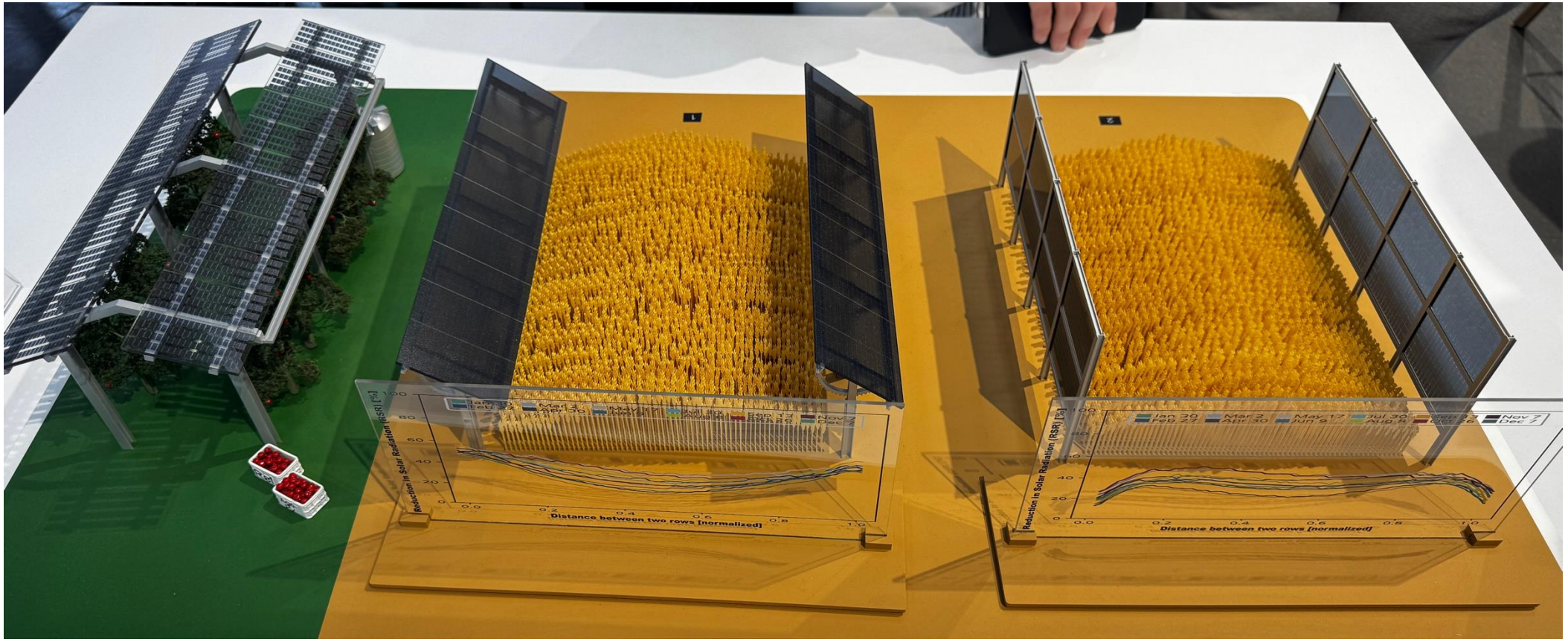


News from Intersolar 2025 - Trackers

News from Intersolar 2025 – Fraunhofer ISE model



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Thank you.

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