Agrivoltaics AA
The Water-Energy-Food Nexus

Tali Zohar, Dead Sea and Arava Science Center
Global projections towards 2050

• 60% more food will need to be produced in order to feed the world population in 2050
• Global agriculture will withdrawals 80% of all freshwater for irrigation
• Global energy consumption is projected to grow by 50% by 2035
Climate change impact

- Climate extremes threaten to reverse food security gains
- Drought, floods, and storms led to disaster-induced displacement
- Estimated 821 million undernourished in 2017
- Extreme heat had deadly impacts
- Devastating wildfires in Europe and North America
- Intense tropical cyclone activity associated with large economic impacts
- Ocean coral bleaching, loss of oxygen and blue carbon
Global desertification

Source: Millennium Ecosystem Assessment
WATER, ENERGY, FOOD - Nexus Thinking
Linking land, water and energy

Energy supply

Water pumping, harvesting
Growing biomass for fuel

Desalination
Power generation cooling

Agricultural land use

Land
Water
Energy Nexus

Water supply

Irrigation

Impacts of nexus approach on SDGs

Dual-use of land
Dual-use of land

Harvesting the sun twice

Image: Rainer Brohm, Vietnam

Image: Antoine BOLCATO (RPC), France
System parameters

- System size - MW installed capacity
- PV configuration - fixed tilt panels, tracking systems, vertically mounted
- Height, width, and turning clearances for farm equipment
- Shading, weed and pest management
- Optimization point - a balance between electrical generation and agricultural production
Evaluation parameters

• Productivity of crop or herd: Including pounds harvested or grazed, herd size growth and/or success of the crop, as applicable, and actual productivity relative to expectations.

• Crop management: Detailing any observable differences in necessary crop treatment relative to solely agricultural systems, including irrigation, soil amendments, disease and weed management, etc.

• Potential changes for future years: Including revised crop or grazing plans.
The Joint Institute for Global Food, Water and Energy Security
Insights from AgriVoltaic research

- Water demand reduction
- Increased biomass production
- Increase solar panels efficiency
- Shade-intolerant crops growth feasibility
Initial results

• We found no differences in size between shade and sun radish.

• Shade lettuce had a better start than sun lettuce. However, the growth rate was slower in the shade than in the sun, which affected the total biomass weight at harvest time.

• This round of planting was short but enabled the chance to establish some measurements protocol, to install equipment, and to have some preliminary insights.
AGRIVOLTAICS – 2ND YEAR
changes implemented in the research model:

1) One pergola was adapted to simulate 100% PV shade. Existing panels were laid at 15° and wood layers added between the rows. So, 3 plots were created for comparison - 100% PV shade, 50% PV shade and control in full sun.

2) We decided to plant a variety of crops simultaneously to make better use of land and time and to simulate the living conditions of a community, with the intention to support a diverse diet while increasing food security.
2\textsuperscript{ND} year crops
Off-grid Agrivoltaics

© Fraunhofer ISE. Schematic diagram of a triple land use through Agrivoltaics.
Policy recommendations

• Estimating the potential of Agrivoltaics in the country
• Definition of deployment targets includes planning aspects and environmental impacts
• Pilot projects including R&D
• Electricity tariff for the pilot phase supporting a variety of projects, in different areas, different crops and different technologies, enabling optimal research practices and precise agriculture
Thanks for listening! Questions?
tali@adsssc.org