Agrivoltaics

Brilliant idea or dead end?

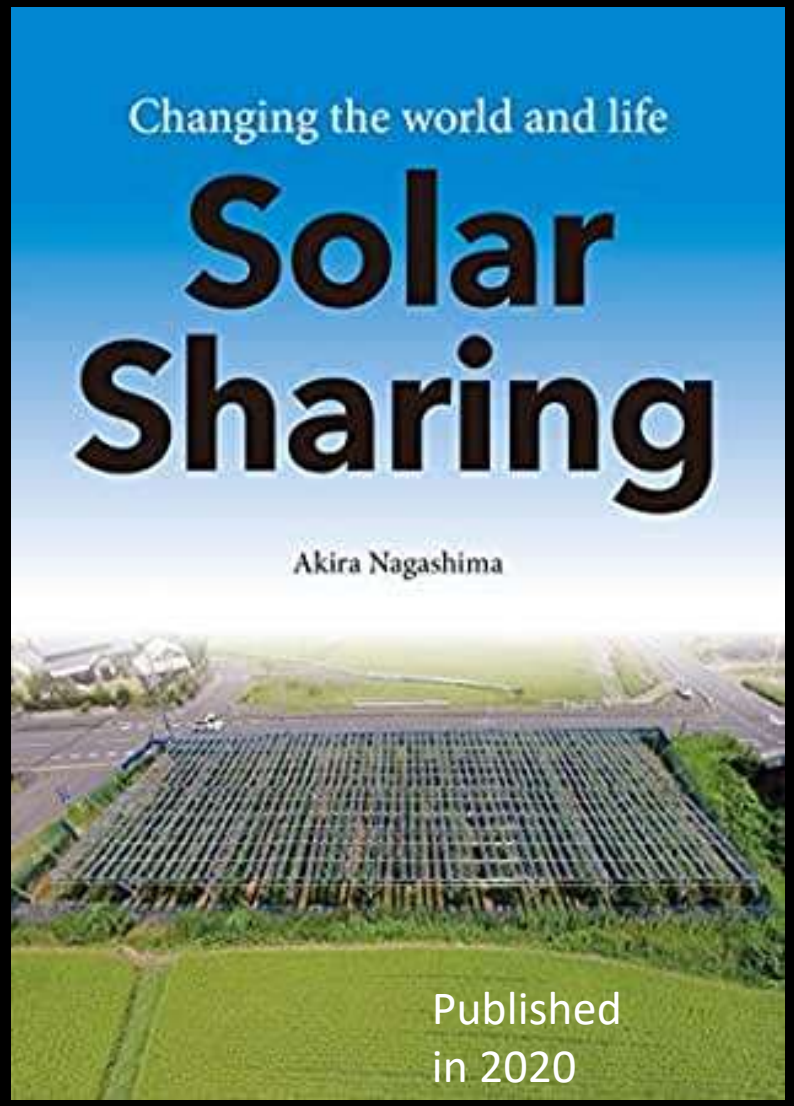
8 February 2024 – Coriolis Conference – Ecole Polytechnique

Christian Dupraz

INRAe, UMR Absys, University of Montpellier, France


CLAAS
MEDION
BAJARDESIGN
ARCHITECTE D'INTERIEUR

Japan


Changing the world and life
Solar Sharing
Akira Nagashima
Published in 2020

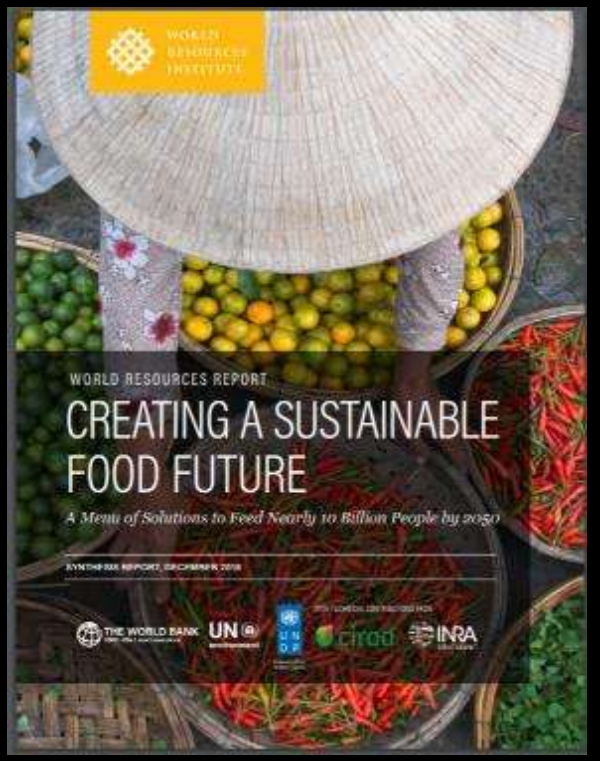

YouTube FR
Rechercher
ソーラーシェアリング回動システム　100Wパネル579枚同時駆動

Italy

Revolution Energy Maker (RemTec)

Is it sound to produce energy on agricultural land ?

- 9 billion people to nourish in 2050 : we need to increase food production by 56% until 2050
- -> Need to sanctuarize agricultural land
- -> Bringing back crop residues to the soil is essential for soil fertility: burning or digesting residues is a menace to long term soil fertility
- Is it efficient to produce energy on agricultural land ?
- Until the fossil fuels revolution, half of the agricultural area was producing only energy!



How to produce energy from crop land? Biofuels or agrivoltaïcs?

- 1 ha of wheat - > éthanol -> heat engine -> 80 000 km
- 1 ha of rapeseed - > diester – > diesel engine - > 100 000 km
- 1 ha of photovoltaic panels - > electricity - > electric engine - > 3 000 000 km
- 1 ha of photovoltaic panels - > electricity - > H2 - > Fuel cell - > electric engine -> 1 000 000 km

Why?

Photosynthesis Yield 1-2% + Heat engine yield 20 à 40% + Cost of transportation of liquid fuels
Photovoltaic panels yield 15% + electric engine 60 à 90%

Podewils, C., *Organized wastefulness. PHOTON International 2007 (04): p. 106-113.*

Benoit, M. and W. Schäfer. 2007 *Which energy vectors for requirements in mechanical energy? Bio-fuels or photovoltaic energy? Territory and social consequences. in Farming Systems Design Conference proceedings, p37-38. 2007. Catania, Sicily, Italy.*

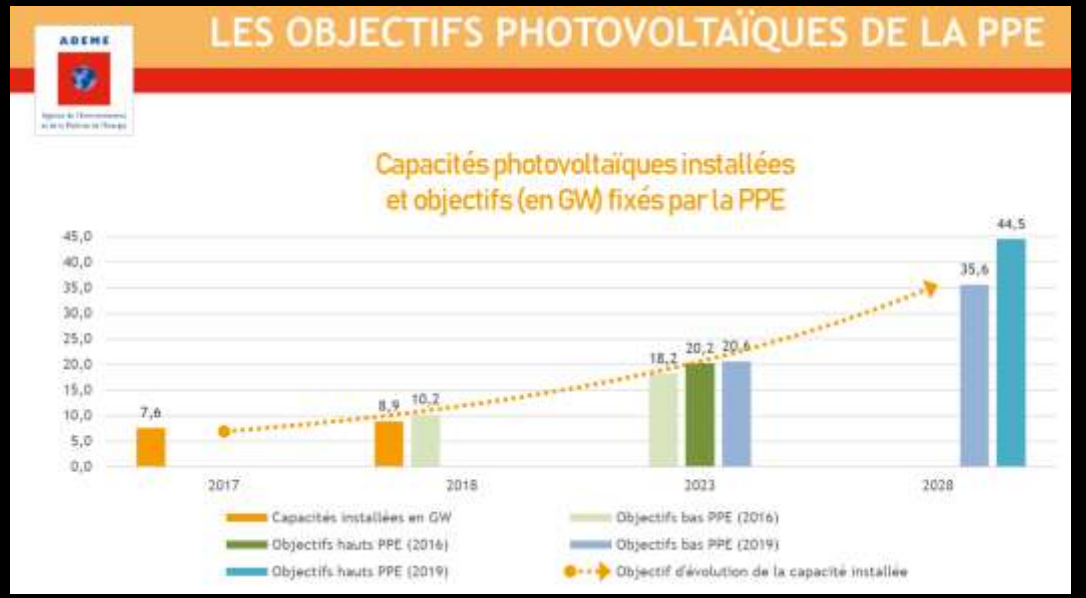
The challenge : finding space for photovoltaic panels :

Rooves, parking lots, industrial areas, degraded lands **will not be enough**

France's expectations : install 35 GWc until 2028 but only space for 23 GWc available

President Macron set the scene for **100 GW until 2050 (10/02/2022 talk)**

Where can we find the required space ?



Orders of magnitude:

1 ha of Ground-Mounted PhotoVoltaic (GM-PV) panels = +/- 1 $MegaWatt_{peak}$ (MWp)

1 nuclear reactor = +/- 2 500 ha GM-PV (1GWp)

56 nuclear reactors = +/- 150 000 ha GM-PV = +/- 0.5 % of the cropped area in France

Strong opposition from the civil society and farmers' unions against the use of crop land for photovoltaic systems

HORIZONS 28 - VENDREDI 3 FÉVRIER 2012

FDSEA

FONCIER La FDSEA rappelle sa position sur le développement de projets d'installations photovoltaïques au sol.

Pas de panneaux photovoltaïques au sol sur les terrains cultivables

Notre département comme bien d'autres, n'échappe pas aux projets photovoltaïques quels qu'ils soient : installations de panneaux sur des hangars agricoles ou création d'un parc photovoltaïque au sol (exemple du parc de Crucey-Villages)

la FDSEA a réaffirmé sa position.

Les sites d'implantation à privilégier

Il y a aujourd'hui suffisamment de place sur les toitures pour permettre de répondre aux enjeux du développement durable et qui

celle de nourrir les hommes. Aussi, les projets d'implantation au sol ne devront voir le jour que sur des terrains non cultivables, tels les friches industrielles ou artisanales, les sites pollués, les anciennes carrières... Les espaces sur lesquels l'activité agricole est

Huge GM-PV projects may replace forests or farm lands

Example : Lot et Garonne, 2 000 hectares,
1 Md€ investment, 1 000 jobs, taxes for local communities

5 investors : Valeco, Green Lighthouse, Neoen, Reden Solar et Amarenco Construction
5 municipalities : Allons, Boussès, Sauméjan, Pompogne et Houeillès

Un projet géant de centrale solaire provoque l'émoi dans les Landes

Par **Guillaume Guichard**
Publié le 12/01/2021 à 19:58, mis à jour le 12/01/2021 à 19:58

En l'absence de recours bloquant, Engie et Neoen ne prévoient pas de débuter les travaux avant 2024. Un branchement au réseau ne surviendrait pas avant fin 2025-début 2026. Un champ de panneaux solaires en Bulgarie.
243152433/diyanadimitrova - stock.adobe.com

Cette installation aussi puissante qu'un réacteur nucléaire nécessite d'abattre 1000 hectares de bois.

What to do?

- Why not produce « simultaneously » … food and energy on crop land?
  - Why not imitate agroforestry and combine…?

Trees and crops

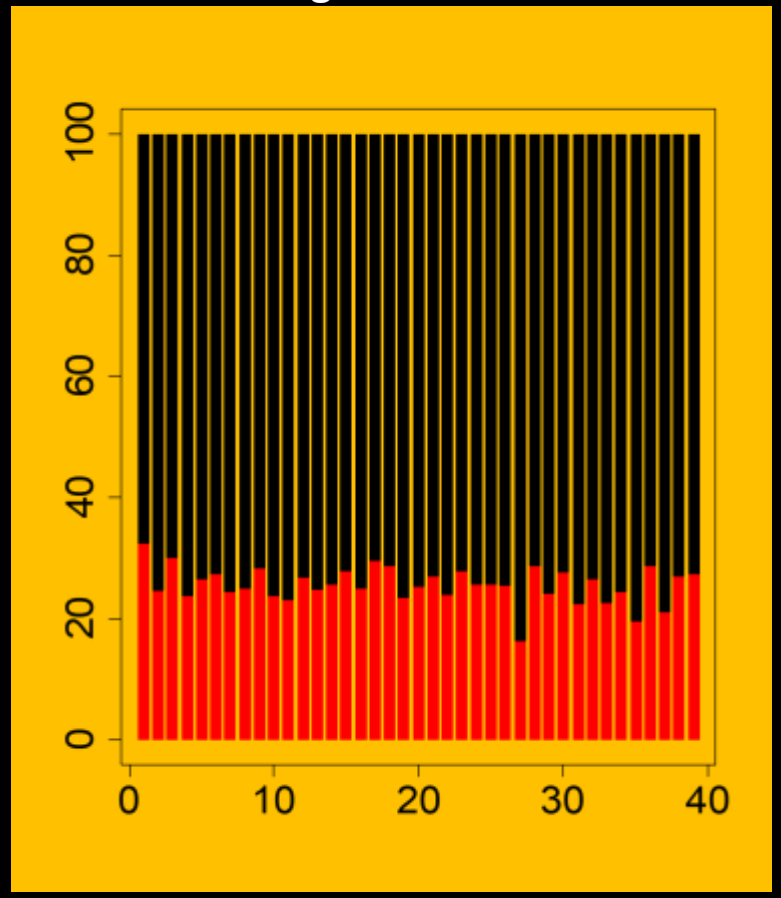
PV panels and crops

Agroforestry

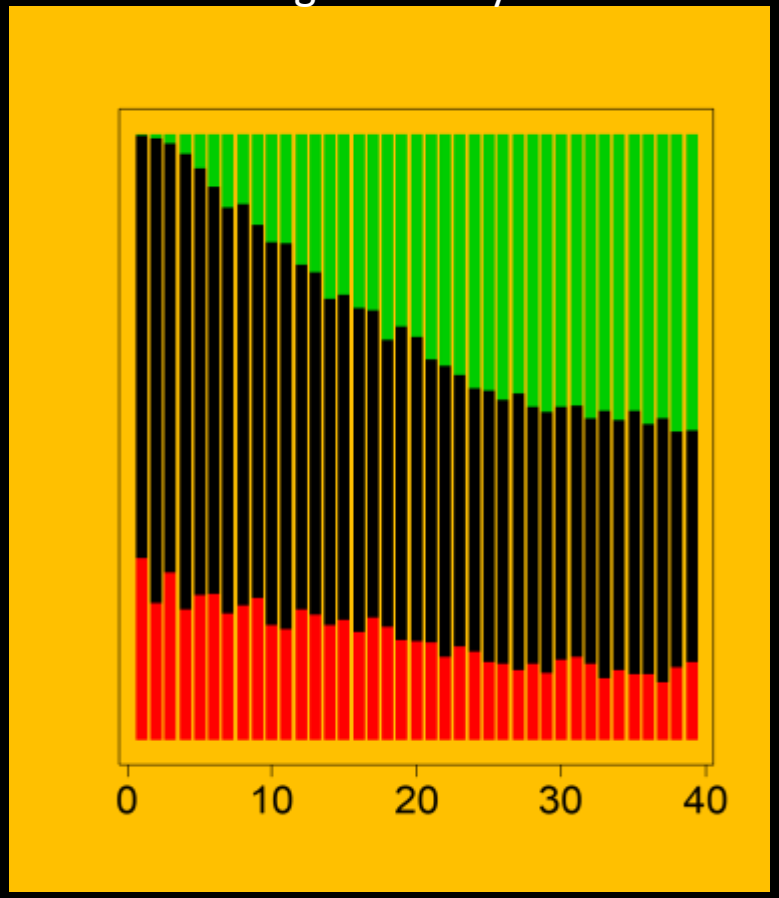
AgriVoltaism

Crops and pastures use less than 30% of the annual irradiation

Agriculture



Agroforestry



INRAE-Sun’R

First world research prototype (Montpellier, since 2010)

2019

2011-2013

Contents lists available at ScienceDirect

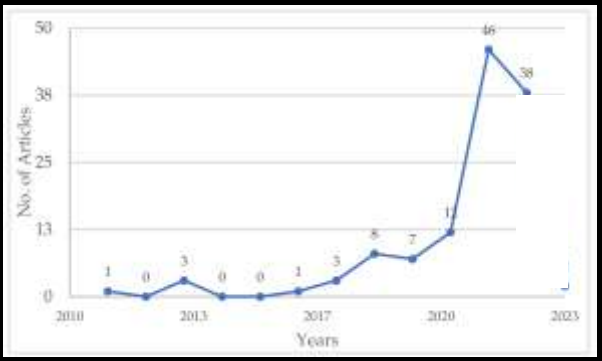
Renewable Energy

journal homepage: www.elsevier.com/locate/renene

Combining solar photovoltaic panels and food crops for optimising land use: Towards new agrivoltaic schemes

C. Dupraz [a,*], H. Marrou [a], G. Talbot [a], L. Dufour [a], A. Nogier [b], Y. Ferard [b]

[a] INRA, UMR System, 2, Place Viala, 34060 Montpellier Cedex, France
[b] Sun'R SAS, 7 rue de Clichy, 75009 Paris, France



Renewable Energy 2011. 36: 2725-2732

On the Coexistence of Solar-Energy Conversion and Plant Cultivation

A. GOETZBERGER and A. ZASTROW

Fraunhofer-Institut für Solare Energiesysteme Oltmannsstrasse 22, D-7800 Freiburg, West Germany

(*Received February 15, 1981*)

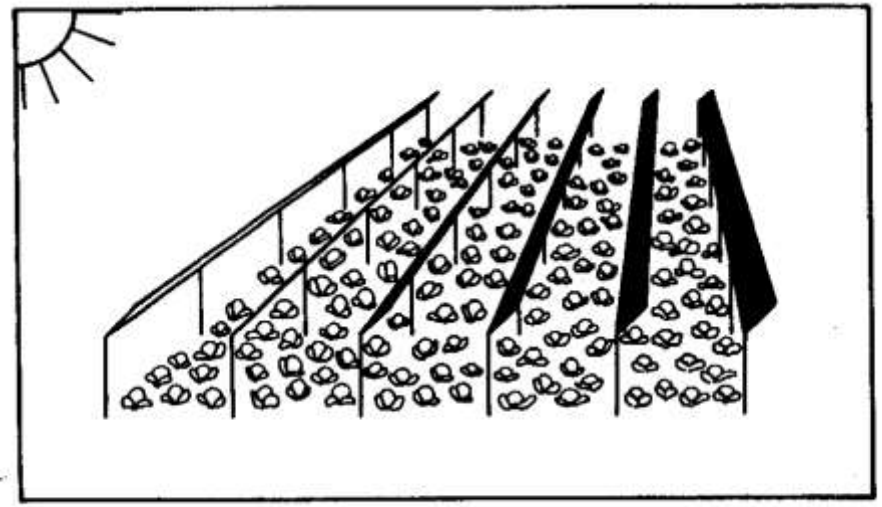


FIGURE 1 Model sketch of elevated collector field.

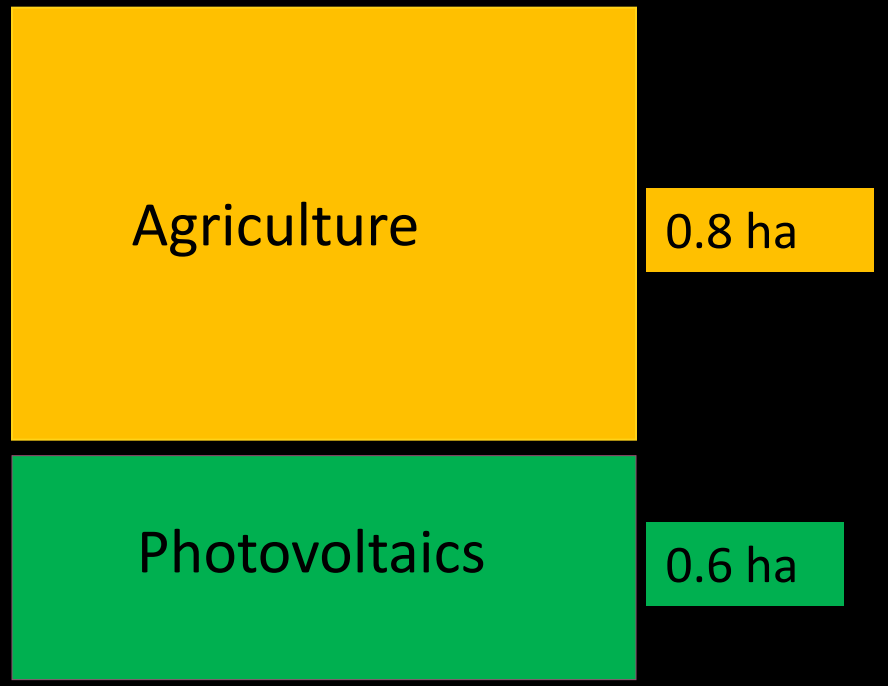
1981

Int. J. Solar Energy, 1982, Vol. 1, pp. 55–69
0142–5919/82/0101–0055$06.50/0

Dual use

1 ha

Single use



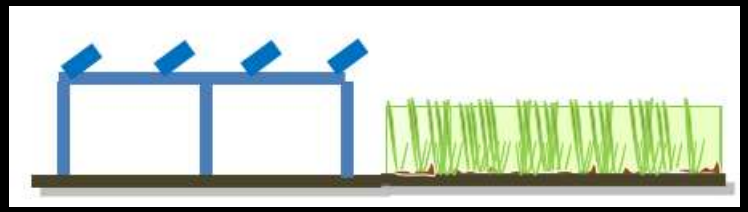
LER = 1.4 ha

Land Equivalent Ratio (LER) (Mead and Willey, 1980)

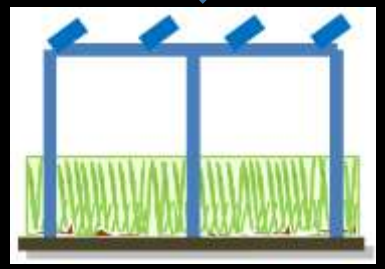

Land
Equivalent
Ratio
1.2 to 1.6
Poplars-cereals
14 years

What LER for Agrivoltaism?

- If crops did not mind shade…



1 ha 1 ha



1 ha

Maximum LER = 2

What LER for Agrivoltaism?

- But crops mind shade!

Density of PV panels	% PV panels	% Crop yield	LER
Standard	100%	73%	**1,73**
Reduced	52%	83%	**1,35**

Marrou (2012)

High LERS can be achieved with lower crop yields

Land Equivalent Ratio of agrivoltaism

1.3 to 1.7

Marrou *et al*, 2013; Valle *et al*, 2017

With a LER of 1.5,

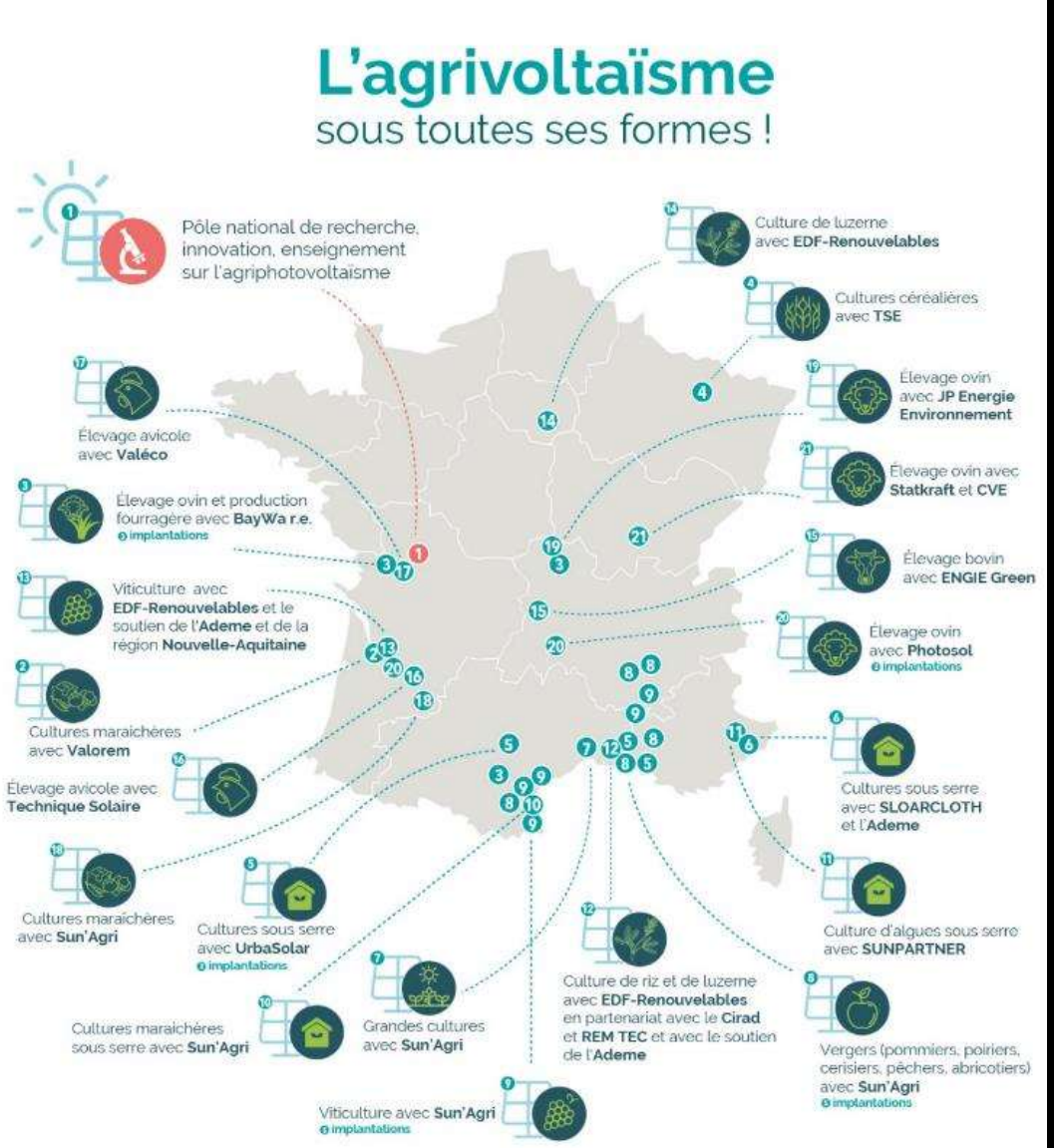
A 100 ha agrivoltaic farm

Would produce as much food and energy

As a 150 ha farm where PV panels and crops would be on different plots

Research on agrivoltaics in France

- 15 years (since 2009)
- Major Innovation: Dynamic AV (Sun'Agri/INRAE)
- Agronomical studies (9 Ph.D. Theses)
- Many industrial partners: Sun'R, Rem Tec, EDF Renouvelables, Photosol, Engie Green, Urbasolar, Baywa.re, SunPartner, SolarTub, Valorem, Valeco, Photosol, TSE, Next2Sun, etc…



INRAE-EDF Renouvelables

- ✓Since 2019
- ✓REMTECH Technology
- ✓INRAE Lusignan

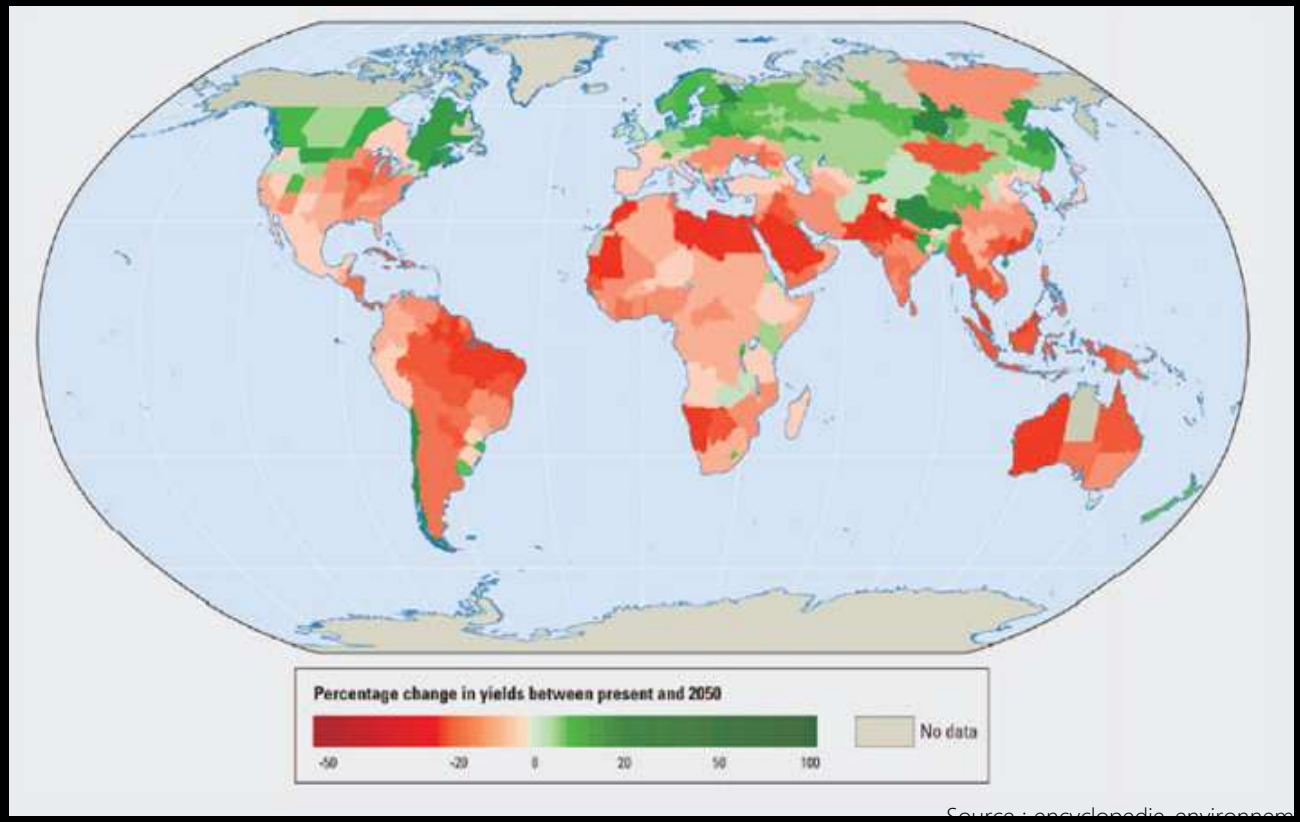
✓https://www.edf.fr/groupe-edf/inventer-l-avenir-de-l-energie/r-d-un-savoir-faire-mondial/toutes-les-actualites-de-la-r-d/une-annee-sous-les-

INRAE – ENGIE Green

Camelia Project (start 2022):

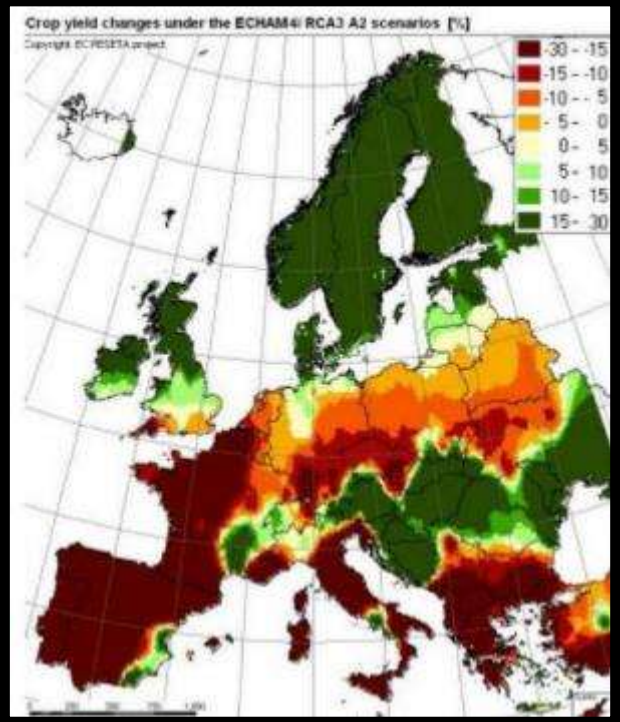
Photovoltaic hedges with cattle grazing

Most crops are endangered by climate change, especially in dry areas

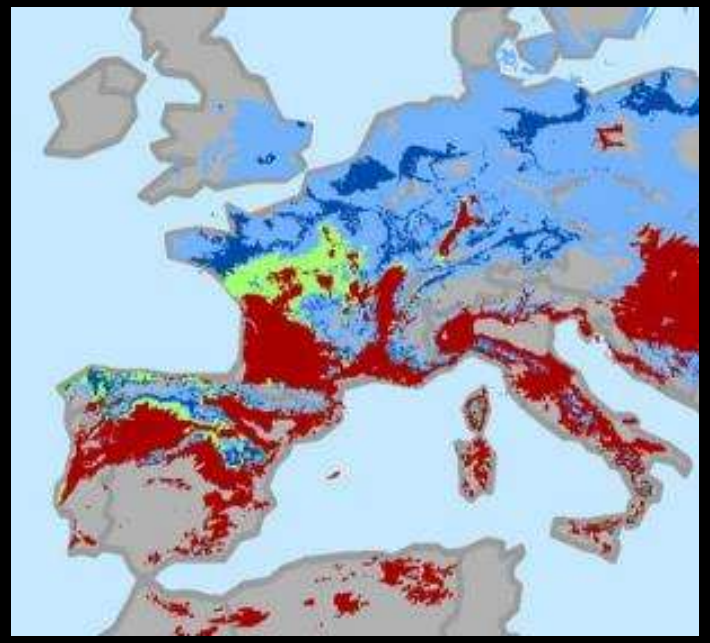


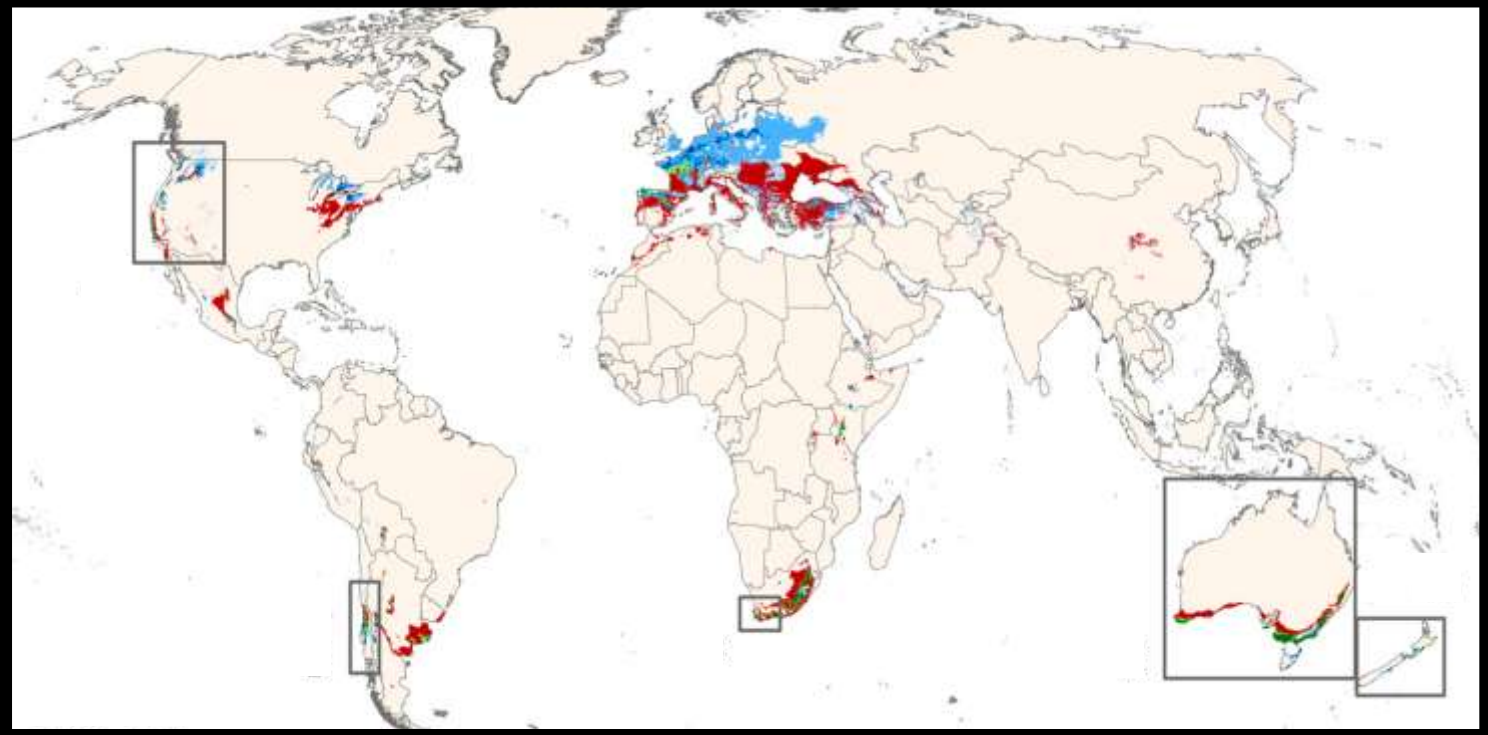
Source : encyclopedie-environnem

Cereal crops



Vineyards





2050 :

- May disappear
- Will stay
- May extend

15 years of collaborative R&D – 7 PhDs

The R&D Sun'Agri program

2009-2013	2013-2017	2017-2023	> 2019
SUN'AGRI 1 Proof of concept	SUN'AGRI 2 Products and softwares development	SUN'AGRI 3 Demonstration phase	COMMERCIAL DEVELOPMENT
1st FIXED SITE	1st DYNAMIC SITES	7 EXP. SITES 14 COMMERCIAL SITES	FRANCE INTERNATIONAL

Innovation awards

SITEVI INNOVATION AWARDS 2019

SIVAL 2021 OR

7 research Labs

lepse Montpellier

G-eau Gestion de l'Eau, Acteurs, Usages

INRAE PSH UR 1115

ABSys

INRAE MUSE Unité expérimentale de PECH ROUGE - UE 0999

INRAE

Mistea

RÉPUBLIQUE FRANÇAISE Liberté Égalité Fraternité

INRAE

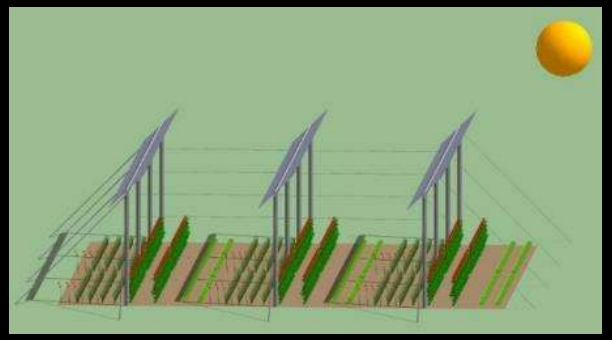
sun'Agri

Photowatt

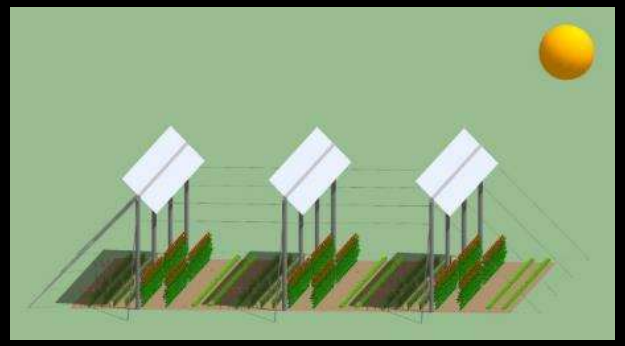
ADEME

Dynamic Agrivoltaism

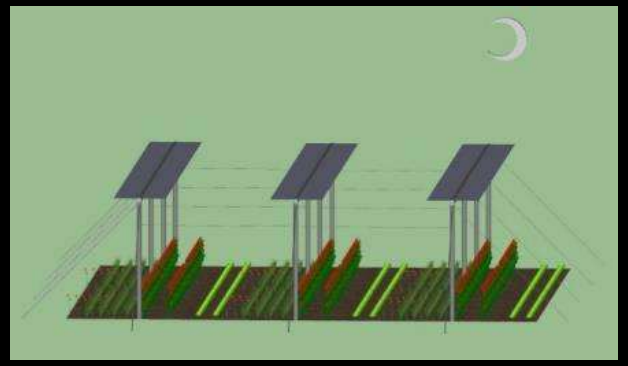
Case 1 : the crop needs high radiation intensity (inverse tracking)



Case 2 : the crop needs protection against excess radiation and heat (or no crop period)



Case 3 : night reduction of heat loss to prevent frost or increase soil temperature



PV panels as a tool to adapt to climate change

Electric yield of 30% during inverse tracking.

Grapevine experimentations

Sun’Agri R&D program

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

INRAE

sun Agri

Photowatt

ADEME

From small sized experimental sites…

Variety: Grenache N (2000)
Construction year: 2019
Size : 2x340m² DAV + 500m² control
Power : 75 kWp
GCR : 75%

Agronomical monitoring: Chambre d'agriculture du Vaucluse

… to real size commercial sites

Tresserre (66)

Varieties: Grenache B, Chardonnay, Marselan
Construction year: 2018
Size : 4.5 ha DAV + 3ha control
Power : 2.1 MWp
GCR : 37,5%

Agronomical monitoring: Chambre d'agriculture des Pyrénées Orientales

3 treatmentss :

- Solar Tracking (TS),
- Dynamic agrivoltaics with curtailment (DAV),
- Control (C)

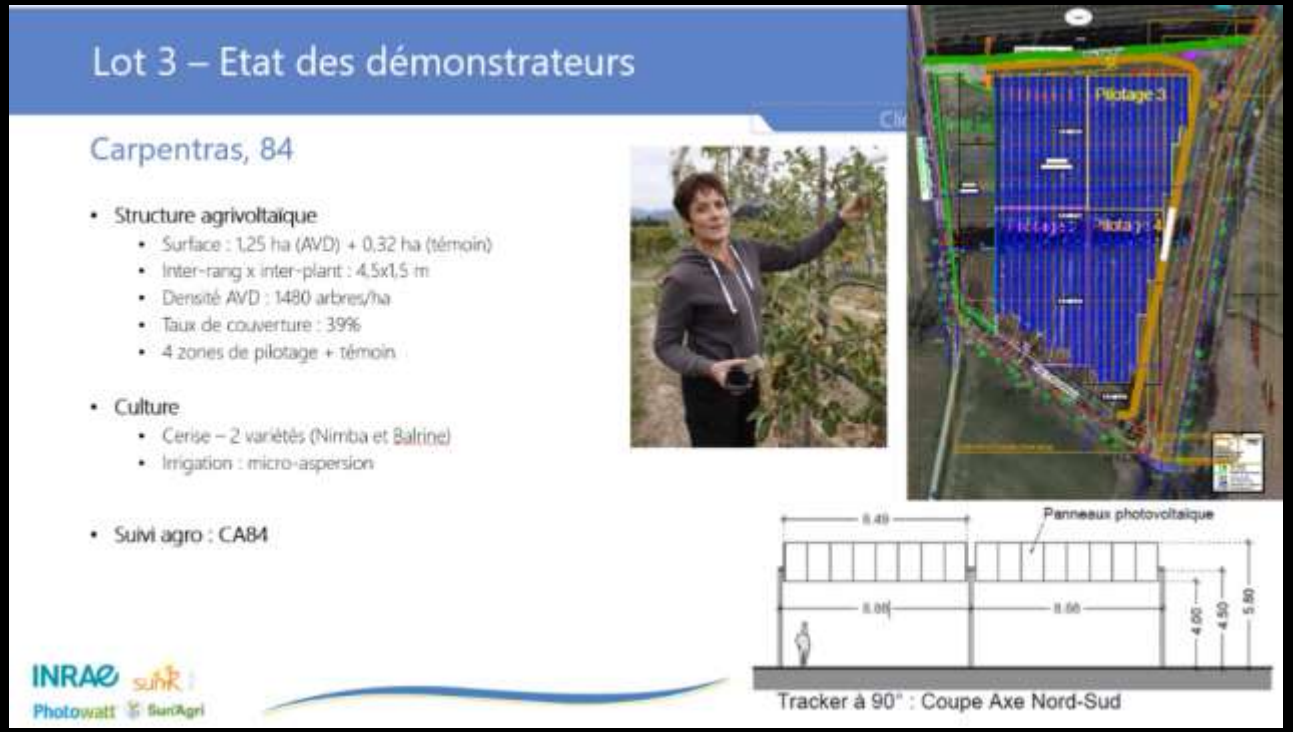
Piolenc (84)

- Protected vineyards stand better heat waves
- Water needs reduced by 12% to 34%
- Better aromatic profile :
  - +13% anthocyanes
  - + 9% à 14% acidity
- Reduced alcohol degree and delayed harvest

- The structure helps to provide various services (irrigation, hail nets, suzuki fly nets, etc..)

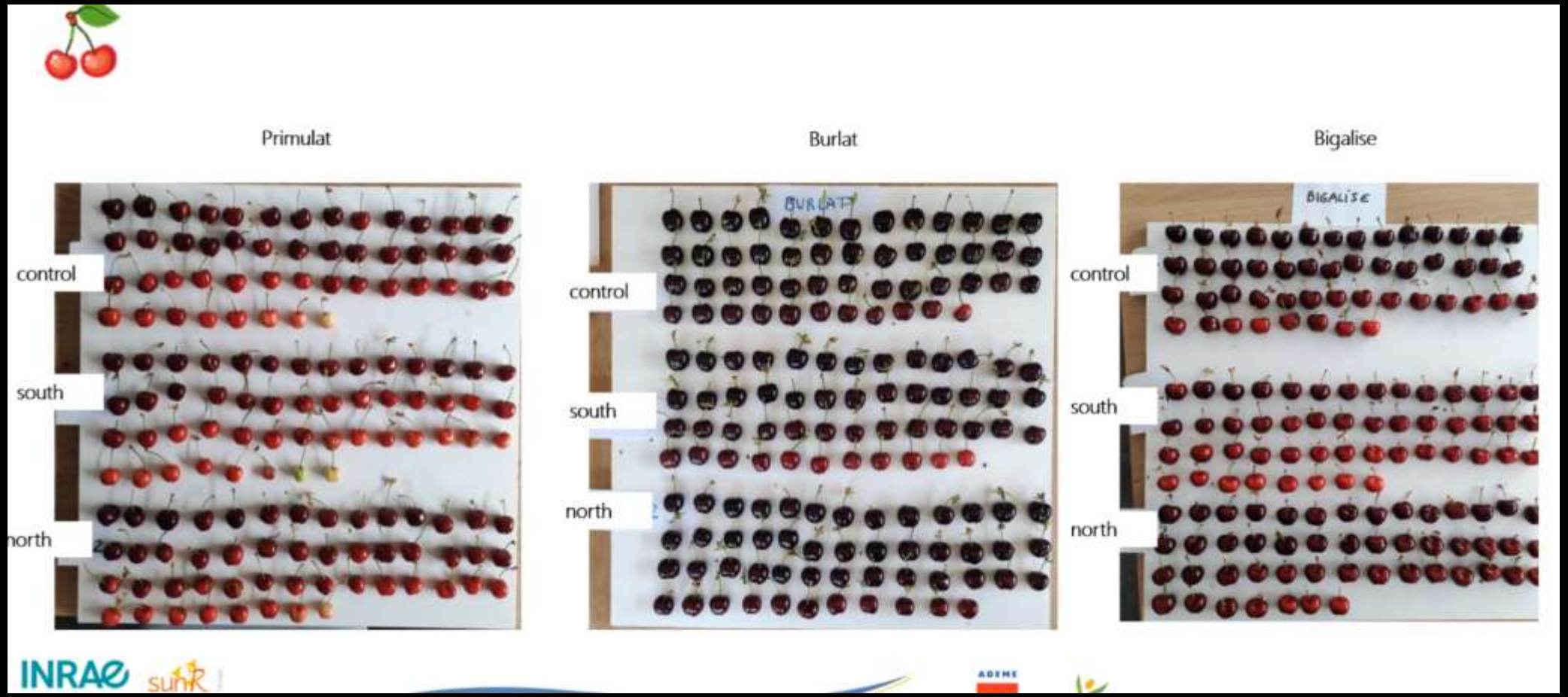
Fruit production in Dynamic AV (Sun'Agri)

- 8 sites with fruit trees (apple; cherry; plum; peach; pear; apricot;kiwi, vineyards)



Impact on quality of the products

- Tenuous impacts, sometimes reduced colour of fruits



Ecological impact of agrivoltaic systems

- Very few published results
- No big concern so far

- Some bird species adapt fast (swallows)
- Favour some insects (buterflies)
- Not fenced (free ranging of wild mammals)
- Interfere with birds of prey hunting
- Not very friendly for bats

Agrivoltaism research : a recent acceleration

- World congresses
  - Agrivoltaics2020 : France, Perpignan, on line;
  - Agrivoltaics2021 : Germany, Freiburg, on line
  - Agrivoltaics2022 : Italy, Piacenza, on site / on line
  - Agrivoltaics2023 : South Korea, Daegu, on site / on line

- Next world congress : Denver, USA June 2024

AgriVoltaics2022
Conference & Exhibition
15-17 June Piacenza, Italy & Online

A soaring of innovations

- Semi-transparent PV modules
- Folded systems
- Mobile systems on skis
- Bi-facial vertical systems
- Assymetrical glasshouses designs
- Tubular Photovoltaic systems
- Organic Photovoltaic systems
- And many more …

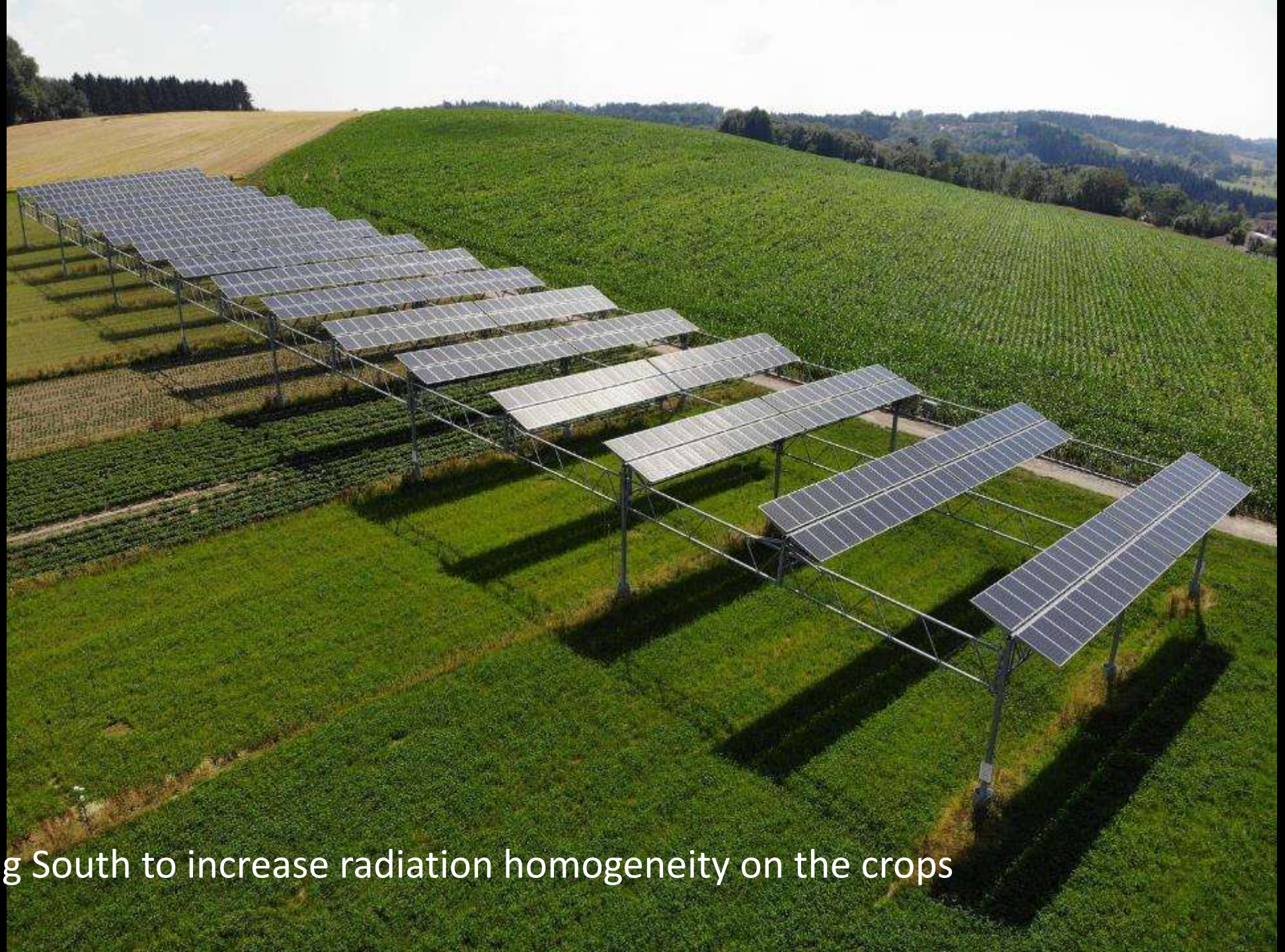
Some examples of new impacts on crops and animals to be evaluated

- On crops
  - Reduction of pest spreading with photovoltaic hedges (+)
  - Reduction of vertical panels yield with high crops (-)
  - Reduction of drought and heat stress of crops under PV panels (+)
  - Impact of modified soil temperatures (mineralisation, soil fauna) (+/-)

- With animals
  - Electric risks for animals (electrosensitivity, electric shocks) (-)
  - Reduction of drinking water needs (+)
  - Foraging behaviour modified
  - Difficulty to move fences for rational grazing management

Some examples of agrivoltaic research sites

Germany



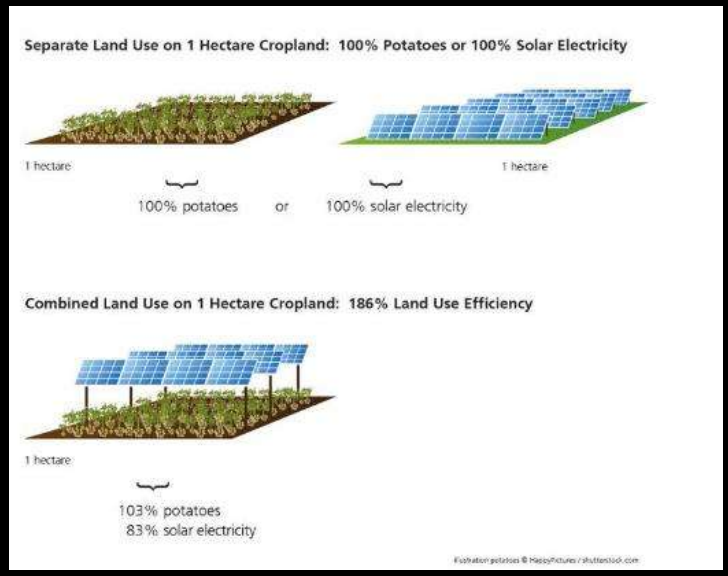
Fraunhofer

Fixed panels not facing South to increase radiation homogeneity on the crops

Press Release #10

Agrophotovoltaics: High Harvesting Yield in Hot Summer of 2018

12.4.2019



Fraunhofer Germany

Surprising results, to be confirmed

Renewable and Sustainable Energy Reviews 140 (2021) 110694

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: http://www.elsevier.com/locate/rser

Check for updates

Combining food and energy production: Design of an agrivoltaic system applied in arable and vegetable farming in Germany

Max Trommsdorff [a,b,*], Jinsuk Kang [a], Christian Reise [a], Stephan Schindele [c], Georg Bopp [g], Andrea Ehmann [d], Axel Weselek [e], Petra Högy [d], Tabea Obergfell [f]

Fraunhofer
Germany

Forschungsprojekt APV-Obstbau
Semitransparente Solarmodule

South Korea

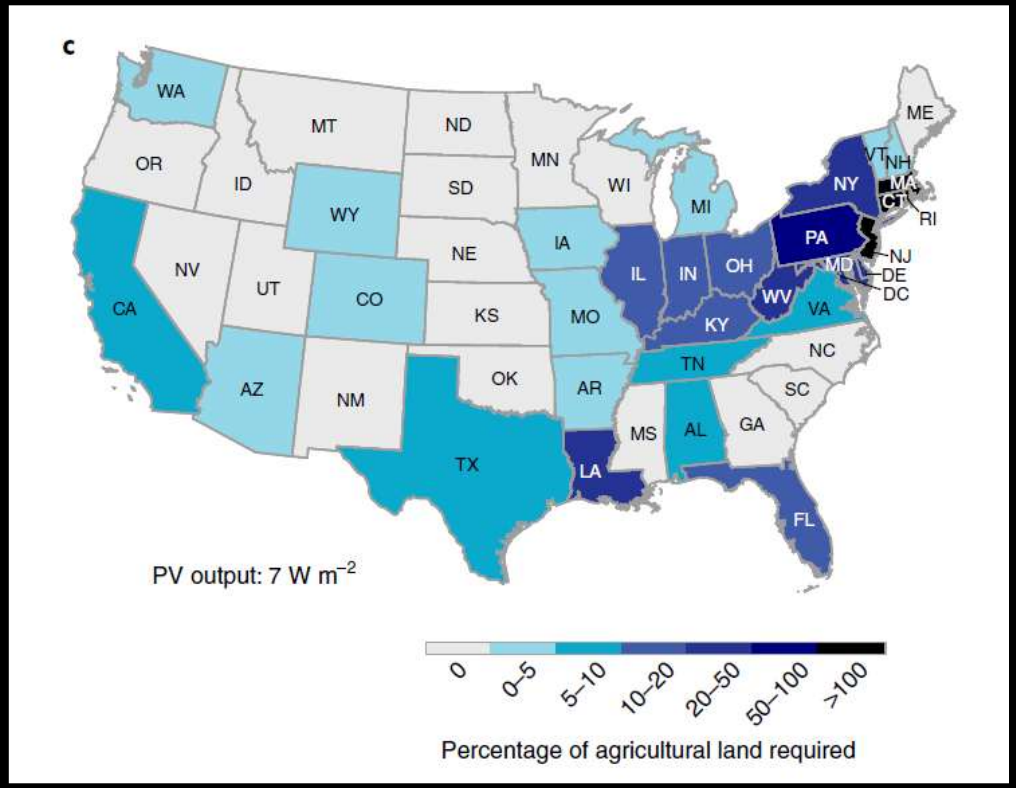
- Several projects since 2016 with rice, cabbage, potatoes, garlic, sesame

- Korea Agrivoltaic Association :
  - Defining standards for Agrivoltaics

Source photo : Korea Agrivoltaic Association (ChungBuk Ochang)

USA « Aglectric » farming

- Towards a fully solar based economy to address the « full » earth
- A 100% electric economy will require to use crop land
- Agrivoltaic plants at each motorway service area



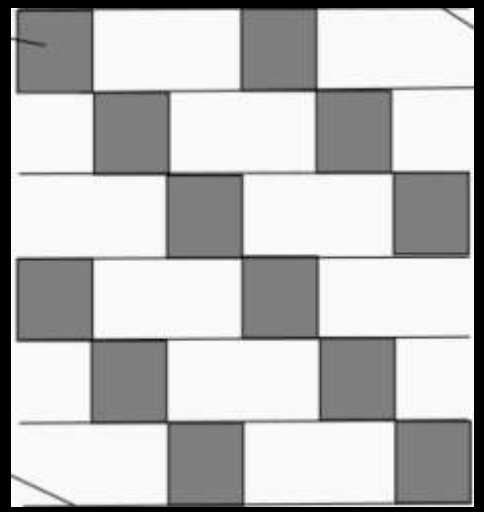
Sustainable co-production of food and solar power to relax land-use constraints
Caleb K. Miskin, Yiru Li, Allison Perna, Ryan G. Ellis, Elizabeth K. Grubbs, Peter Bermel and Rakesh Agrawal
2019, Nature sustainability

China

- 1 GW project with goji berries cultivation in Ningxia Province (Huawei)

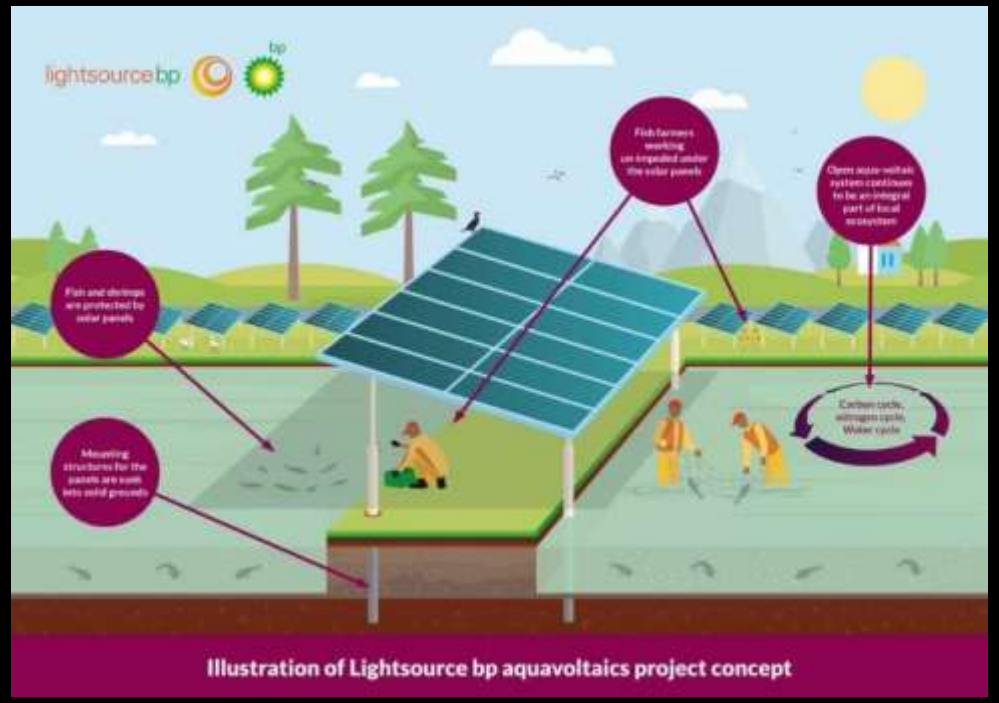
- Smart PV (trackers)

- Water saving (-30%)
- Higher biodiversity (desert area)



Taiwan

- Leaders of aquavoltaics
-



Agrivoltaics in desert areas

Source: www.saharaforestproject.com

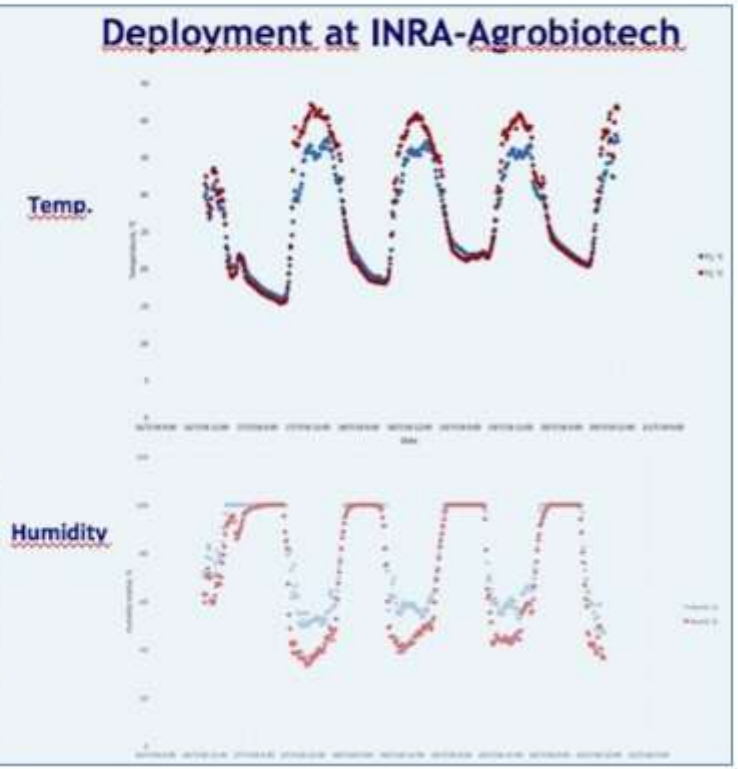
Source: www.bellona.org/imagearchive/Testsenter-Jordan.jpg

- Sahara Forest Project (SFP) in Qatar (funded a.o. by Norway, Bellona, and QAFCO)
- Solar Breeder Project in Algeria (funded a.o. by Japan)

SOLARCLOTH®

SYSTEM

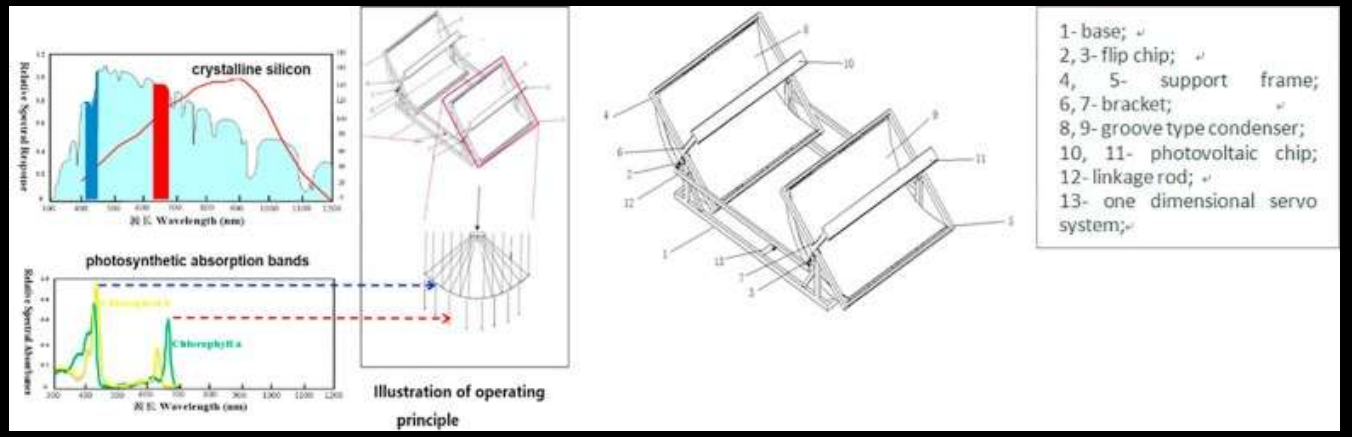
Brevet - Écran d'Ombrage PV



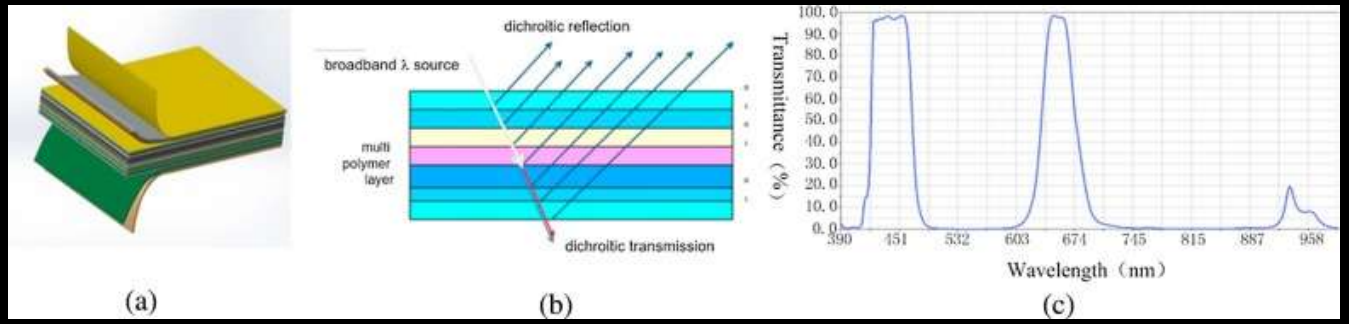
Solar Energy
Volume 162, 1 March 2018, Pages 84-94

A novel agricultural photovoltaic system based on solar spectrum separation

Wen Liu [a, b], Luqing Liu [a, b] ✉, Chenggang Guan [c], Fangxin Zhang [a, b], Ming Li [b], Hui Lv [d], Peijun Yao [a], Jan Ingenhoff [b]



1- base;
2, 3- flip chip;
4, 5- support frame;
6, 7- bracket;
8, 9- groove type condenser;
10, 11- photovoltaic chip;
12- linkage rod;
13- one dimensional servo system;



So what?

Brilliant idea or dead end?

Agrivoltaics is no longer a niche : big players want to run agrivoltaics

La France Agricole @FranceAgricole · 3 Apr 2020

@InstitutElevage et @EleveursOvins développent avec Neoen u
de recherche pour répondre à une demande forte de données
agronomiques et zootechniques sur le pâturage d'ovins sous des p
photovoltaïques.

Sun'Agri et Engie Green s'associent pour le déploiement de l'agrivoltaïsme

À la une › ÉNERGIE

Business

L'agrivoltaïsme : « escroquerie verte » ou vrais « énergieculteurs » ?

ÉNERGIE

Sun'Agri, Engie, Total... L'agrivoltaïsme progresse en France, y compris chez les géants de l'énergie

signent une
sme

Le gouvernement a désigné le 1er avril une salve de 288 projets dans les énergies renouvelables. C'est également l'un des premiers appel d'offres pour l'agrivoltaïsme, une filière qui intéresse de plus en plus de gros acteurs de l'énergie comme Total..

L'agrivoltaïsme est une approche innovante qui associe une production d'électricité photovoltaïque et une production agricole sur une mê
surface. Elle aide à valoriser des terres peu productives, très caillouteuses, sur des plateaux venteux ou encore trop exposées au soleil,
rendant possible la diversification vers de nouveaux types de cultures, tout en produisant de l'énergie photovoltaïque. La démarche peut
également faciliter la création d'emplois grâce à une augmentation de la productivité des exploitations.

Total Quadran et InVivo mutualisent leurs expertises via trois engagements :

- La mise en place d'une cellule recherche et développement sur l'évolution de l'agrivoltaïsme.

EDF et Rem Tec ont installé dans le département de la Seine-et-Marne, des panneaux photovoltaïques au-dessus d'un champ de luzerne. © Michael Ayach/Rem Tec

« Positive agrivoltaism » Label validated by AFNOR (Class A on crops)

- To certify projects and avoid «poor projects»
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- «Positive» means that the crop production will not decrease <u>at all</u>

France Agrivoltaïsme

Created 9 June 2022

Promotes regulation and a crop priority in projects

Second association:

Promotes less regulation and free enterprise

« Priority to agility »

FFPA
Fédération Française des Producteurs Agrivoltaïques

Do we need Agrivoltaics?

PV on Agriculture lands is not an option: we need it

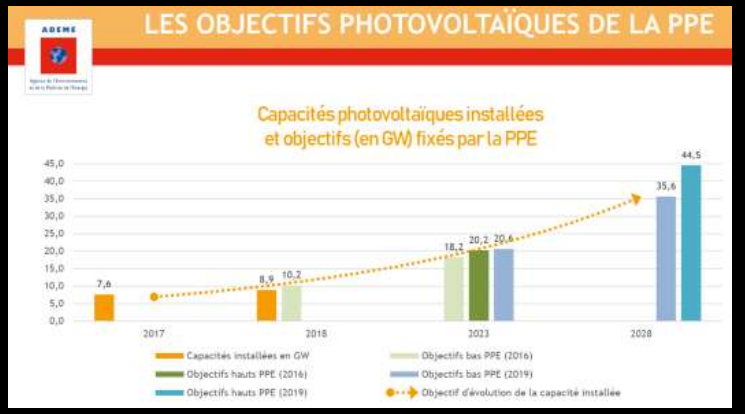
(in most European countries).

50% of PV electricity will be produced on agriculture land

After oats and barley and grass / hay for horses, after agrofuels (ethanol or diesters for thermal engines)… electricity

Some few countries have desert areas (Spain?) and could manage without using Agriculture land

But deserts are usually far away from the electricity consumers



Chatzipanagi, A., N. Taylor, and A. Jaeger-Waldau, 2023. *Overview of the potential and challenges for agri-photovoltaics in the European Union*, ed. C.J.R.C. European. Vol. EUR 31482 EN. 57p

Nijsse, F.J.M.M., et al., The momentum of the solar energy transition. Nature Communications, 2023. 14(1): p. 6542. 10.1038/s41467-023-41971-7.

But… practical difficulties are huge…. and lead to surrender

Assemblée nationale,
Commission du Développement durable,
4 février 2024

Antoine Peillon,
Sec. Gén. à la planification écologique France nation verte

Jean-Luc Fugit,
Président Conseil Supérieur de l'Energie

The legal Ground Coverage Ratio (GCR) dilemma

- GCR = area of panels / area of land
- Lower GCR for a viable agriculture production
- Lower GCR result in higher LCOE that may endanger the electricity business model
- The search for low cost structures to support low GCR AV facilities is crucial for agrivoltaics

The pathetic history of photovoltaic glasshouses

- 50% GCR glasshouses = too dark for most crops

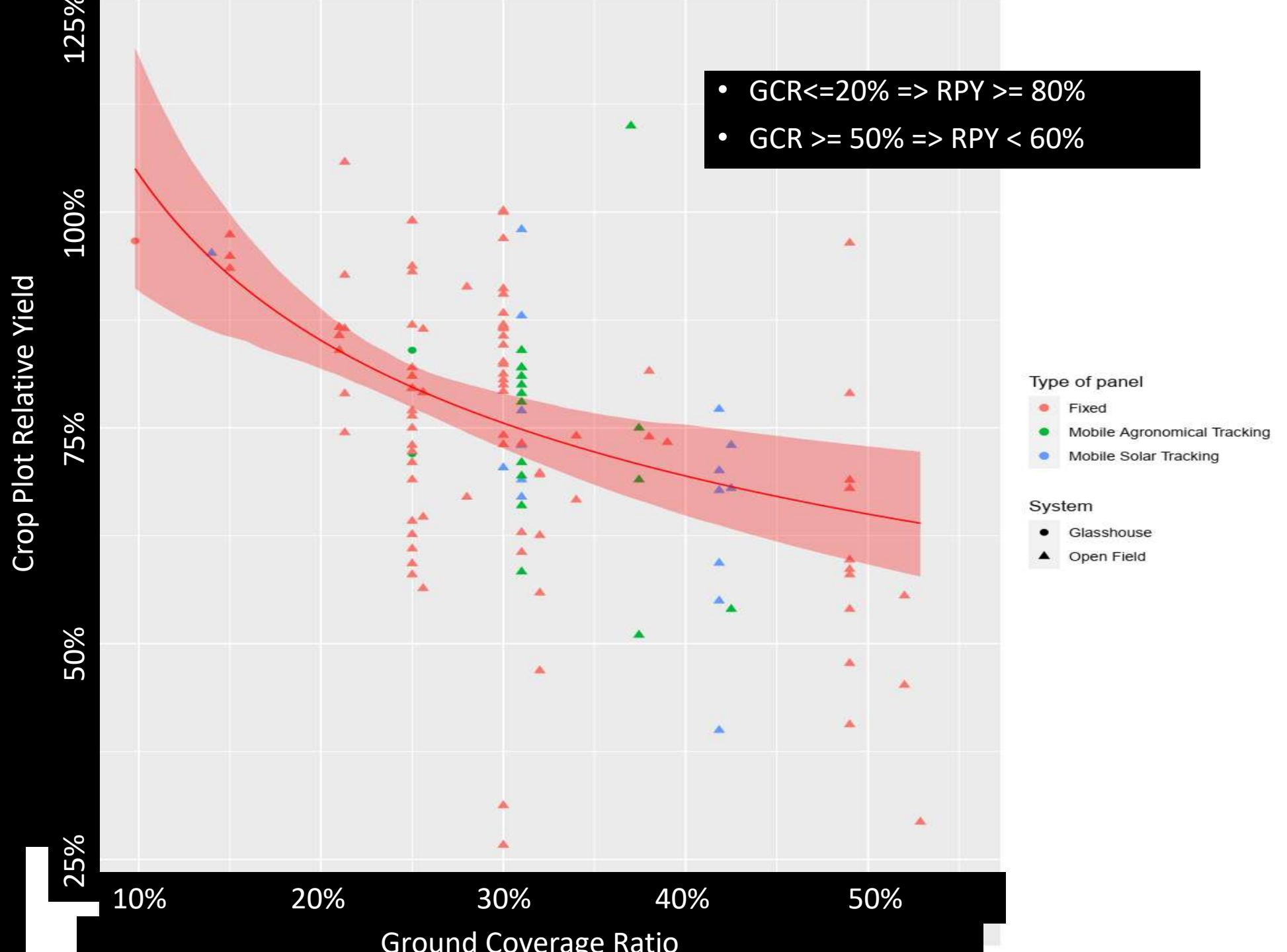
- New systems with lower GCRs, semi-transparent panels, mobile reflecting curtains

Who loves shade? The raspberry / spinach quarrel

- Raspberries love shade as well as tea, goji, meadows, and many more
- Spinach is less happy, like soybean, rice, maize…
- Some don’t know : apple, olives, tomatoes…
- Indian and European tomatoes disagree…

Magical numbers : 23…. 30… 50… 84…

- What % of shade is acceptable to crops ?
  - Crops and animals will have different requirements
  - Forage crops are alike crops… until a given threshold, the more light, the better
  - In dynamic system, this ratio can be adjusted in real time



Dupraz, C.,. *Agroforestry Systems, 2023. https://doi.org/10.1007/s10457-023-00906-3.*

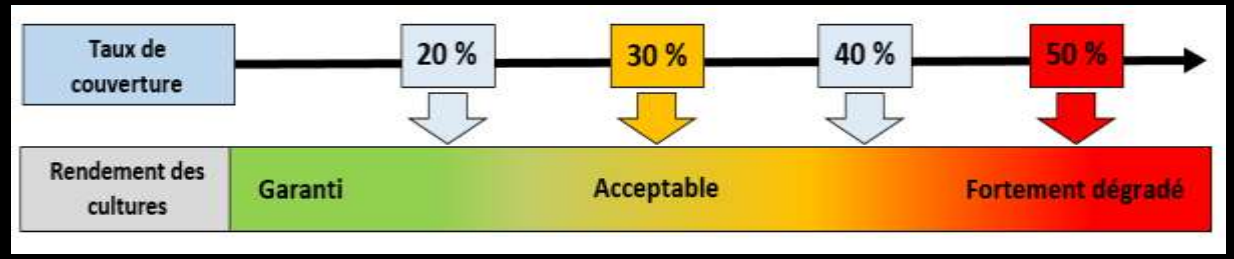
About the challenge to maintain crop yield in Agrivoltaics

Lizuka, Sosa, Chiba, Japan
Blé
Distance entre les rangées de poteaux : 4 m
Surface cultivée : 75 %
GCR : 33%

Sasaya, Nihonmatzu, Fukushima, Japan
Blé
Distance entre les rangées de poteaux : 2 m
Surface cultivée : 50%
GCR : 25%

Two examples of Japanese sites where it is impossible to obtain the required 80% crop relative yield

- Usual Ground Mounted PV GCRs are not compatible with AV
- A model with 100% of agriculture relative yield allow an « infinite » area to be available
- Half GCR x twice area = same electricity production with agriculture production maintained but higher LCOE
- Some perennial crops (fruit trees, vineyards, berries, pastures) may tolerate more shade (more data needed)



To be or not to be Agrivoltaics ?

Required : Solar sharing for 2 productions

No solar sharing = shelters, buildings…

Electricity production on agriculture buildings is not AV

This biophysical definition does not assume any ratio of the relative weight of the two productions, nor the relative productivity of the two productions as compared to the reference monosystems

Is this Agrivoltaics ?

Yes, definitely

Is this wanted Agrivoltaics?

Well… it depends!

The answer may be different from places to places, from countries to countries.

The replacement hypothesis

Electricity income/ha > 10 to 100 times the Agriculture income /ha

Developers need land
Some farmers are attracted to become annuitants

The required area is not huge (less than 1% of the used agriculture area in France)

Simple and straightforward : allow to replace

Let it be ? Go for it?

The coexistence hypothesis

Let’s compromise, Share the sun, Produce both on the same land

Incentives : LERs are > 1, crops/animals may benefit from the PV panels protection

In terms of income, Agriculture will never be dominant

Will never happen « naturally ». Only driven if regulations prohibit the replacement option.

The Strong coexistence option

Balanced compromise between electricity and agriculture

Low GCRs (10 to 30%) to allow enough light to the crops

Feed in Tariffs conditional on the agriculture productivity

80% in Japan
66% in Germany
90% In France

Only option compatible with CAP payments

The Weak coexistence option

Priority to the rewarding component (electricity)

Agriculture production is anecdotal (sheep, hives, biodiversity services)

GCRs are close to standards of Ground Mounted PV (40 to 60%)

High risk of agriculture abandonment.

Renting incomes will never justify to loose money while cropping, especially if the farmer is not the land owner

Solar grazing (with sheep) as a « kill agriculture » option

Electricity income per ha > 300 times the Sheep income

If you replace a productive agriculture with this system, it is close to agriculture abandonment

The land owner / farmer will be a happy annuitant

The society may disagree (loss of agriculture production)

The neighbour farmers may strongly disagree.

Why keep working when your neighbour is rich doing nothing? May induce havock in rural communities.

Sharing the AV pie

- Agrivoltaism target areas should be coherent with the energetic transition objectives. In France:
  - Neither too low : > 10 000 ha
  - Nor too high : < 1 Mha
  - 100 000 – 200 000 ha is a sensible target

- The pie is limited!

- Currently more than 1 Million hectares are pre-contracted in France!

- A lot of cries ahead

What business models to improve the acceptability?

- Limit the size of projects to allow a large number of farmers to benefit from it (1ha? 5 Ha? 10 ha? 100 ha?)
- 100 000 ha of AV can be 100 projects of 1000 ha or… 100 000 projects of 1 ha (Japan model)
- Avoid Farm Land speculation by limiting rents for land for PV projects
- 1% of the French agricultural area could produce as much as the 56 French nuclear reactors without loosing the crop production (-20% on 2% = 4/ooo of the production)

Dual AgriVoltaic systems?

- Large facilities

- Few systems, limited number of beneficiaries
- Close to the national grid connection points

- Low LCOE, economies of scale

- Significant contribution to the electricity mix

- Small facilities

- Many beneficiaries, May be dispatched all over the territory
- Can be installed also in remote areas far away from the national grid connection points
- Higher LCOE

- Release of tension on the distribution grid by providing electrons at the remote end of the delivery network

- Self-consumption model; Farm decarbonation targets (electric tractors, local production of N fertilizers)

How to stimulate inventivity by AV designers?

The « no constraints » philosophy

Will favour big companies
Could result in simply elevated GM-PV facilities with no innovation
Rejected by many players

The regulation philosophy

Limitations (to GCR, to panel elevation, to rent levels) and forbiding of GM-PV on agricultural land will stimulate inventivity
Implemented in most countries

The APER law (Accélération des énergies renouvelables, 10 mars 2023)

- Forbids GM-PV on agricultural land (some options or long term fallows)
- Defines Agrivoltaics as a tool for adapting agriculture to climate change
- Gives a huge power to the CDPENAF (Avis conforme) and put pressure on mayors
- Open the scene for corruption…

A decree against the law ?

APER Law: AV as a tool to improve agriculture

Agrivoltaic decree: could allow systems that may create havoc in agriculture and rural communities

requires 90% agriculture yield but allows 40% GCRs (and more)

The Conseil d'Etat will tell…

To sum up

- AV is a serious option for our energy future: the resource is huge
- The design of AV systems that maintain crop yield is tricky but worth trying (graal)
- The decarbonation of farms could be also a target of AVs, with self consumption on site of the electricity
- Social and political issues are hot: how to calm down the current far west experience?
- Shared or captured AVs? How many beneficiaries?
- A standard PV plant (eg panels density) is NOT COMPATIBLE with a « normal » crop production
- Farm Land speculation should absolutely be avoided : limit rents for land for PV projects

Thank you
for listening

Translation :

- Such a fertile crop land! What are you doing????

An electrical field!