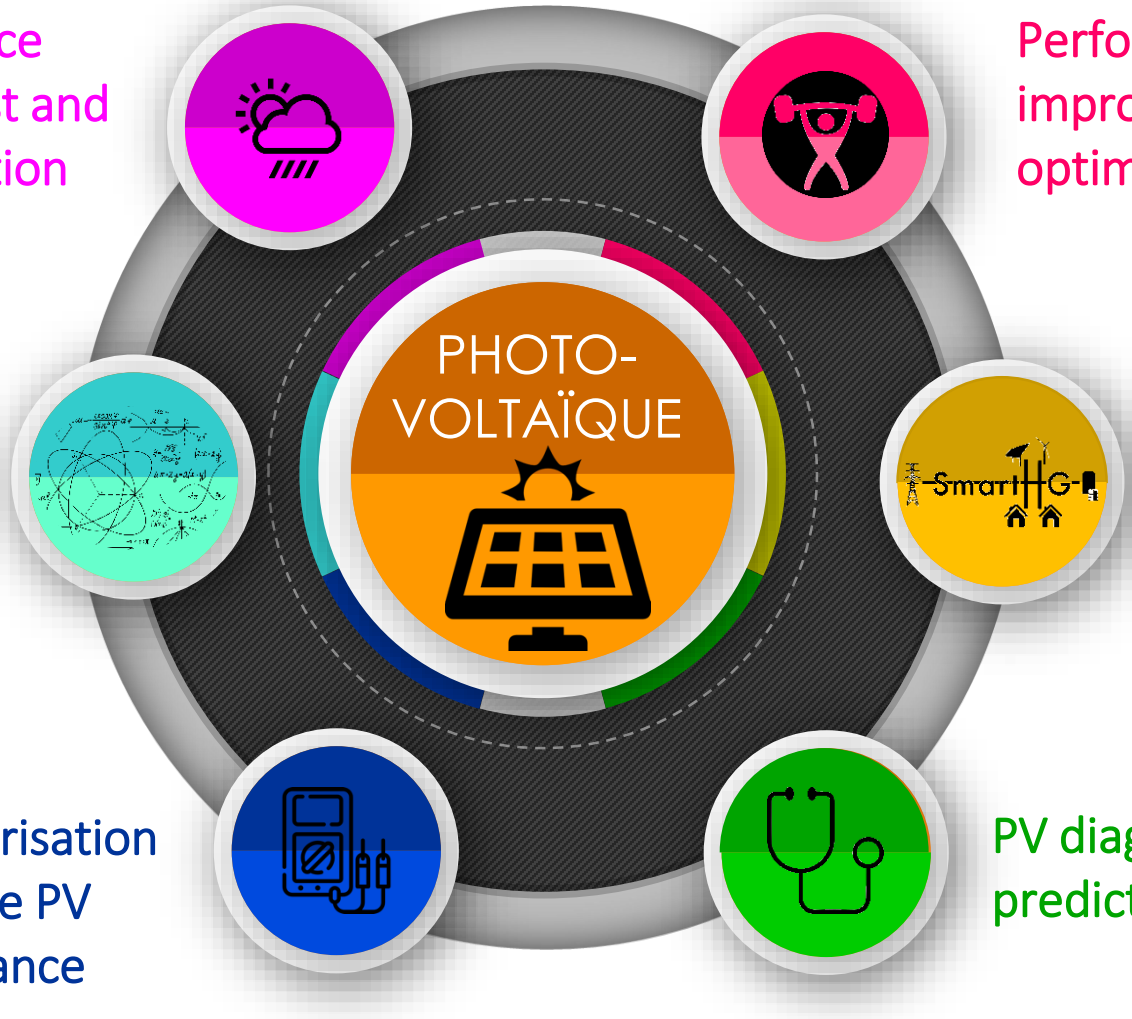
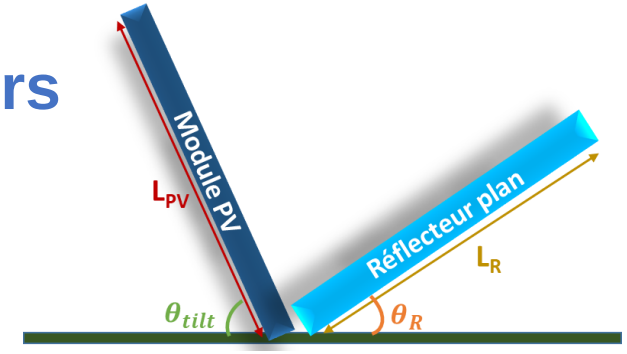
Renewable energy and microgrids

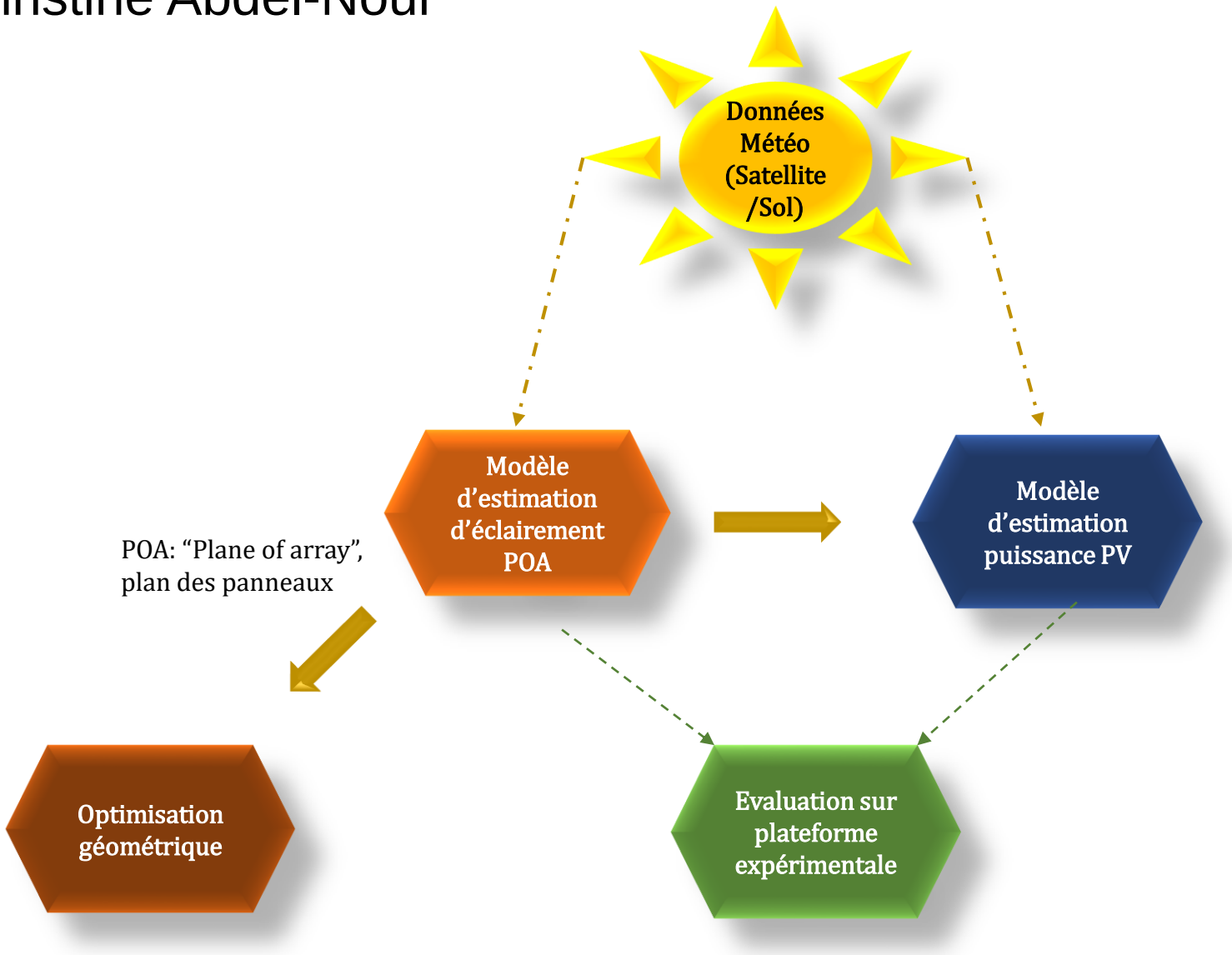


Anne Migan Dubois (GeePs)
Jordi Badosa (LMD)
Vincent Bourdin (LIMSI)
Christine Abdel-Nour (GeePs)
Fausto Calderon (GeePs-LMD-LIMSI)

Modélisation d'une installation photovoltaïque avec réflecteurs

Thèse de Christine Abdel-Nour





POA: "Plane of array", plan des panneaux

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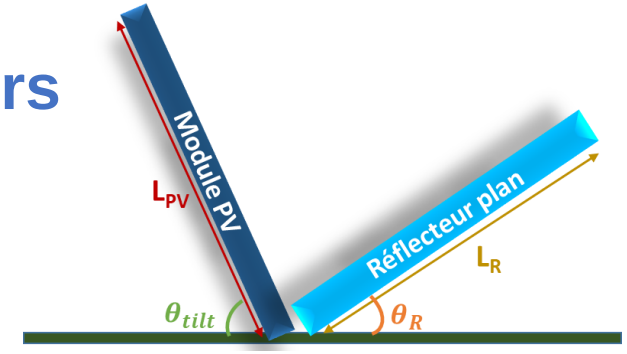
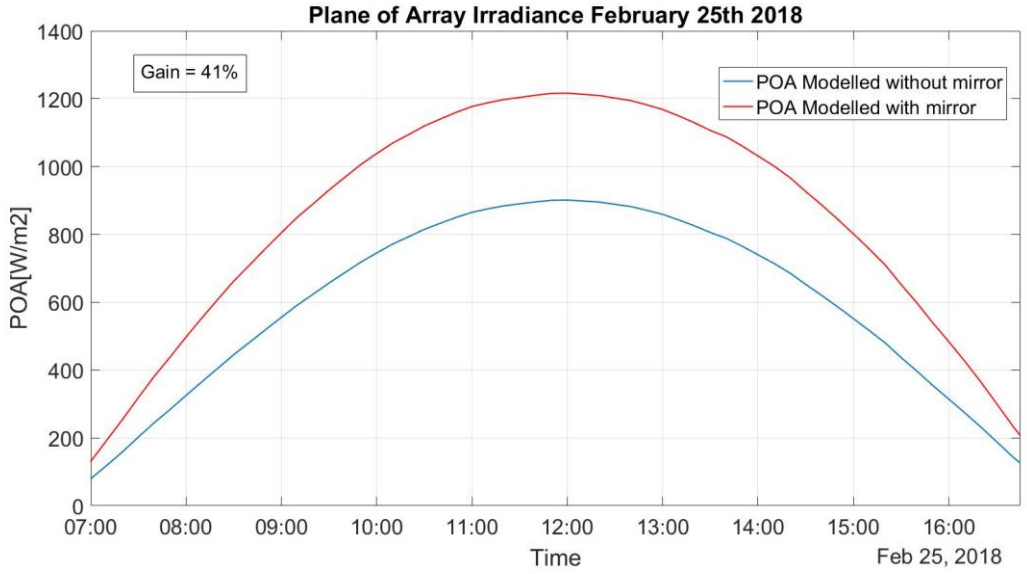
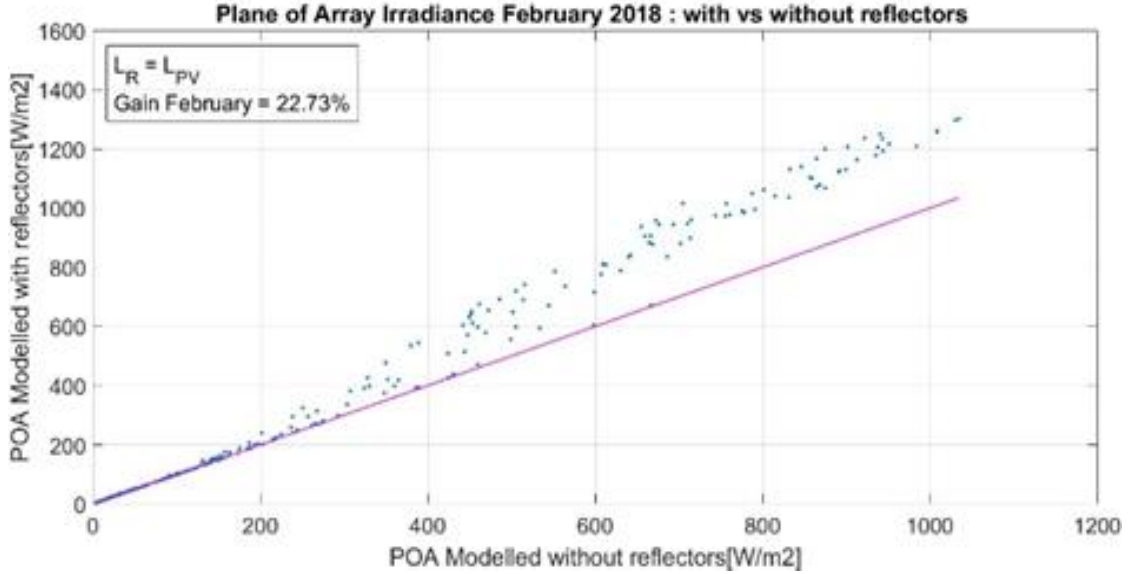


Optimisation du gain en éclairement sur le plan des panneaux (POA)

Cas d'application : Palaiseau, France





$$Gain = \left[\frac{\sum_{durée} POA_{Mir}\left(\theta_{tilt_{opt}}, \theta_{R_{opt}}\right)}{\sum_{durée} POA\left(\theta_{tilt_{opt}}\right)} - 1\right]$$

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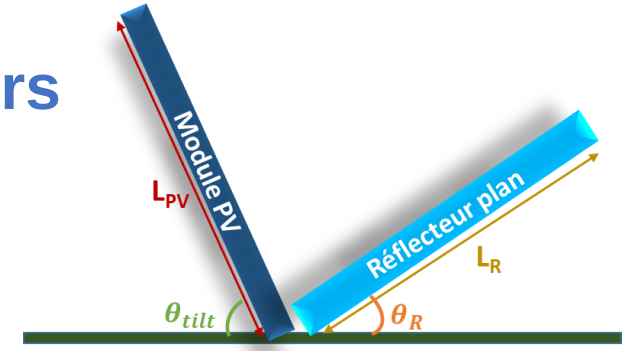
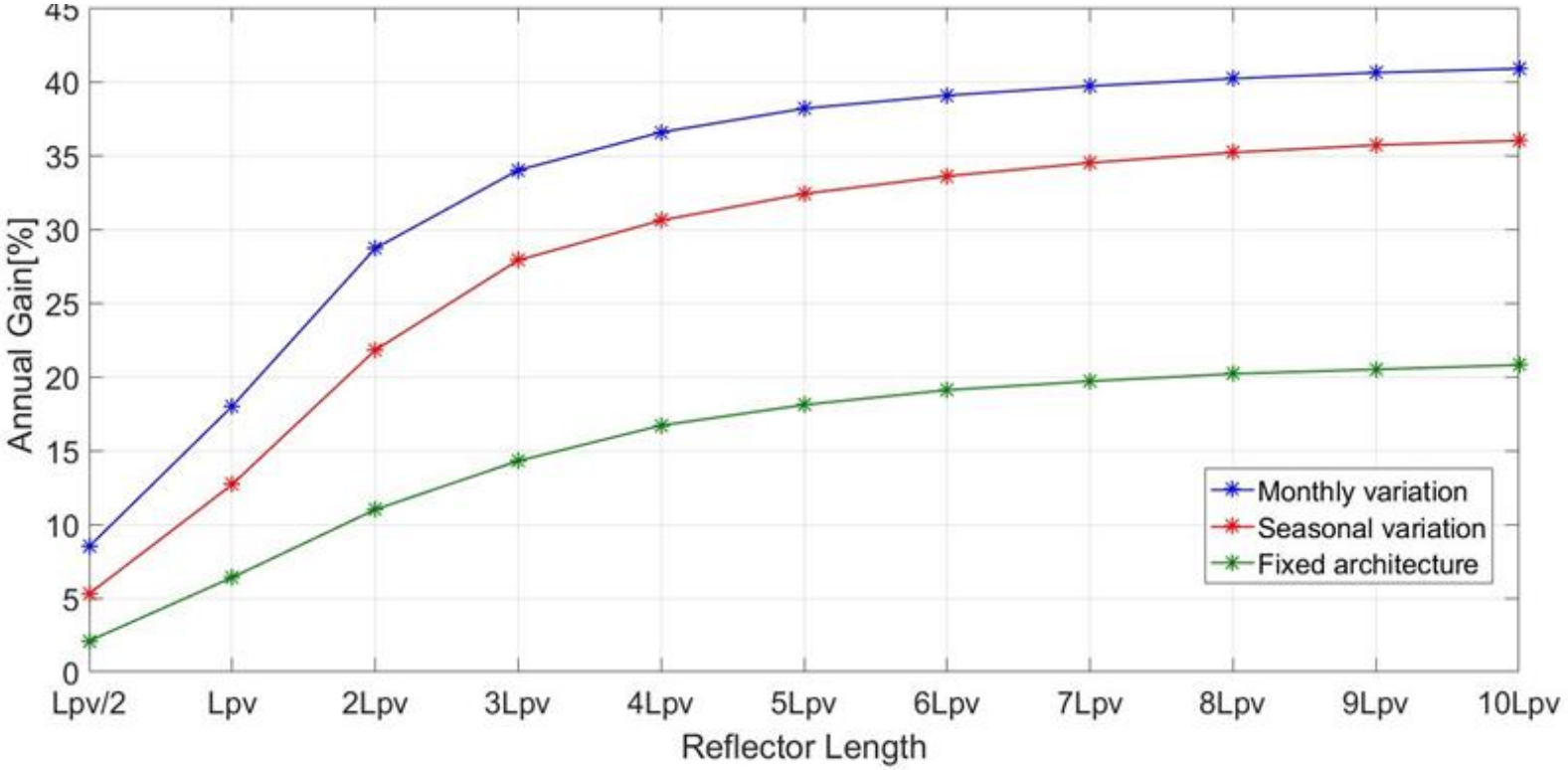


Gain en éclairement par rapport à la longueur du réflecteur



- Saturation du gain au-delà de 7L_{PV}
- Gain maximum théorique : 100%

Modélisation d’une installation photovoltaïque avec réflecteurs

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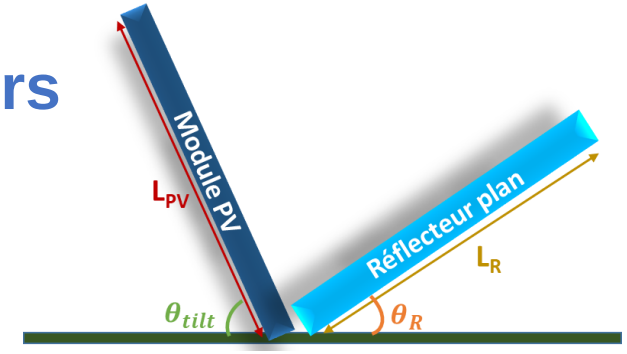
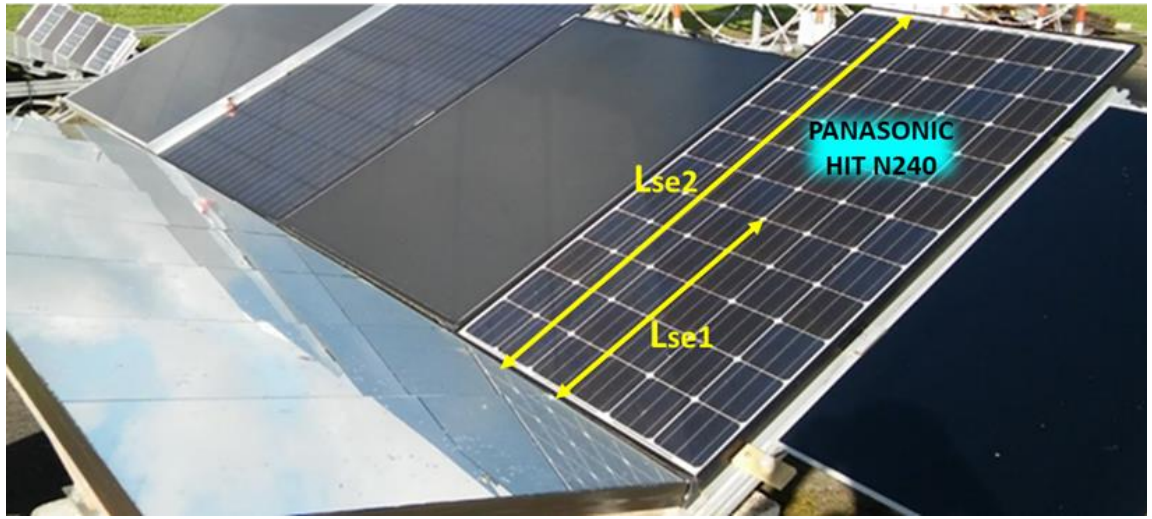


Evaluation des méthodes sur deux plateformes expérimentales

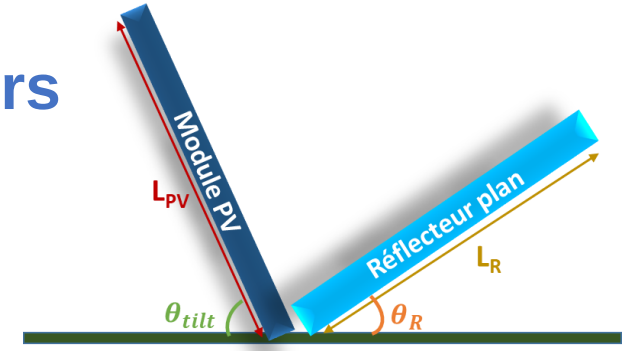
SIRTA, campagne en 2017



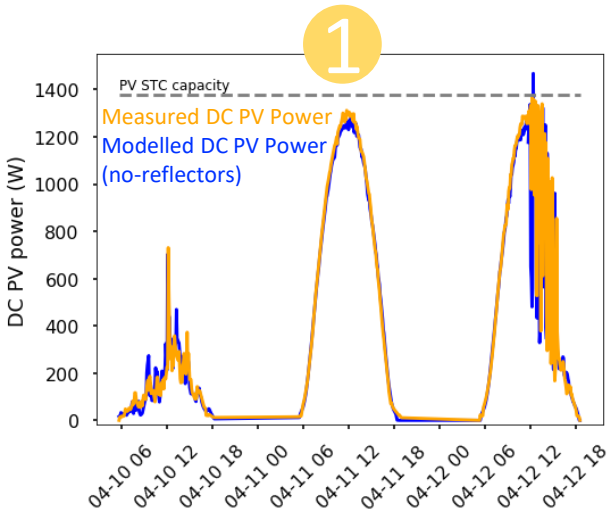
GeePs, installation depuis février 2019

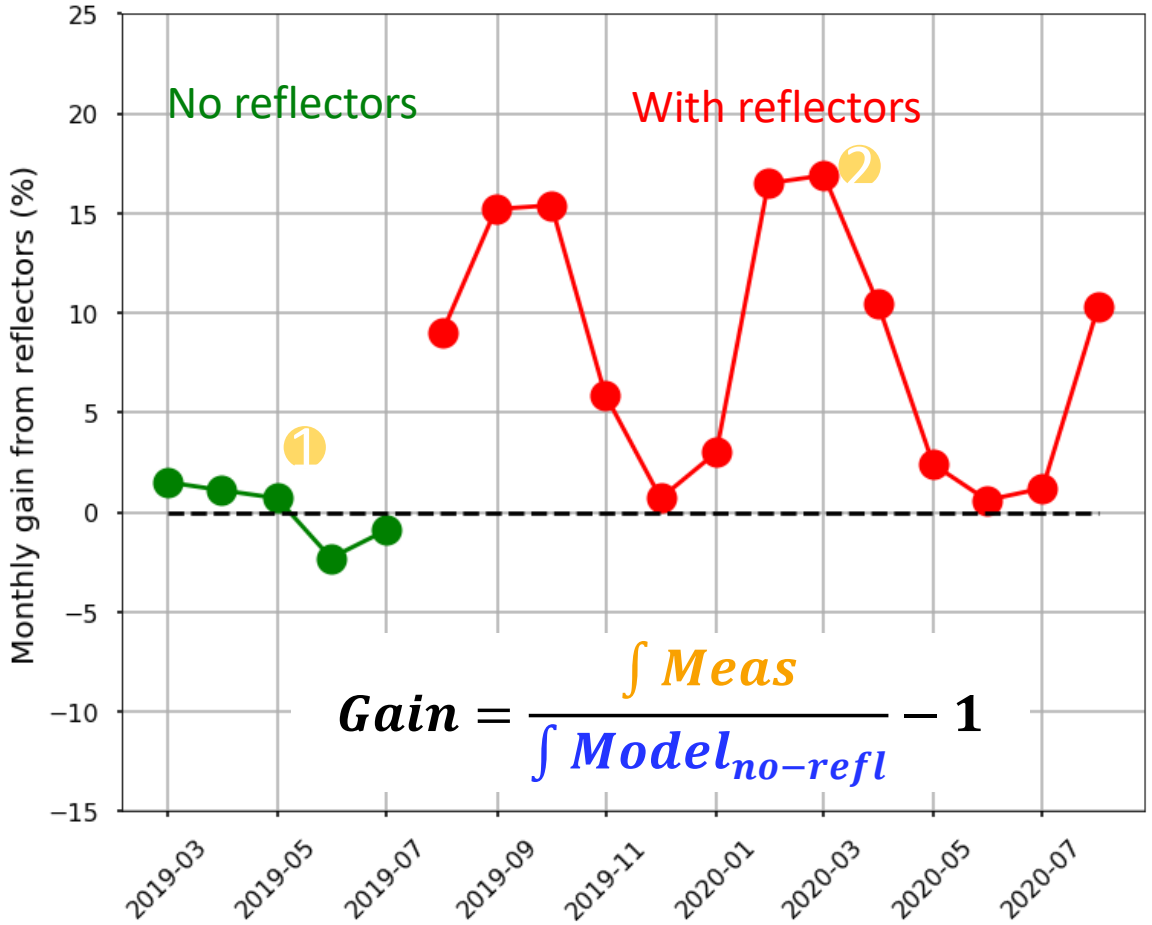
Modélisation d'une installation photovoltaïque avec réflecteurs

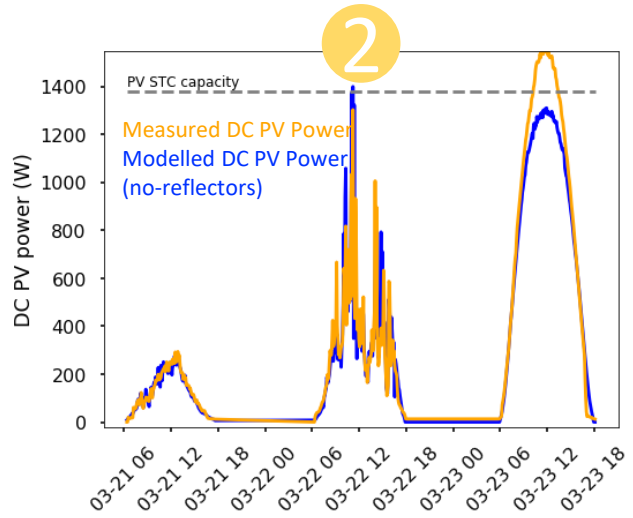
Thèse de Christine Abdel-Nour



Gain en énergie produite, apportée par les réflecteurs

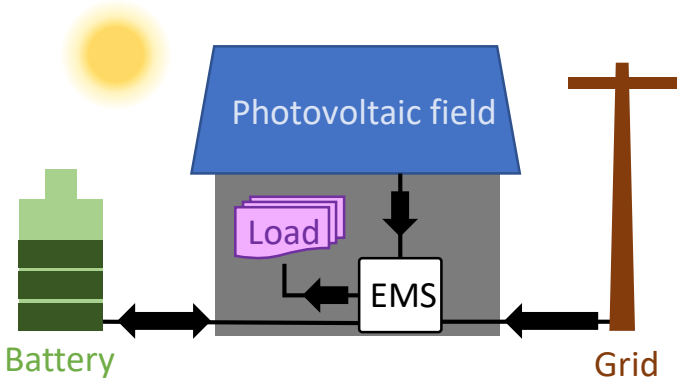


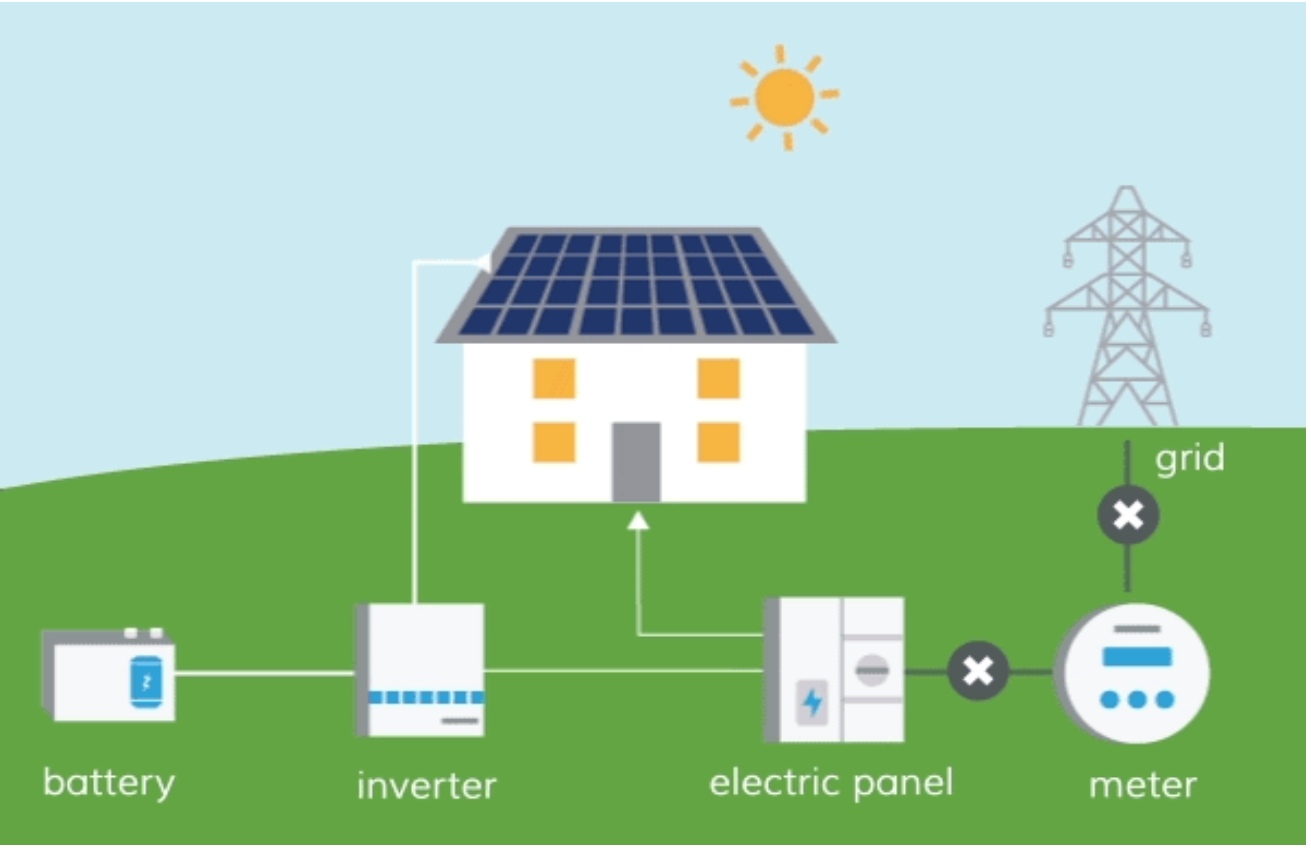




Photovoltaic power generation uncertainty forecast for microgrid energy management efficiency enhancement

Thèse de Fausto Calderón





- DG is based on the concept of producing the electricity where it is needed
- Microgrids (MGs) emerge as the technical solution to achieve this goal
- A MG is a self-contained power system, with energy storage means powered mostly by IRES intended to satisfy a target load©

Photovoltaic power generation uncertainty forecast for microgrid energy management efficiency enhancement

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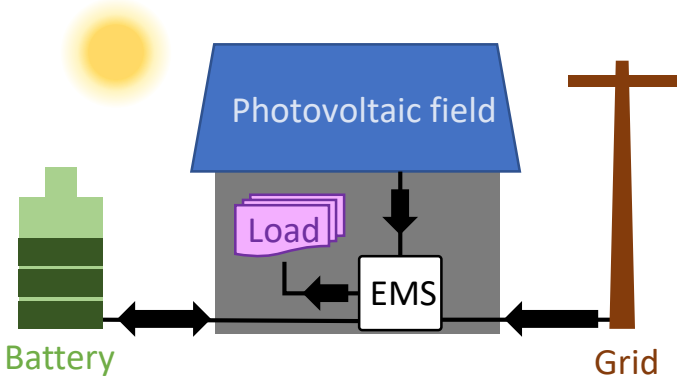

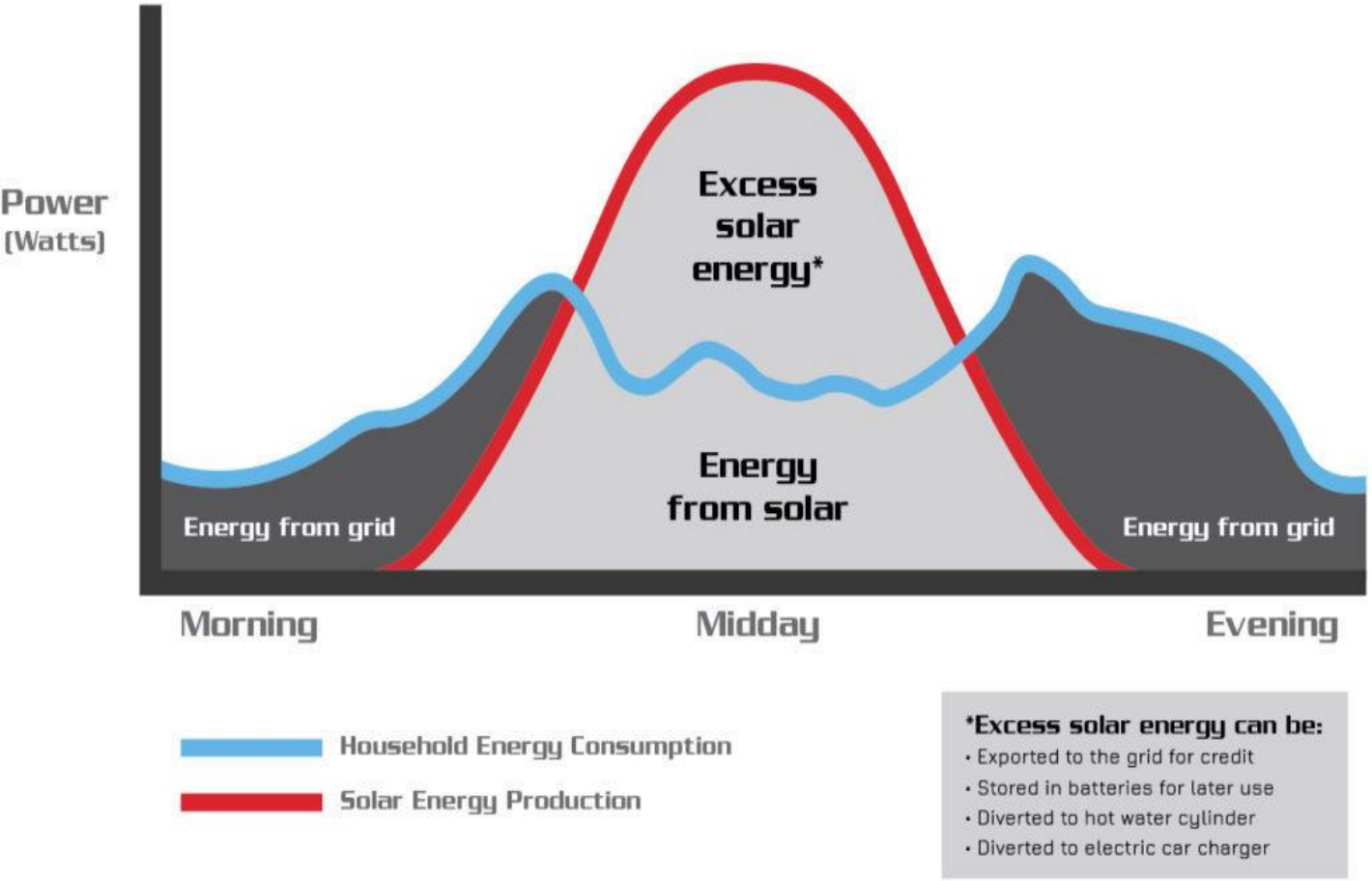

- IRES production and consumption profiles do not match
- Battery Storage (BS) and a Grid Connection help to solve this problem
- But the mismatch is variable & uncertain, then dispatching BS and Grid is not trivial, specially if we want to **optimize performance**

Figure taken from: https://www.nzsolarpower.com/how-solar-power-works/

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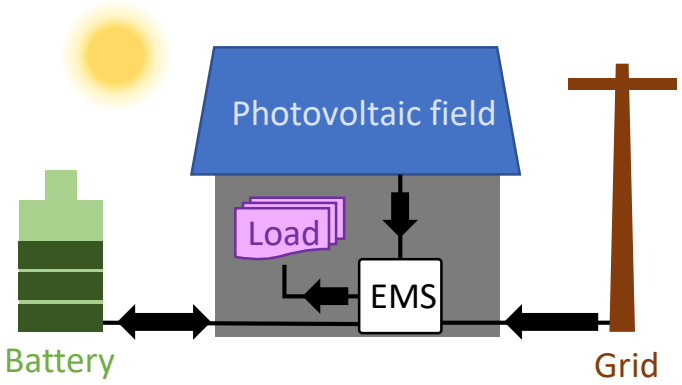
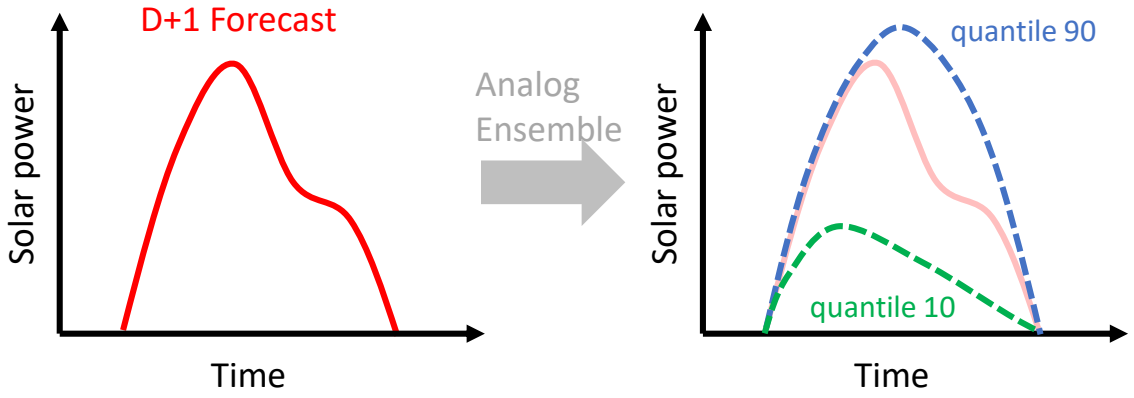
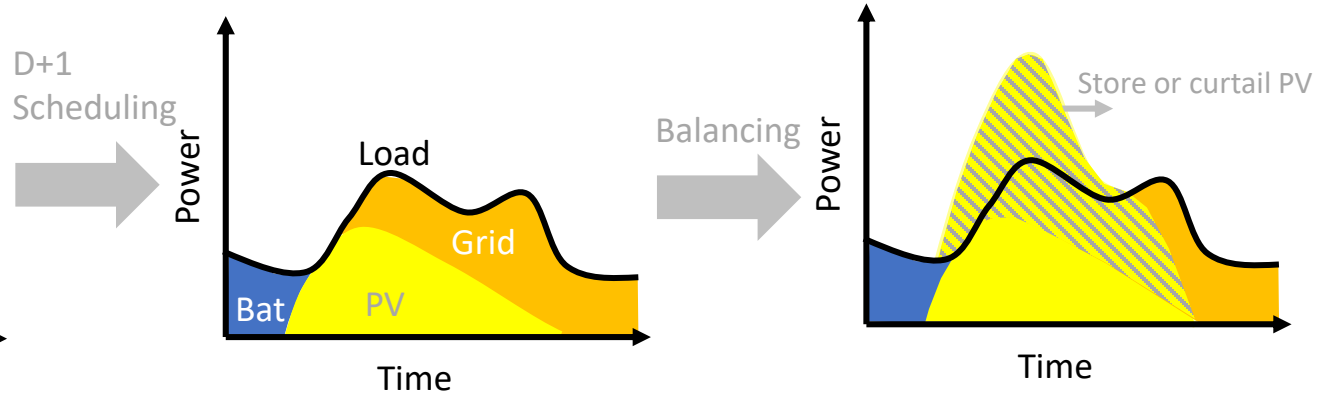


PV forecast uncertainty



Two-step energy management



Min Energy Cost
Min CO2
Min Grid P peaks

Grid commitment

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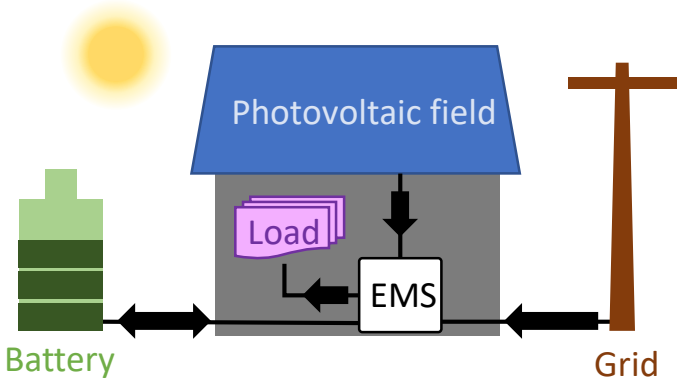

Results: Proposed scheduling strategies vrs reference strategies

No scheduling Scheduling

Proposed Strategy strategy	Reference strategy NO MG	PVB_{max}	PVB_{max-}	Performance indicator
EC_{min}-$AnEn_{\tau=0.5}$	-14.5%	-10.3%	-8.8% ($AnEn_{\tau=0.1:0.2}$)	EC (€/kWh)
$CO2_{min}$-$AnEn_{\tau=0.3}$	+3.3%	-6.0%	-1.6% ($AnEn_{\tau=0.1}$)	CO2 (gCO_2/kWh)
GPP_{min}-$AnEn_{\tau=0.4}$	-36.5%	-9.0%	-36.5% ($AnEn_{\tau=0.1:0.9}$)	GPP (€)

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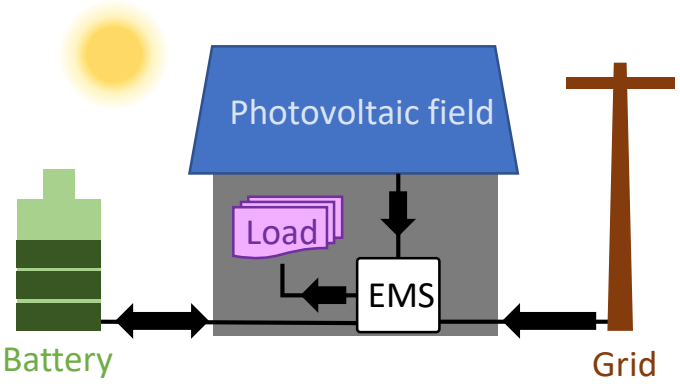

Results on seasonal optimisation

Performance with respect to NWP

Performance indicator	Winter	Spring	Summer	Autumn
EC (€/kWh)	0.236 (-1.7%)	0.114 (-2.6%)	0.091 (-5.2%)	0.173 (-2.2%)
CO2 (gCO2/kWh)	58 (-2.1%)	53 (-0.6%)	56 (+1.1%)	89 (-24.1%)
GPP (kW)	15 (-16.7%)	12 (0%)	9 (0%)	15 (0%)
GC (%)	100 (+0.4%)	100 (+1.8%)	100 (+1.6%)	100 (+0.1%)

- The proposed scheduling strategies that use **Q**uantile **F**orecasts outperform NWP in most of the seasons

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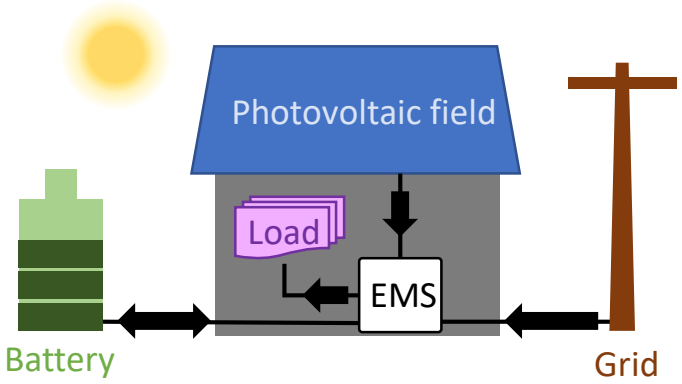
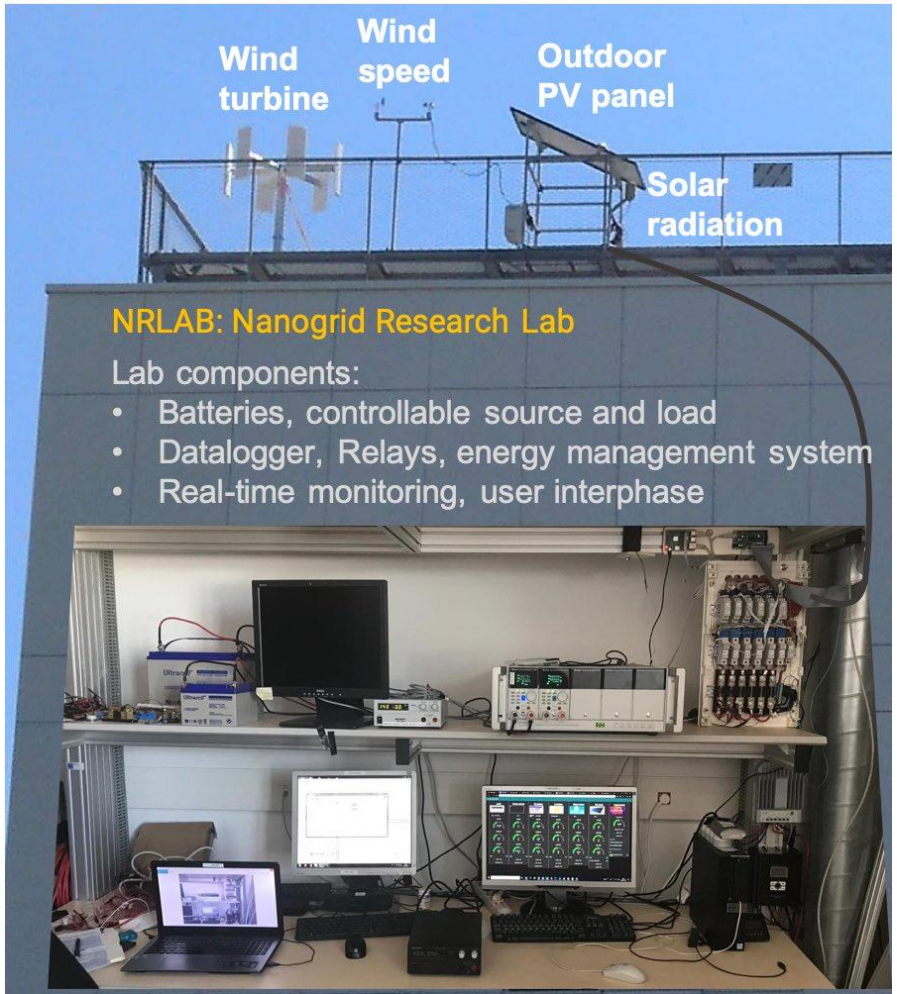


Nanogrid Research Lab (NRLAB)



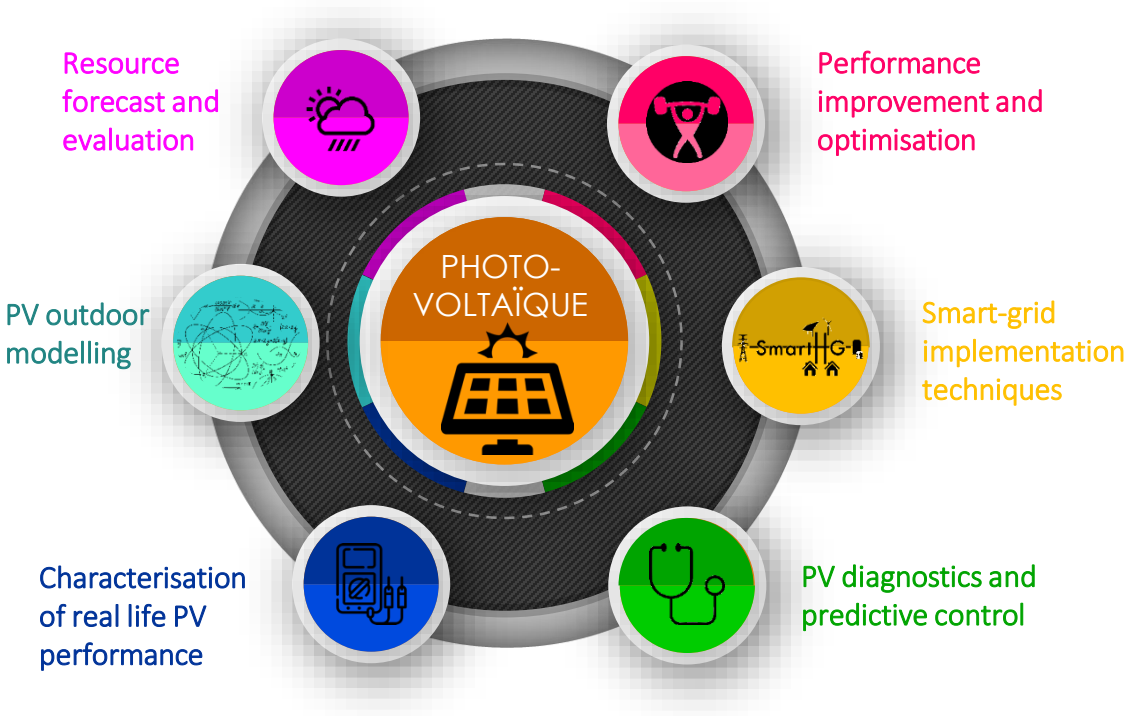
Bâtiment Drahi-X Novation Center, Ecole Polytechnique

Projet PLEINERGIE

Plateforme d'intégration interdisciplinaire pour la recherche et enseignement en énergie solaire, éolienne et les micro-réseaux.

Schéma des moyens de production, de capacité de stockage et de gestion pour le micro-réseau PLEINERGIE, qui permettront atteindre un taux d'autoproduction de plus de 50% pour les espaces dédiés à l'autoconsommation dans le bâtiment SIRTA-2020

Merci pour votre attention



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