imagen: Freepik.com

BUSINESS SKILL LABS TRAINING

A business opportunity: Grid connected PV self consumption

Rafael Jiménez Castañeda

Inoma renovables, sl
Co-funded by the Erasmus+ Programme of the European Union
DALILA
www.inoma.es
www.dalilaproject.eu

PRELIMINAR CONCEPTS
CENTRALIZED, DECENTRALIZED, DISTRIBUTED

In general, the concept DECENTRALIZED and DISTRIBUITED is not the same, i.e. computer or politics world.

Centralized: From one point are taken all decision or control systems

Decentralized: All or some decision are taken from different points

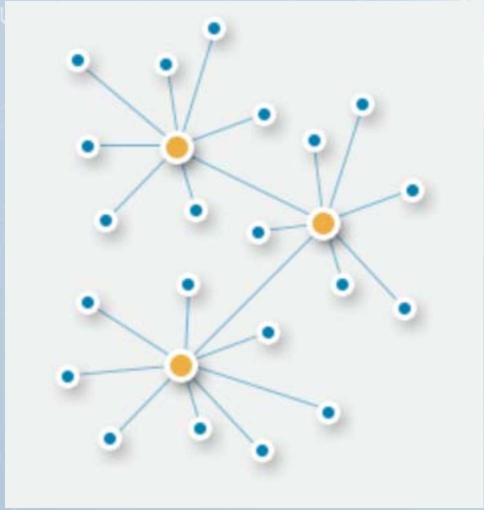
Distributed: All or some decision are taken in multiple point, very close of final destination

Source: SBMlibre

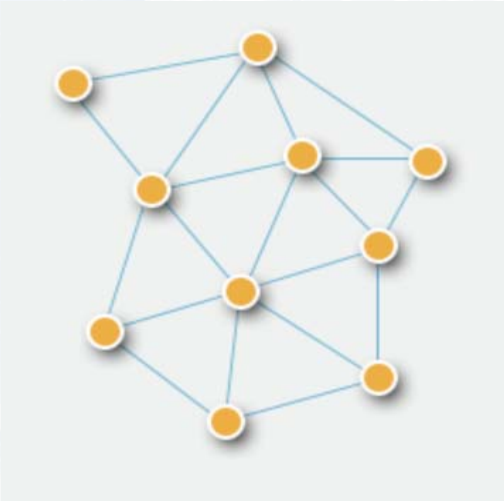
CONCEPTS CENTRALIZED, DECENTRALIZED, DISTRIBUTED IN ELECTRIC POWER SYSTEMS

Electric Power system. When we talk **decentralized or distributed electric generation,** the concepts is the same in this sector

CENTRALIZED ELECTRIC GENERATION CONCEPT

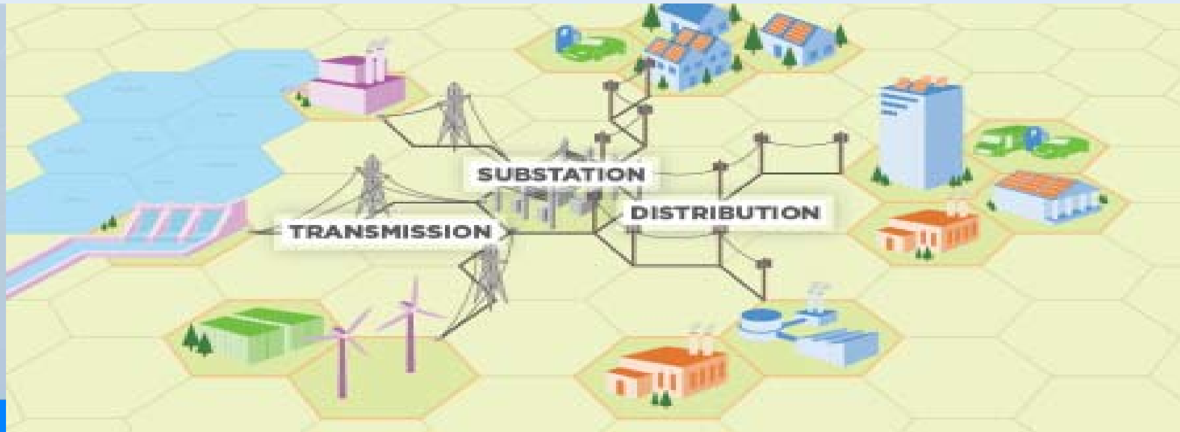


DECENTRALIZED OR DISTRIBUTED ELECTRIC GENERATION CONCEPT



POWER ELECTRIC SYSTEM CENTRALIZED vs DECENTRALIZED

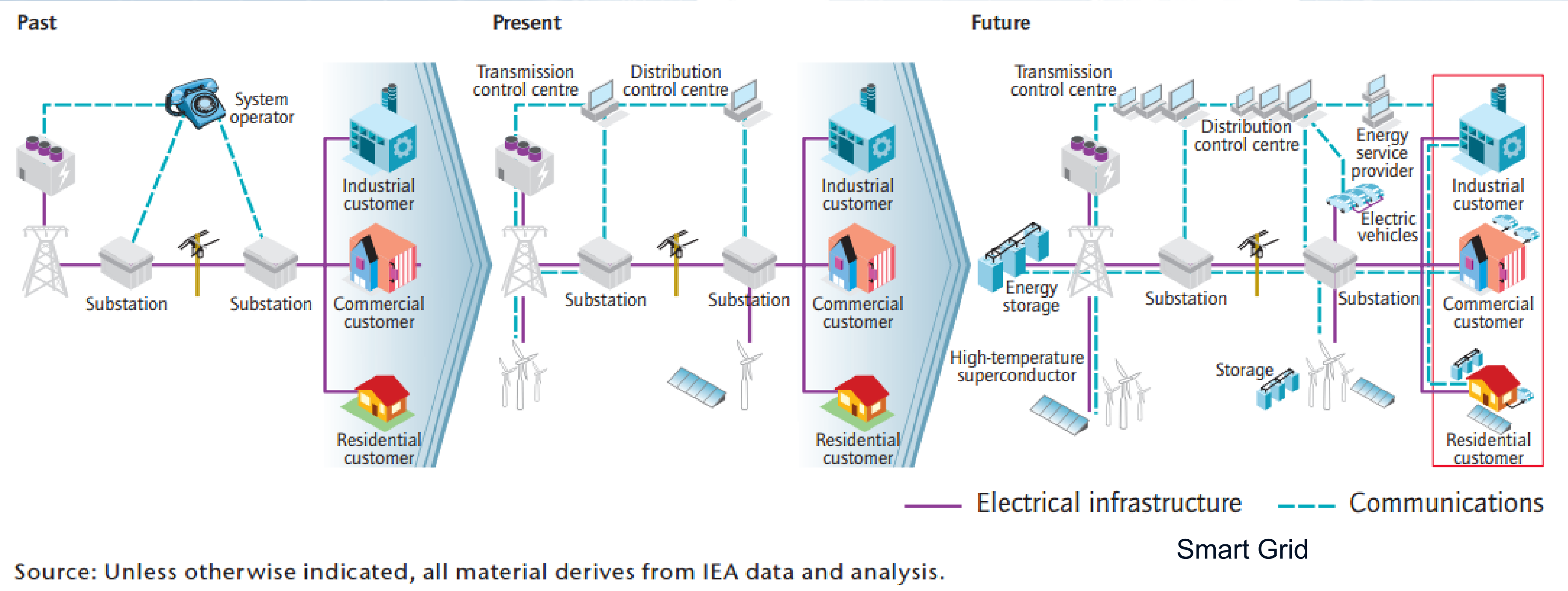
- Great power station sited very far from consumption points
- Important Electric Power Lines are required, to transport and distribute the electric energy to great distances. (critical in large countries)
- High Energy Losses in the transport and distribution power grids. Until 10-15% of the total power generated in Spain
- Social and environmental problems when the electric infrastructures are built
- Normally, the primary energy used is not renewable. In consequence, severe environmental impacts



POWER ELECTRIC SYSTEM CENTRALIZED vs DECENTRALIZED

- The Electric Energy Generation is very close with the consumption point. (Normally, even in the same point)
- Reduce the overload in the Electric Power Transmission Lines, even increasing the energy consumption.
- Reduction of Energy Losses in the Power Electric System
- Great Environmental benefits. Reduce greenhouse gases emission
- The final cost of the energy supplied to the user is very competitive in comparison with the electric market
- Normally, the primary energy used is renewable, specially PV.

POWER ELECTRIC SYSTEM EVOLUTION



Smart Grid

The challenge: From classical electric power grid to the Smart Power Grid

POWER ELECTRIC SYSTEM REGULATION TO DEVELOP THE ENERGY DECENTRALIZATION

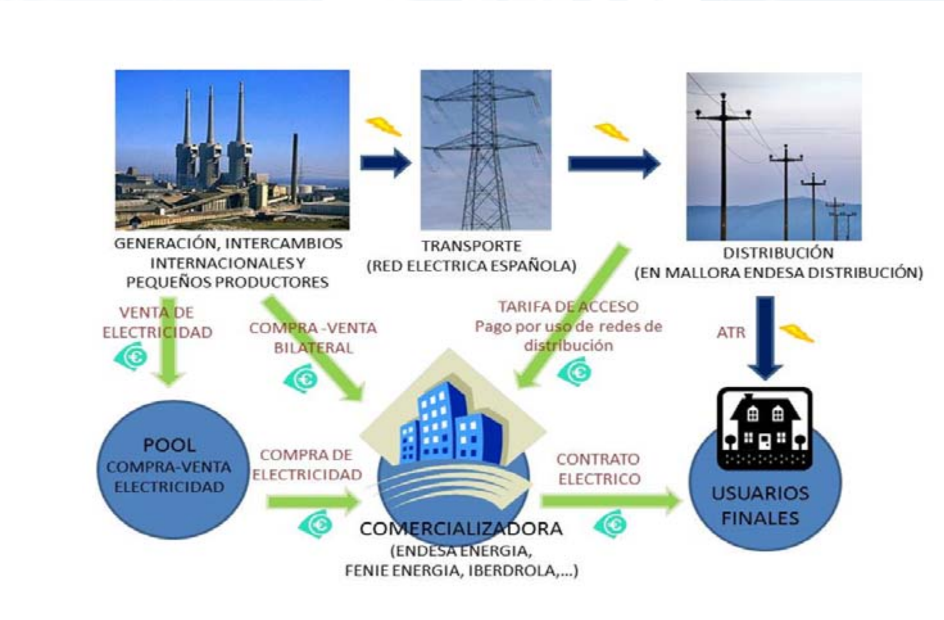
ELECTRIC ENERGY MARKET LIBERALIZATION

Activities separation
Generation, transmission, distribution, Commercialization and Consumers

The consumer can buy the energy in a free market (multiple sellers), without regulated price of the electric energy

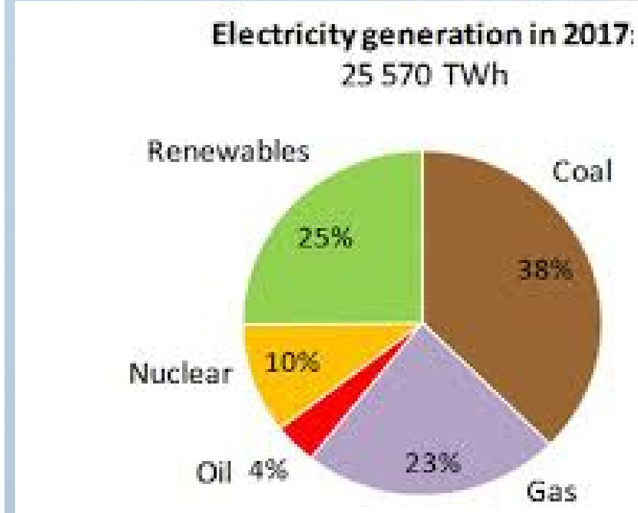
The consumer can do local energy management: consume, storage, self-consumption

Each consumer can have a new role, producer+consumer ("PROSUMER")

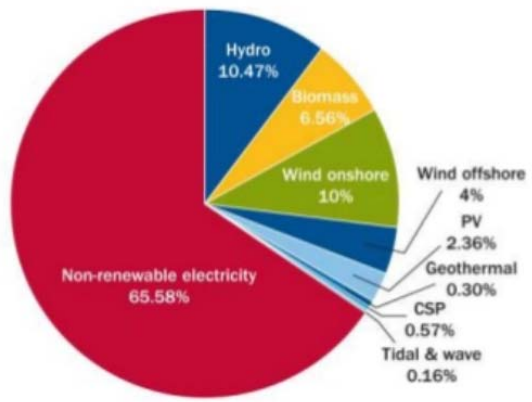


ELECTRIC ENERGY MARKET LIBERALIZATION

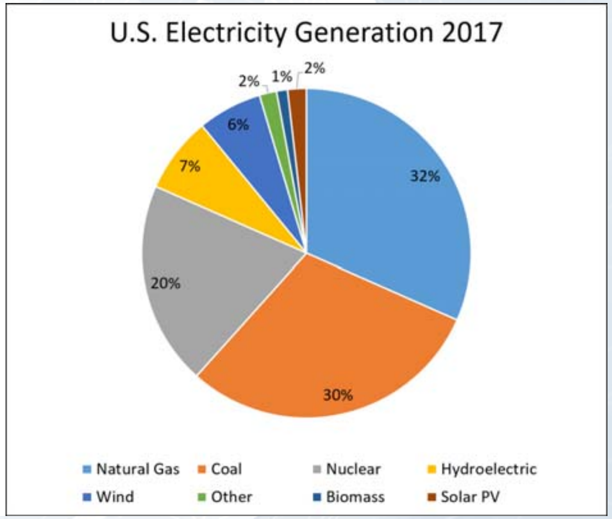
This liberalization of the market let the free competence among different energy technologies, conventional (Non-Renewable), with Renewable, in the energy mix in each countries. Participating large and small producers.



World Data 2017: Source IEA



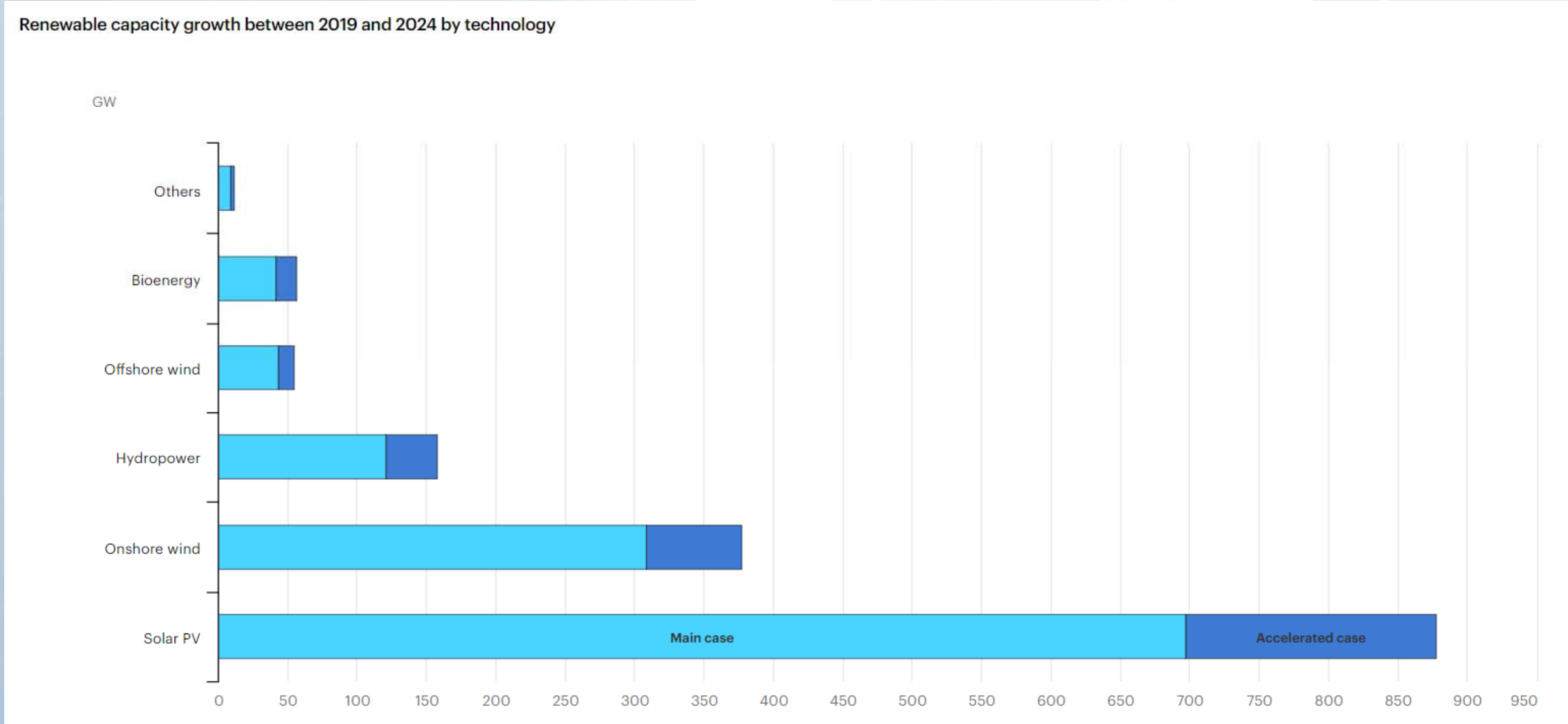
EU Data 2020: Source EWEA



US Data 2017: Source American Experiment

ELECTRIC ENERGY MARKET. FORECAST PV GROWTH

The global PV market has a very good forecast for the next years, probably could be the most important.



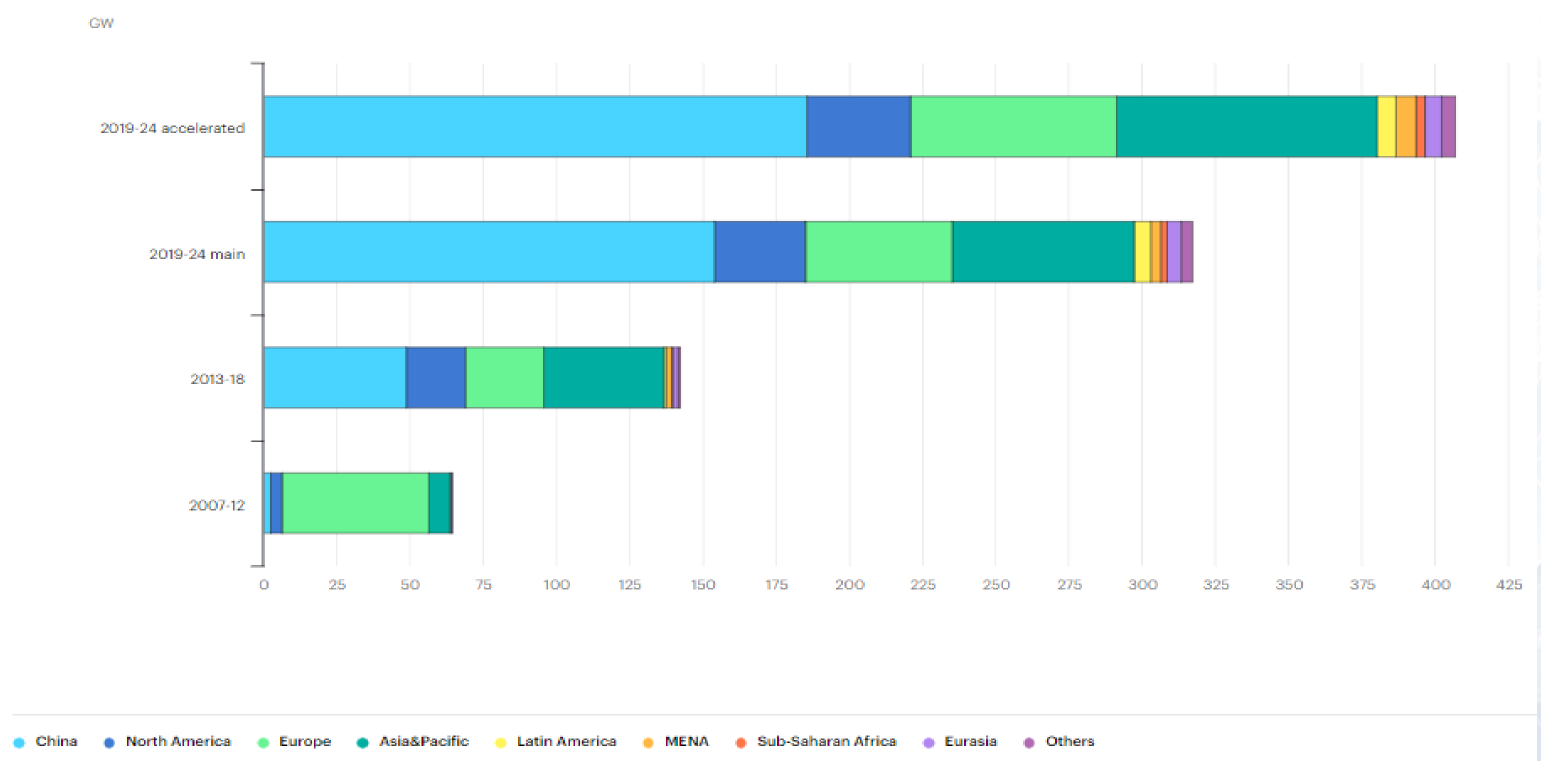
Nowadays, the winner is PV technology

Source IEA

ELECTRIC ENERGY MARKET. PV DISTRIBUTED GENERATION GROWTH FORECAST

The distributed PV market will have a strong growth in the world for the next years.

Distributed solar PV capacity growth by country/region



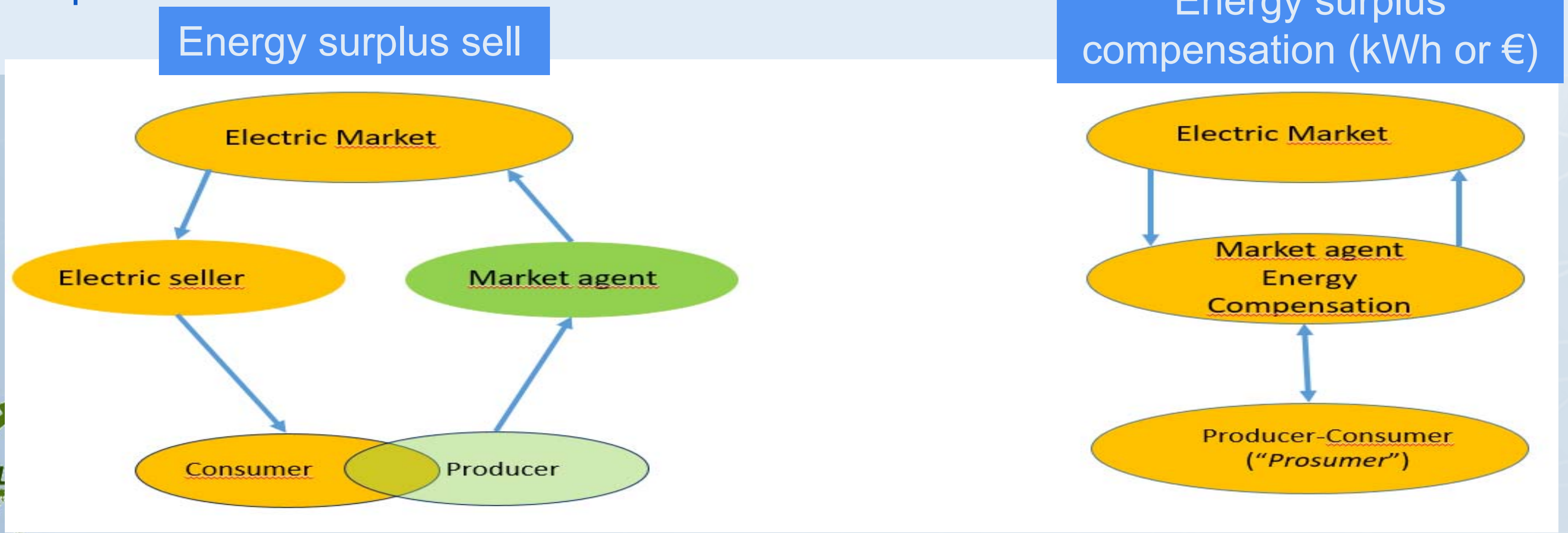
Source IEA

PV SELF-CONSUMPTION CONCEPTS

INSTANT SELF-CONSUMPTION: This mean the instant compensation of the energy between energy generated and consumption, in the same moment. If it be have surplus generation this is injected in the grid but without any compensation. (a gift for the grid). Other possibility is install devices to don´t let energy surplus to the grid (mandatory in Spain for system without energy surplus)

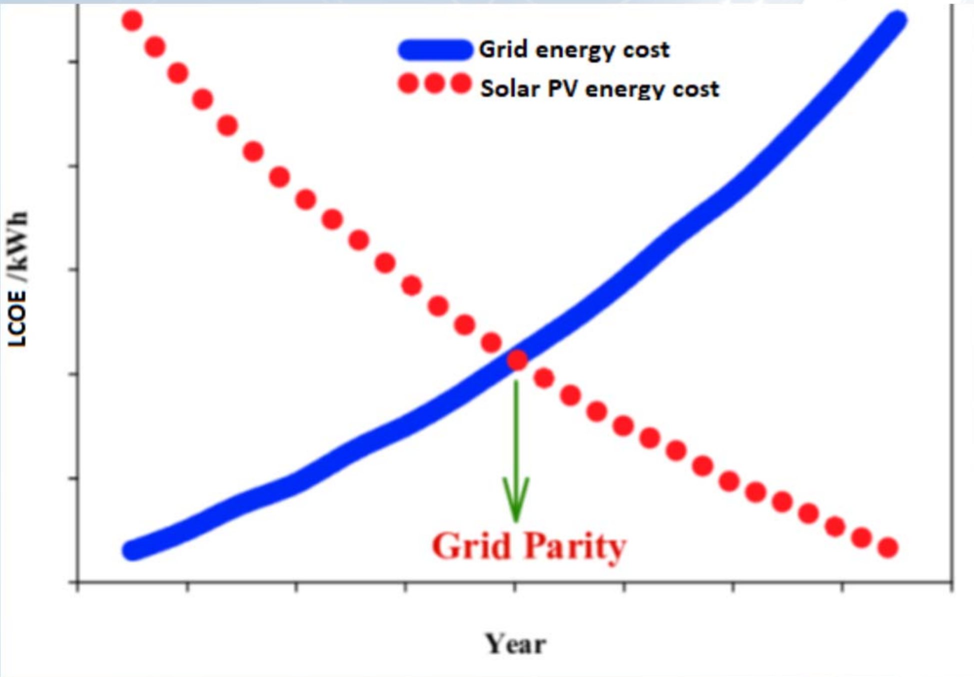
NET METERING: The surplus generation of energy PV generated over the consumption, can be compensated (kWh) to get a reduction in the net energy consumption at the final of the period established in the country regulation for the liquidation.

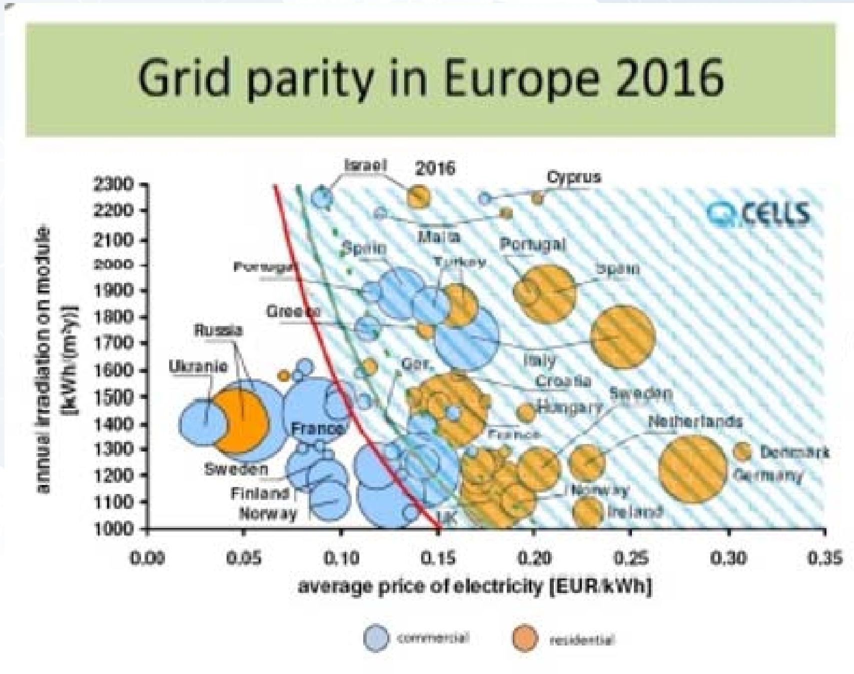
NET BILLING: The surplus generation of energy PV generated over the consumption, can be sold or compensated (Credit in monetary value) producing an economical discount in the energy invoice (in the compensation case) applied at the final of the period established for the liquidation



PV SELF-CONSUMPTION CONCEPTS

GRID PARITY: Is the point where the analyzed alternative energy source (PV in this case), can generate electricity with levelized cost (LCOE)1 equal to the end consumer´s retail price. This is the point to let a quick widespread development of the technology without subsidies or government support.



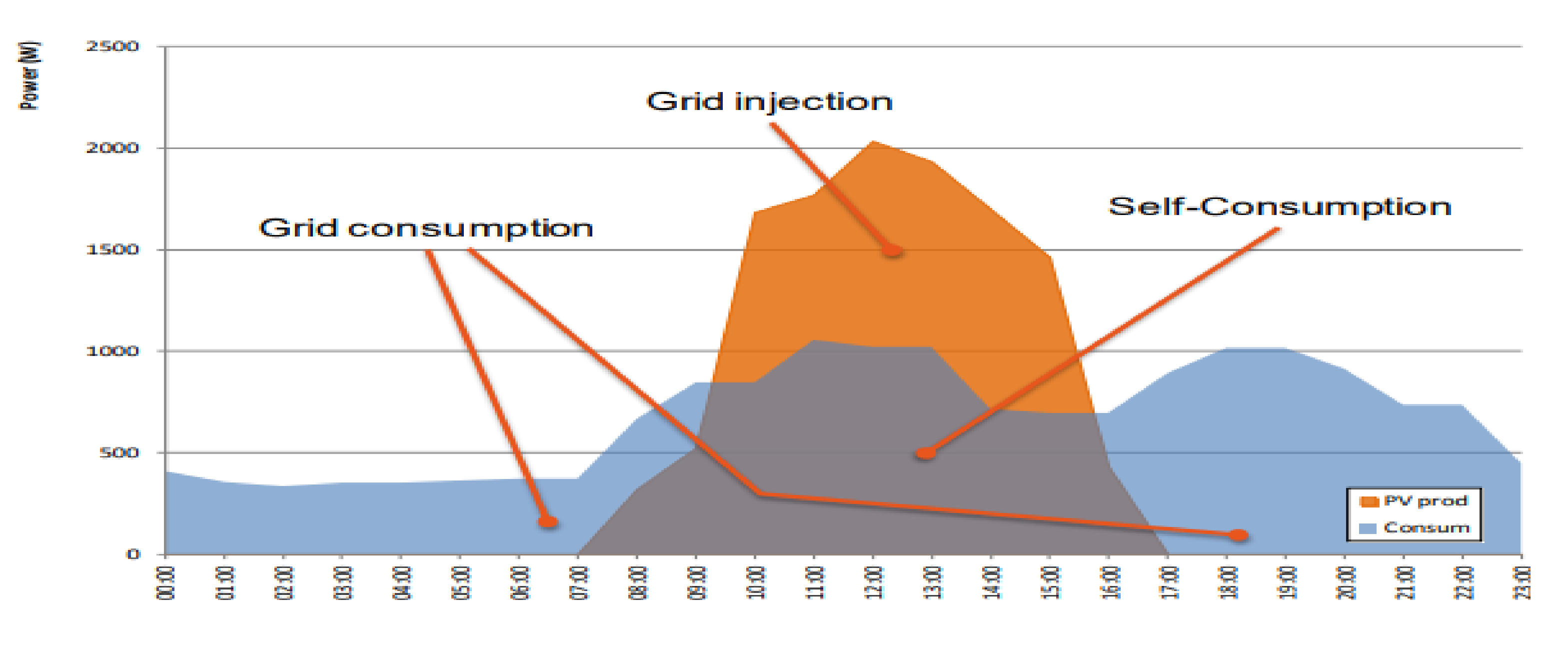


(1) LCOE (Levelized Cost of Electricity): Is the average revenue per unit of electricity generated required to recover the costs of building and operating a generating plant during all lifetime. Including capital cost, operations and maintenance cost, financing cost, etc

DALILA

PV SELF-CONSUMPTION CONCEPTS

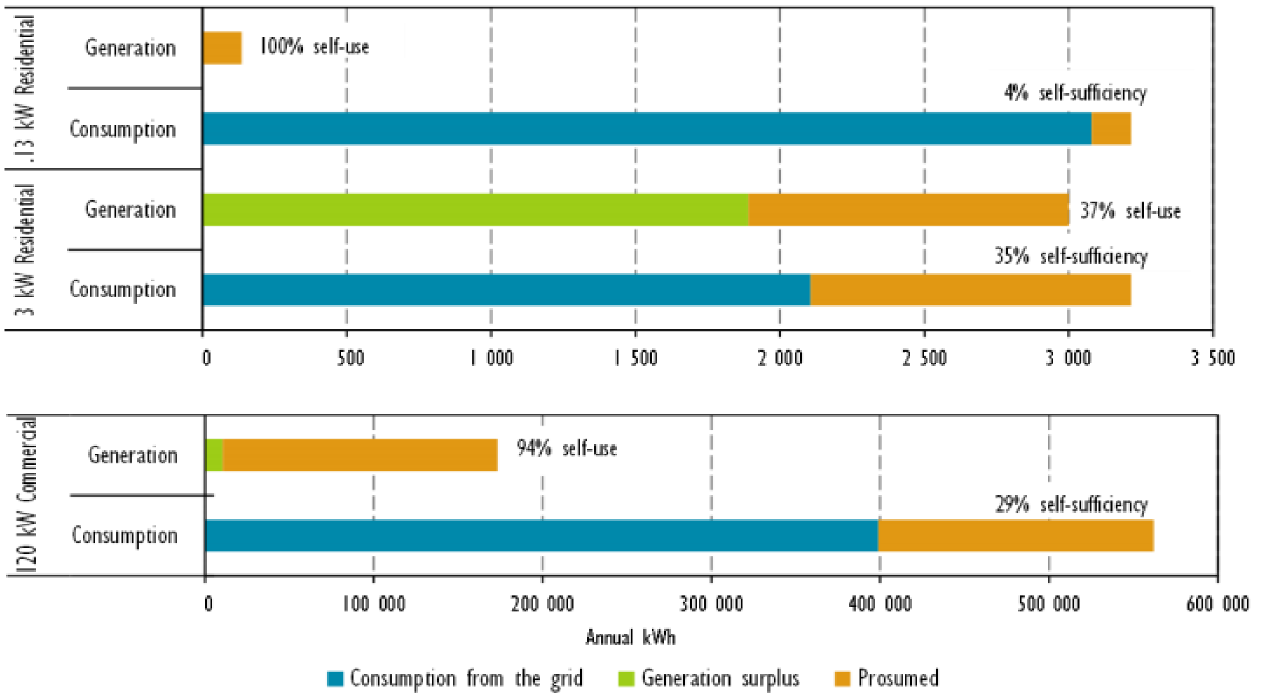
- Production and consumption daily profiles has an important role in the profitability of PV self-consumption installations
- Synchronization between both profiles are very important to get the maximum efficacy in PV self-consumption.
- The ideal situation is the maximum coincidence of the PV daily production hourly curve with the daily consume hourly profile !



Example hourly curves for one day. Source: IEA

PV SELF-CONSUMPTION CONCEPTS

Examples of Residential and Commercial consumers



Source IEA

Example Residential two different scenarios with the same annual consumption:
-Small PV installation 0.13 kW
-Big PV installation 3 kW

Example Commercial consumer with more high PV power installed, 120 kW

Example to learn that **self-consumption** (self-use) is not equal to **self-sufficiency**

PV SELF-CONSUMPTION LEGAL FRAME IN THE WORLD

Is clear, the PV self-consumption objective: Use the electric energy generated to reduce the electric invoice.

1º Energy buy reduction

2º Discount from monetary value of possible energy surplus, done in the electric invoice. (depend of the electric contract done)

Onsite Self-Consumption	Right to self-consume	• Self-consumption is legally permitted
	Revenues for self-consumed PV electricity	• Savings on the variable price of electricity from the grid
	Charges to finance T&D costs	• Additional costs associated to self-consumption such as fees or taxes may exist
Excess PV Electricity	Value of excess electricity	• Net metering: energetic compensation (credit in kWh) • Net billing: monetary compensation (credit in monetary unit)
	Maximum timeframe for compensation	• Self-consumption: real time (e.g 15 minutes) • Net metering and net billing: time frame is typically one year although there are some exceptions (from credits that can be rolled over to the following billing cycle to quarterly compensation)

Key:
- The same normally (red)
- Main differences (dark blue)

Source IEA

These topics, shown in the table, must be applied in each countries according of the **local regulations**

Please, FIRST of all, review the applicable national local regulation for PV self-consumption. Continuously is in evolution and change !

DALILA

PV SELF-CONSUMPTION MODELS IN EACH COUNTRY. CHECK LIST

We need analyze these parameters in each country to define the PV self-consumption scheme, according with the local regulations.

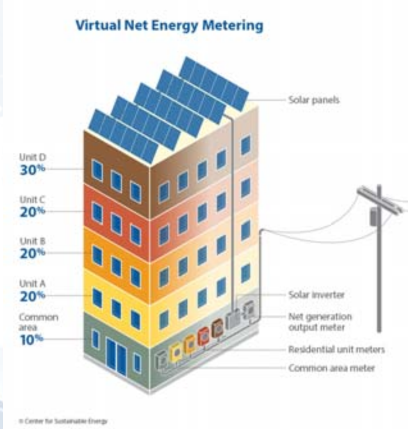
PV Self-consumption	1	Right to self-consume
	2	Revenues from self-consumed PV
	3	Charges to finance T&D
Excess PV electricity	4	Revenues from excess electricity
	5	Maximum timeframe for compensation
	6	Geographical compensation
Other system characteristics	7	Regulatory scheme duration
	8	Third party ownership accepted
	9	Grid codes and additional taxes/fees
	10	Other enablers of self-consumption
	11	PV System Size Limitations
	12	Electricity System Limitations
	13	Additional features

Source IEA

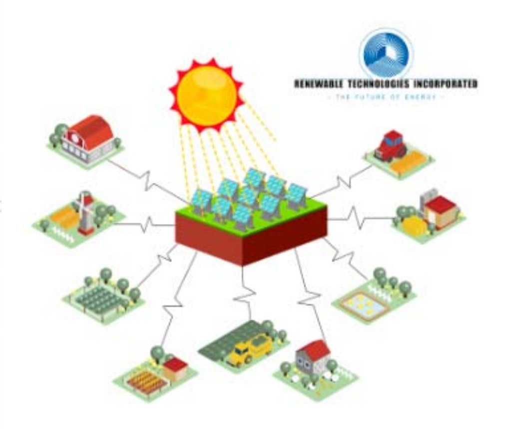
1.- Has the consumer legal frame to do PV-self-consumption?

2.- What are the extra benefits can be obtained further of saving on the electricity invoice? Like green certificates, fiscal benefit, etc…

3.- Must the customer pay specific taxes or electric tolls, for the use of T&D grids in self-consumption?



Source: Center for Sustainable Energy



Source: Renewable Technologies Inc.

PV SELF-CONSUMPTION MODELS IN EACH COUNTRY. CHECK LIST

We need analyze these parameters in each country to define the PV self-consumption scheme, according with the local regulations.

PV Self-consumption	1	Right to self-consume
	2	Revenues from self-consumed PV
	3	Charges to finance T&D
Excess PV electricity	4	Revenues from excess electricity
	5	Maximum timeframe for compensation
	6	Geographical compensation
Other system characteristics	7	Regulatory scheme duration
	8	Third party ownership accepted
	9	Grid codes and additional taxes/fees
	10	Other enablers of self-consumption
	11	PV System Size Limitations
	12	Electricity System Limitations
	13	Additional features

Source IEA

4.- How the local regulation give value to the energy surplus, same or less than retail electricity price, to apply a discount in the electric invoice? or some payment can receive for the energy surplus, as feed-in tariff or other?

5.-Time period to apply the compensation for surplus? (daily, monthly, yearly, indefinitely)

6.-Is it possible apply self-consumption mechanism as: Virtual Net Metering, Meter Aggregation or Peer to Peer?

Source: 100% Renewable

imagen: Freepik.com

PV SELF-CONSUMPTION MODELS IN EACH COUNTRY. CHECK LIST

We need analyze these parameters in each country to define the PV self-consumption scheme, according with the local regulations.

PV Self-consumption	1	Right to self-consume
	2	Revenues from self-consumed PV
	3	Charges to finance T&D
Excess PV electricity	4	Revenues from excess electricity
	5	Maximum timeframe for compensation
	6	Geographical compensation
Other system characteristics	7	Regulatory scheme duration
	8	Third party ownership accepted
	9	Grid codes and additional taxes/fees
	10	Other enablers of self-consumption
	11	PV System Size Limitations
	12	Electricity System Limitations
	13	Additional features

Source IEA

7.- The compensation mechanism, could have time limits in years?, or, is it unlimited?

8.- The local regulation lets one owner of PV self-consumption, different of the consumer. Using tools as leases or PPA (Power Purchase Agreement), between Producer and consumer

9.- Has the country model specific costs or taxes applied to the PV self-consumption for phase balancing, frequency-based power reduction, reactive power control, out power control, etc?, or is it the PV self-consumption free?

10.- Possible additional support. As example: storage bonus, TOU plans (Time Of Use) for demand management in off-peak, super off-peak or peak periods reducing the energy cost (specific plans for PV self-consumptions).

DALILA

PV SELF-CONSUMPTION MODELS IN EACH COUNTRY. CHECK LIST

We need analyze these parameters in each country to define the PV self-consumption scheme, according with the local regulations.

PV Self-consumption	1	Right to self-consume
	2	Revenues from self-consumed PV
	3	Charges to finance T&D
Excess PV electricity	4	Revenues from excess electricity
	5	Maximum timeframe for compensation
	6	Geographical compensation
Other system characteristics	7	Regulatory scheme duration
	8	Third party ownership accepted
	9	Grid codes and additional taxes/fees
	10	Other enablers of self-consumption
	11	PV System Size Limitations
	12	Electricity System Limitations
	13	Additional features

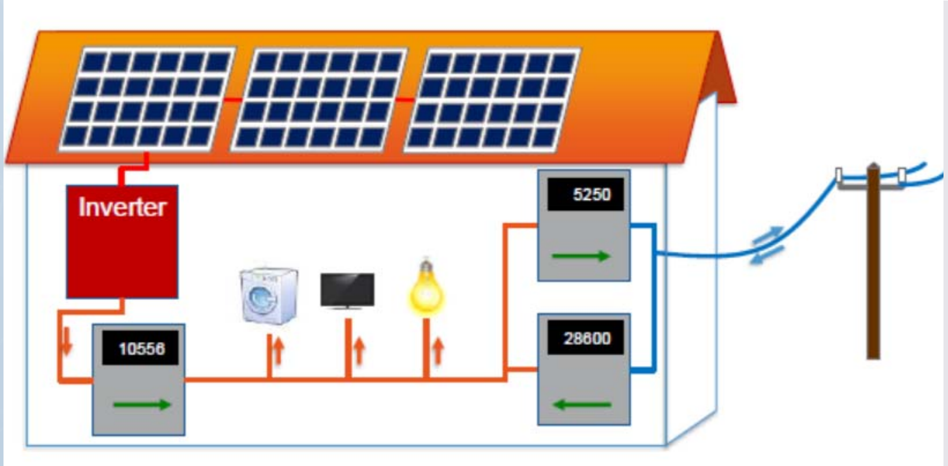
Source IEA

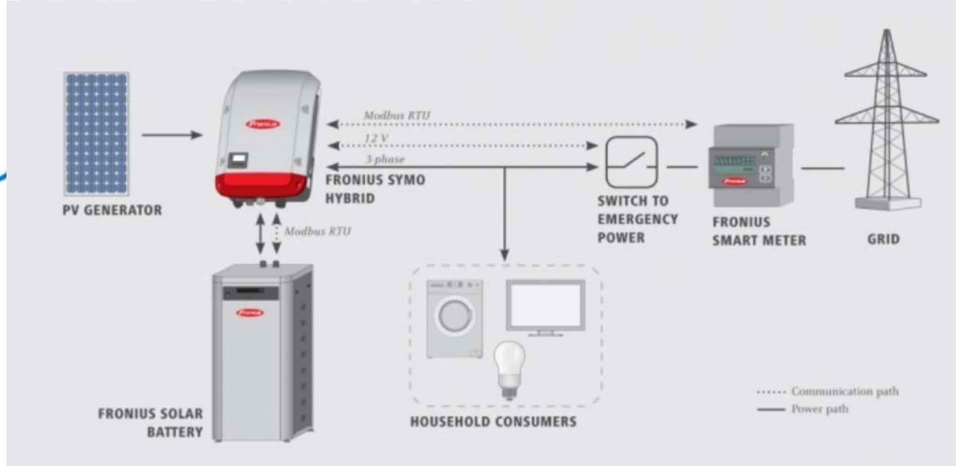
11.- If has a limits in the country self-consumption, which are?

12.- The country electric system could have limits for self-consumption penetration, which are?

13.- Has the country other rules, circumstances or limits for self-consumption?

PV SELF-CONSUMPTION CONFIGURATIONS



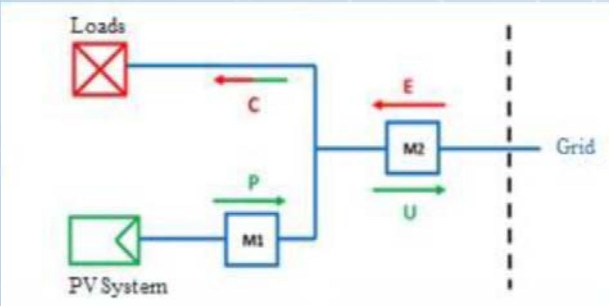


Individual consumer without battery

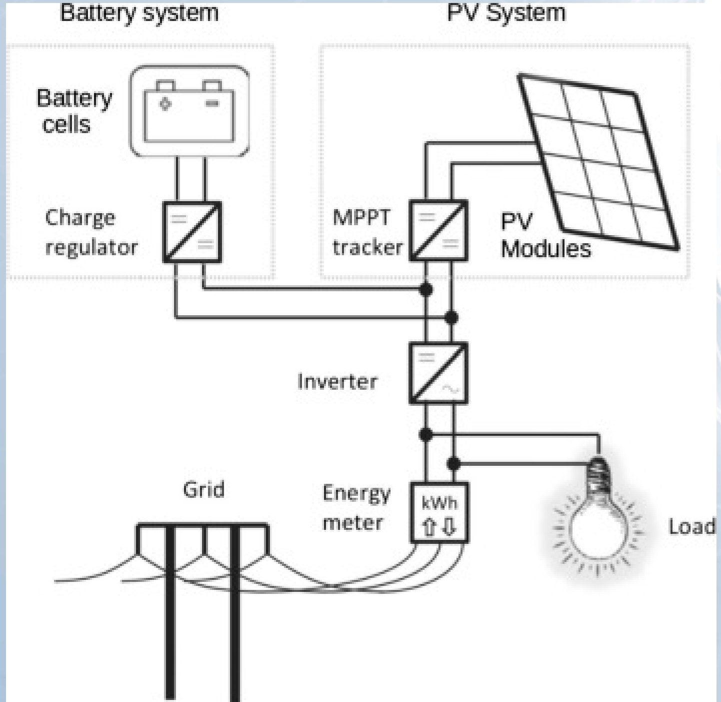
Individual consumer with battery storage system

Collective consumer without battery

PV SELF-CONSUMPTION ENGINEERING



Simple electric concept



MAIN ELEMENTS

Source: Solarcity

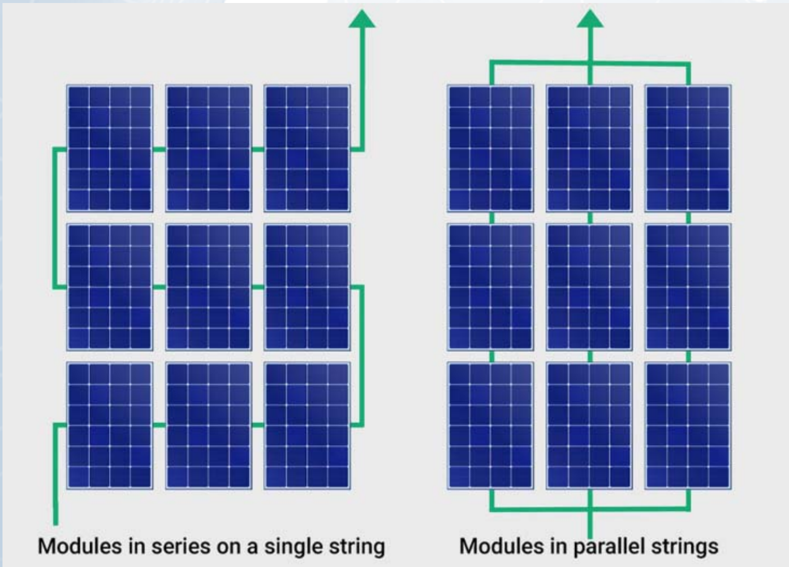
PV panels, Si-c, mono and polycrystalline, to built the PV array, parallel and serial connection, according the peak power required

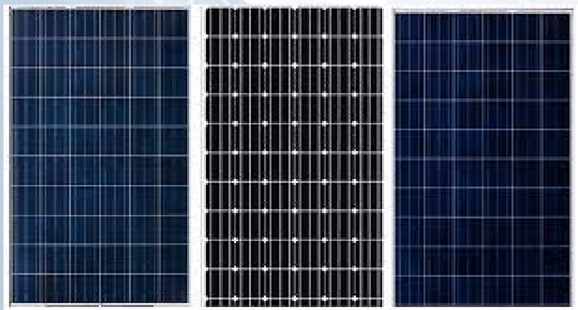
Grid connected solar inverters. Single or triple phase

A lot of manufacturers offer batteries storage system

PV SELF-CONSUMPTION ENGINEERING

Design of PV array for peak power required
(using CAD/CAE software)
1. Select PV panel model
2. Design array interconnection
3. Calculate Output values to select the inverter



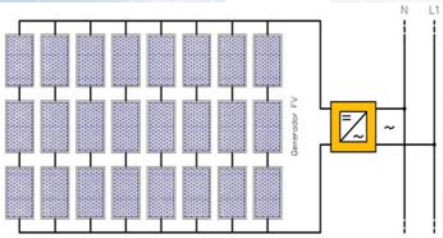


PV SELF-CONSUMPTION ENGINEERING

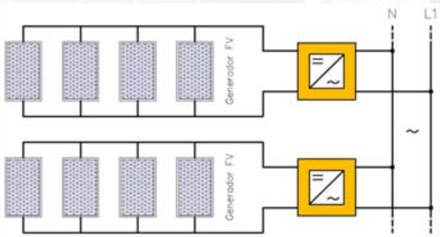
Select the Inverter (using CAD/CAE software)

1. Select model with the nominal power required for the user
2. Analyze DC input values, in the datasheet or database of the simulator
3. Verify the correspondence between PV array output values and Inverter DC input values

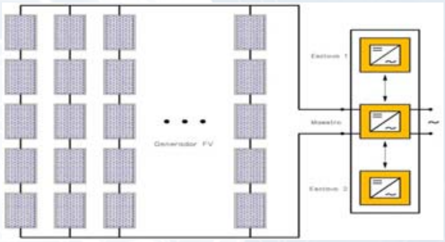
4.-Decide the inverter/PV array configuration



Central inverter



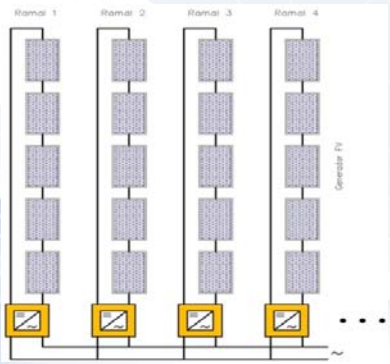
Parallel inverter



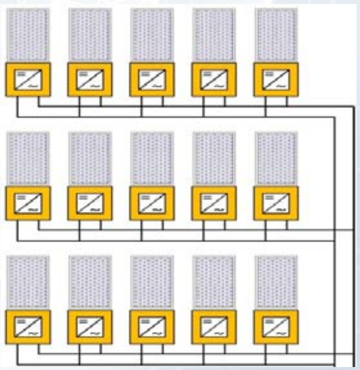
Master-slave inverter

Technical data and types

Type code	PVS300-TL-3300W-2	PVS300-TL-4000W-2	PVS300-TL-4600W-2	P
	3.3 kW	4.0 kW	4.6 kW	
Input (DC)				
Nominal PV-power (P_{PV})	3400 W	4100 W	4700 W	
Maximum PV-power ($P_{PV,max}$)	3700 W	4500 W	5200 W	
DC voltage range, mpp (U_{DC})			335 to 800 V	
Max DC voltage ($U_{DC,max}$)			900 V	
Nominal DC voltage, (U_N)			480 V	
Max DC current ($I_{DC,max}$)	10.5 A	12.7 A	14.6 A	
Number of DC inputs (parallel)			4, with MC4 quick connector	
Output (AC)				
Nominal AC output power (P_{AC})	3300 W	4000 W	4600 W	
Nominal AC current ($I_{AC,nom}$)	14.3 A	17.4 A	20.0 A	
Nominal voltage ($V_{AC,nom}$)			230 V	
Operating range, grid voltage [1]			180 to 276 V	
Operating range, grid frequency (f_{AC}) [2]			47 to 63 Hz	
Harmonic distortion of grid current (K_{IAC})			< 3%	
Power factor (cosfii)			1	
Grid connection			Single phase: L, N and PE	
Transformer			No	



String inverter

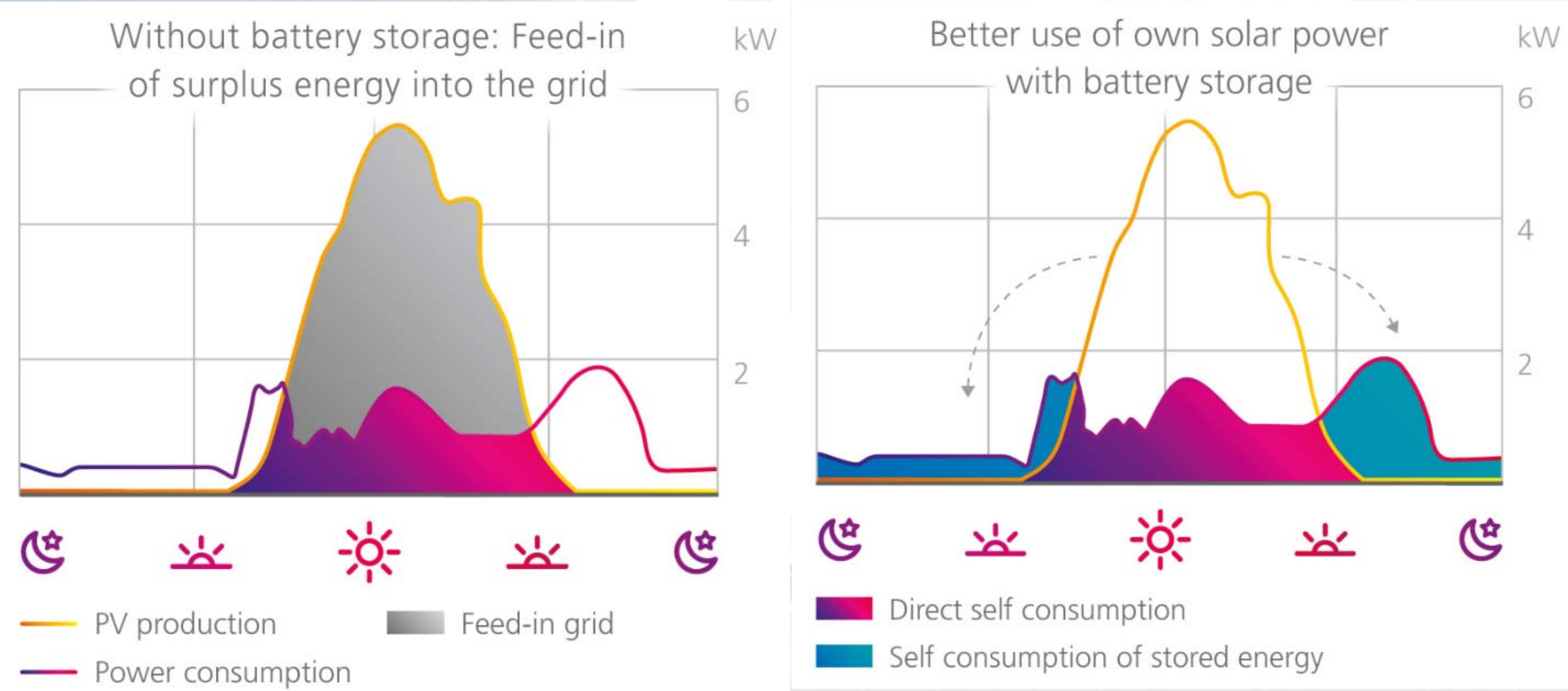


Micro inverter

PV SELF-CONSUMPTION ENGINEERING

PV Self-consumption without or with Battery, the decision
(using CAD/CAE software)

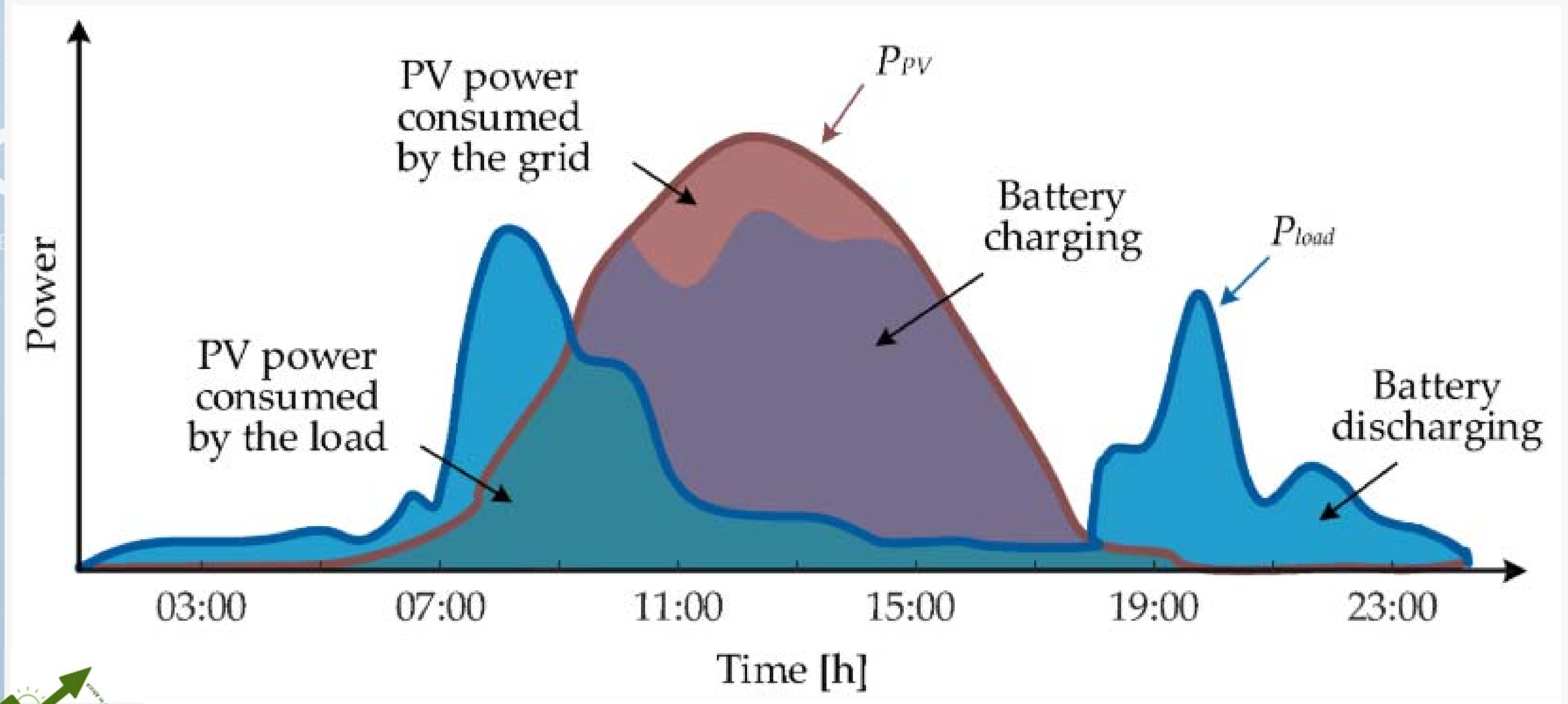
1. Analyze the synchronization between daily load curve and daily PV generation curve
2. Analyze the energy surplus to decide if use battery to adapt the load and generation curves



PV SELF-CONSUMPTION ENGINEERING

PV Self-consumption with Battery (Daily energy management) (using CAD/CAE software)

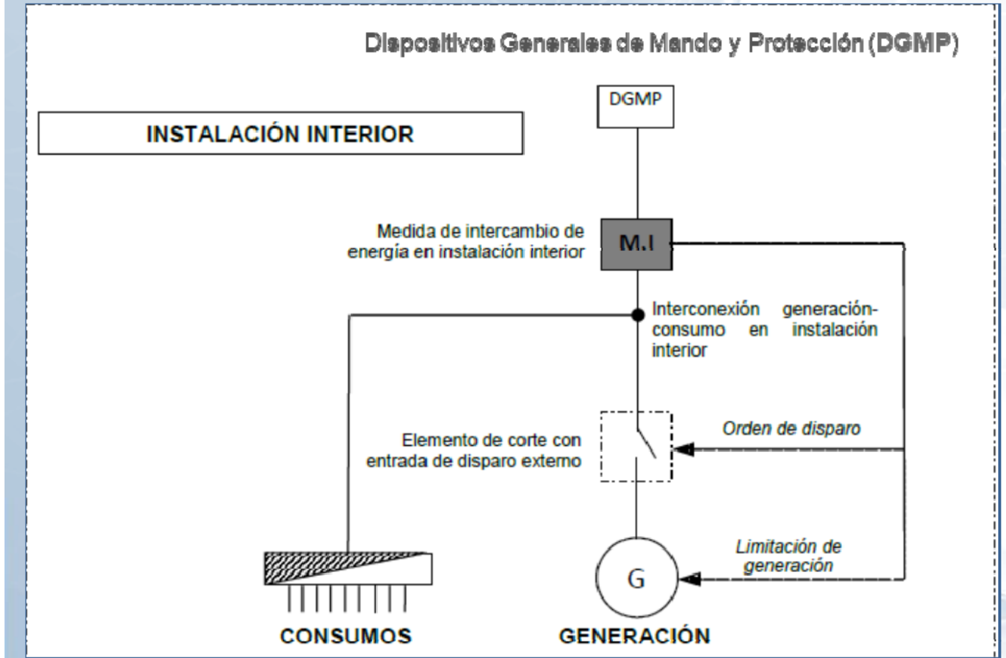
The use of battery reduce the surplus to the grid, remember, the energy injected in the grid can be use to mechanism of compensation (economical value), or sold to the grid, but a less price that energy bought from the grid.



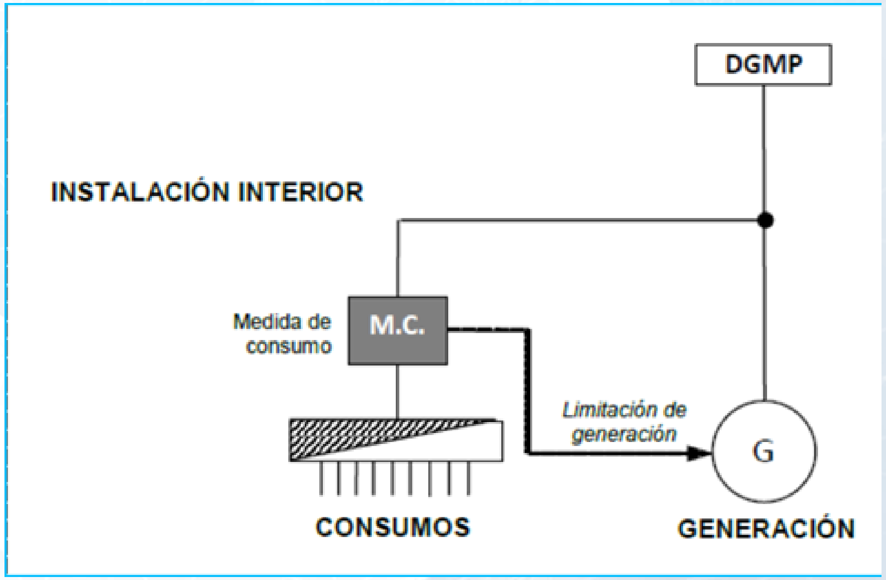
PV SELF-CONSUMPTION ENGINEERING

PV Self-consumption without energy surplus and without Battery (using CAD/CAE software)

This model for self-consumption require the use of energy surplus control to disconnect or reduce the production for don't produce more energy that is required by de user (No surplus). In Spain is regulated by ITC-BT 40



PV generation is disconnected

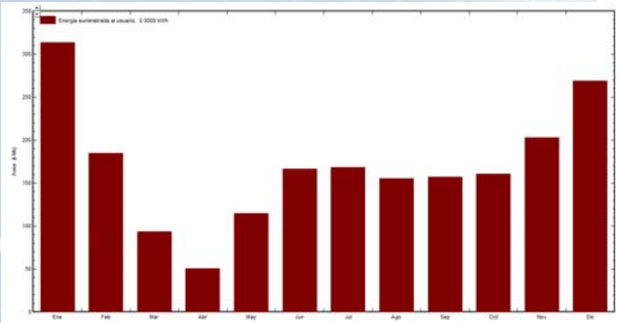


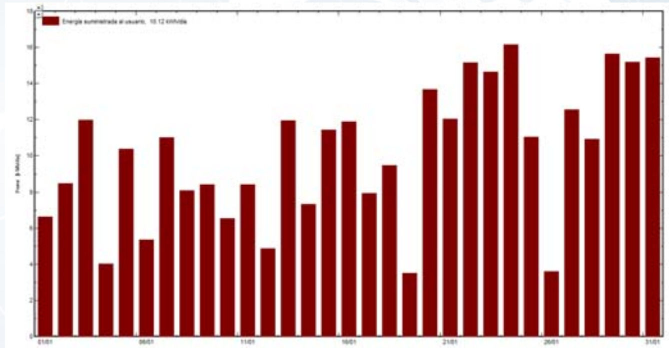
PV generation is reduced to adjust with the load requirements

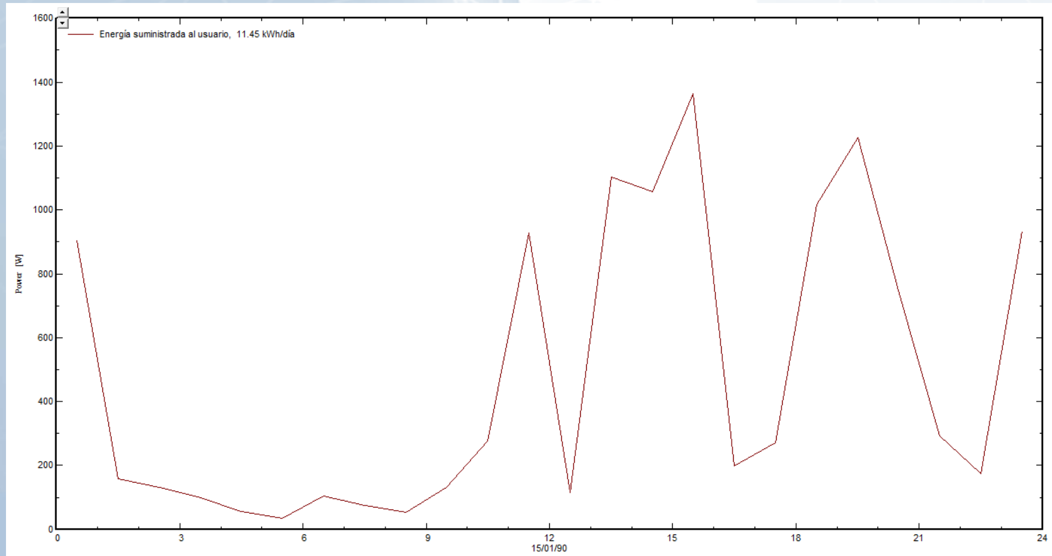
PV SELF-CONSUMPTION ENGINEERING

Real example done with PVSYST simulator for domestic PV self-consumption

1º Obtain the load curve. The best option use hourly load profile of the last year. ¡Attention! 8760 hours in one year.







These data are from real consumer type ATR2.0 Low Voltage (domestic user)

PV SELF-CONSUMPTION ENGINEERING

Real example done with PVSYST simulator for domestic PV self-consumption

2º Design the PV self-consumption according of the user needs, avoiding produce a great energy surplus, because these surpluses could not be produce revenues enough in the compensation or billing period.

Normally a domestic user select PV self-consumption without energy surplus, or with energy surplus with compensation mechanism.

User's needs Yearly energy defined

Average power	232 W	
Yearly energy	2036 kWh/year	

Info system: Defined PV array

Nominal PV Power	1120 Wp	
Estimated system yield:	1942 kWh/year	

User's needs Yearly energy defined

Average power	232 W
Yearly energy	2036 kWh/year

Info system: Defined PV array

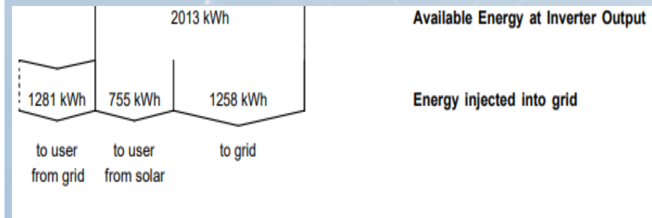
Nominal PV Power	3.30 kWp
Estimated system yield:	5.72 MWh/year

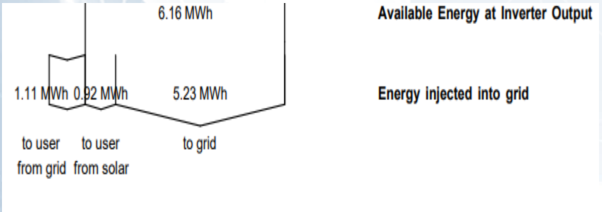
User's needs Yearly energy defined

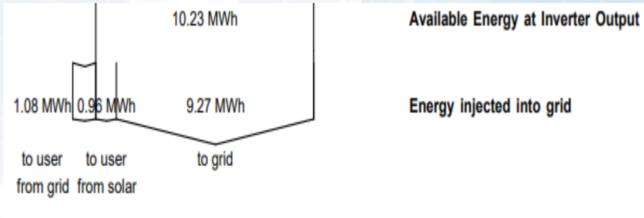
Average power	232 W
Yearly energy	2036 kWh/year

Info system: Defined PV array

Nominal PV Power	5.40 kWp
Estimated system yield:	9.36 MWh/year





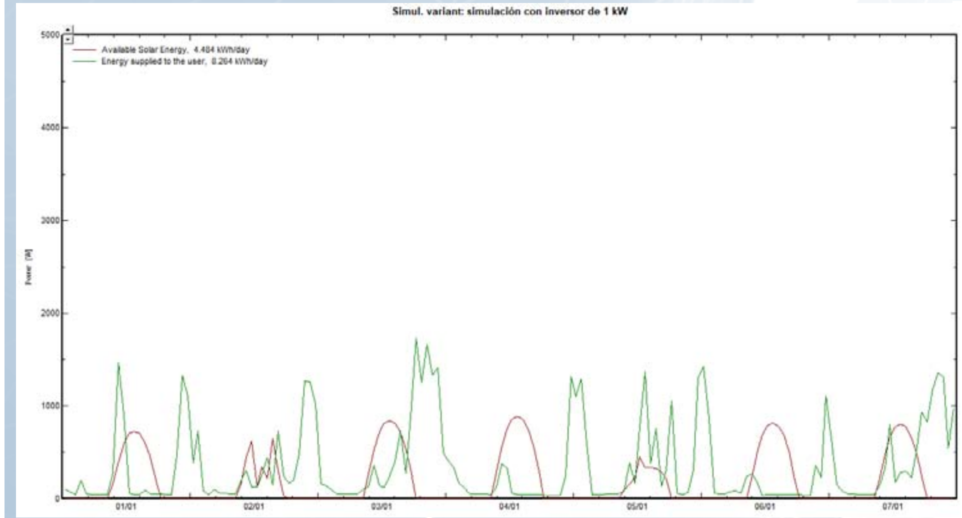


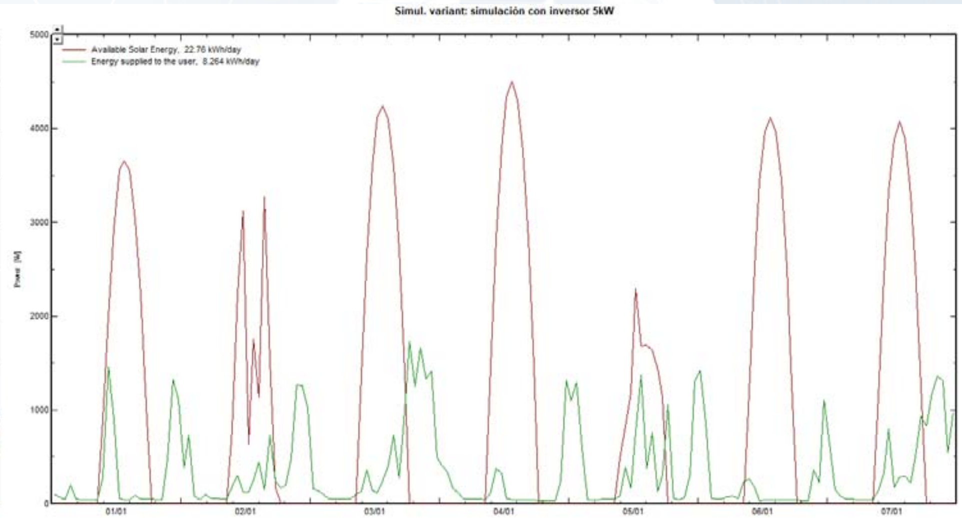
No synchronization between load curve and PV generation curve

PV SELF-CONSUMPTION ENGINEERING

Real example done with PVSYST simulator for domestic PV self-consumption

2º Design the PV self-consumption according of the user needs, avoiding produce a great energy surplus, because these surpluses could not be produce revenues enough in the compensation or billing period. No synchronization, then the solution is use batteries storage. PV production vs User load.





When no synchronization between load curve and PV generation curve. Increase only the PV power is not a good idea

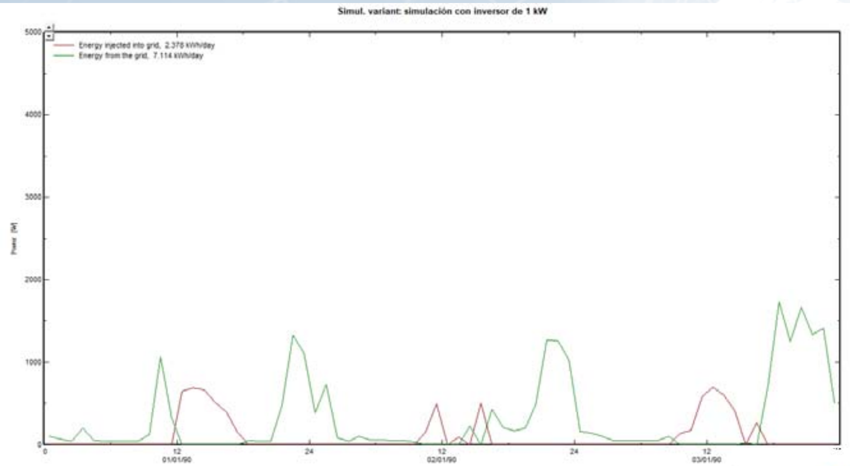
Limits when the economical value of energy surplus is equal to the cost of energy bought from the grid

PV SELF-CONSUMPTION ENGINEERING

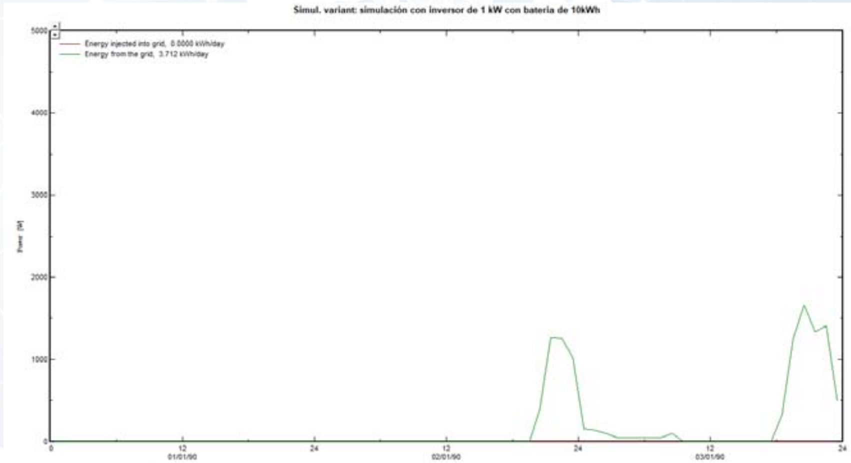
Real example done with PVSYST simulator for domestic PV self-consumption

3º Energy balance without Battery and with battery, example 1 kW vs 5 kW. Energy surplus (injected) vs Energy bought from the grid

1kW Without Battery

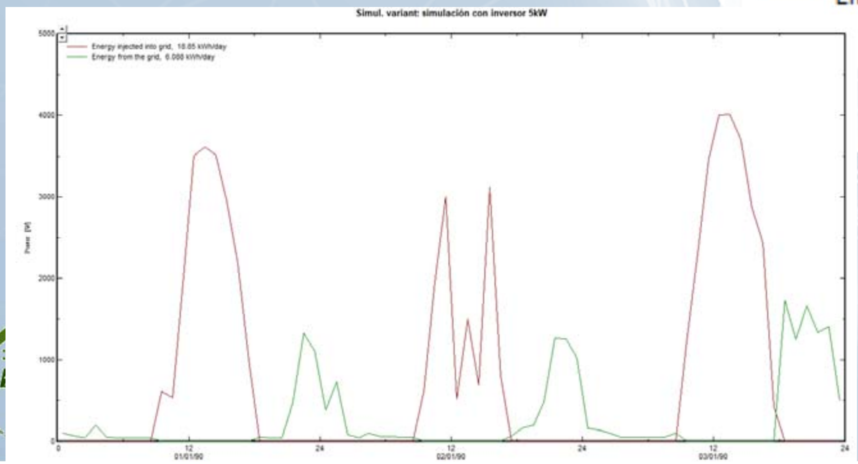


1kW With Battery

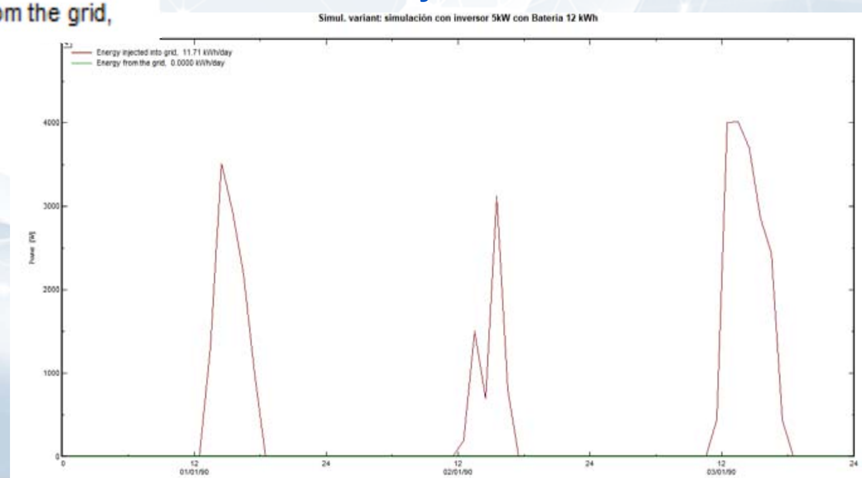


Energy injected into grid,
Energy from the grid,

5kW Without Battery



5kW With Battery. See excess over limits useful



PV SELF-CONSUMPTION ENGINEERING

Real example done with PVSYST simulator for domestic PV self-consumption

4º Economical calculations. PV self-consumption billing. In this case with energy surplus compensation. The price to buy energy is the price agree in the electric contract supply, but the price to sell energy to the grid is different each hour. The hourly price to sell is less than the price to buy. We need much more energy surplus to compensate the energy cost bought.

PV self-consumption 5kW without battery

Factura ENERO	31	días	Sin Autoc.
Potencia Contratada	kW	€/kW/año	€/mes
Total término fijo			14.83 €
Energía Consumida	kWh	€/kWh	€/mes
Peaje de energía P1	313.77	0.044	13.81 €
Coste energía P1	313.77	0.0943	29.59 €
Total término variable			43.39 €
Subtotal			58.22 €
Impuesto Eléctrico	5.11%		2.98 €
Alquiler contador	31	días	0.82 €
Subtotal			62.02 €
IVA	21%		13.02 €
TOTAL FACTURA			75.04 €
Factura ENERO AUT			Con Aut.
Potencia Contratada	kW	€/kW/año	€/mes
Peaje potencia P1	4.6	37.95	14.83 €
Total término fijo			14.83 €
Energía Consumida	kWh	€/kWh	€/mes
Peaje de energía P1	191.76	0.044	8.44 €
Coste energía P1	191.76	0.0943	18.08 €
Excedente FV	499.87		20.71 €
Excedente Efectivo			-18.08 €
Total término variable			8.44 €
Subtotal			23.26 €
Impuesto Eléctrico	5.11%		1.19 €
Alquiler contador	31	días	0.82 €
Subtotal			25.28 €
IVA	21%		5.31 €
TOTAL FACTURA			30.58 €
AHORRO ECONÓMICO POR AUTOCONSUMO			59%

PV self-consumption 5kW with battery

Factura ENERO	31	días	Sin Autoc.
Potencia Contratada	kW	€/kW/año	€/mes
Peaje potencia P1	4.6	37.95	14.83 €
Total término fijo			14.83 €
Energía Consumida	kWh	€/kWh	€/mes
Peaje de energía P1	313.77	0.044	13.81 €
Coste energía P1	313.77	0.0943	29.59 €
Total término variable			43.39 €
Subtotal			58.22 €
Impuesto Eléctrico	5.11%		2.98 €
Alquiler contador	31	días	0.82 €
Subtotal			62.02 €
IVA	21%		13.02 €
TOTAL FACTURA			75.04 €
Factura ENERO AUT			Con Aut.
Potencia Contratada	kW	€/kW/año	€/mes
Peaje potencia P1	4.6	37.95	14.83 €
Total término fijo			14.83 €
Energía Consumida	kWh	€/kWh	€/mes
Peaje de energía P1	16.79	0.044	0.74 €
Coste energía P1	16.79	0.0943	1.58 €
Excedente FV	284.32		11.45 €
Excedente Efectivo			-1.58 €
Total término variable			0.74 €
Subtotal			15.57 €
Impuesto Eléctrico	5.11%		0.80 €
Alquiler contador	31	días	0.82 €
Subtotal			17.18 €
IVA	21%		3.61 €
TOTAL FACTURA			20.79 €
AHORRO ECONÓMICO POR AUTOCONSUMO			72%

PV SELF-CONSUMPTION ENGINEERING

Real example done with PVSYST simulator for domestic PV self-consumption

5º Annual resume of savings using PV self-consumption.

Nombre Cliente:	IEEE Webinar without Battery			Potencia FV Autoconsumo:				5kW consumo horarios					
IMPORTES	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ANUAL
Factura sin autoconsumo	75.04 €	50.43 €	36.27 €	28.08 €	26.28 €	48.46 €	49.40 €	47.14 €	46.82 €	48.10 €	54.94 €	67.18 €	**578.16 €**
Factura con autoconsumo	30.58 €	23.94 €	23.02 €	20.76 €	22.79 €	23.03 €	23.39 €	22.87 €	22.93 €	24.29 €	26.39 €	29.98 €	**293.97 €**
Ahorro en la factura	44.46 €	26.50 €	13.25 €	7.33 €	3.49 €	25.43 €	26.01 €	24.27 €	23.89 €	23.81 €	28.55 €	37.20 €	**284.18 €**
% Ahorro sobre total factura	59%	53%	37%	26%	13%	52%	53%	51%	51%	49%	52%	55%	**49.15%**
Valoración Excedente FV real	20.71 €	22.13 €	24.32 €	47.77 €	45.98 €	43.56 €	49.23 €	41.99 €	34.04 €	34.59 €	24.48 €	17.30 €	**406.10 €**
Valoración aplicable Exc. FV	-18.08 €	-10.12 €	-5.34 €	-2.60 €	-4.95 €	-6.43 €	-5.96 €	-5.09 €	-6.26 €	-7.48 €	-12.10 €	-17.07 €	**-101.47 €**
Excedente no aprovechado	2.63 €	12.01 €	18.99 €	45.17 €	41.03 €	37.13 €	43.27 €	36.90 €	27.78 €	27.11 €	12.38 €	0.23 €	**304.62 €**

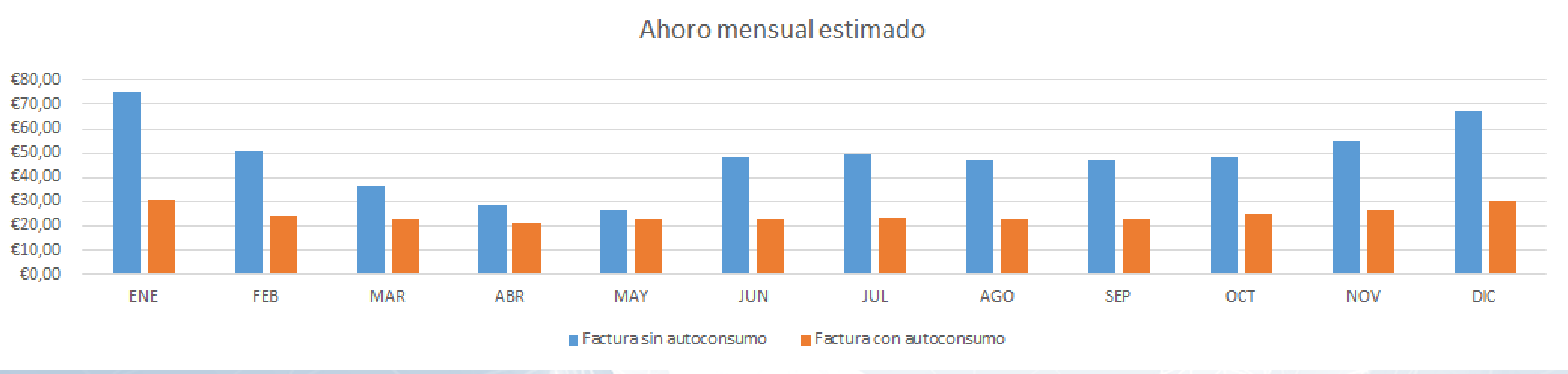
Nombre Cliente:	IEEE Webinar with Battery			Potencia FV Autoconsumo:				5kW consumo horario					
IMPORTES	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ANUAL
Factura sin autoconsumo	75.04 €	50.43 €	36.27 €	28.08 €	26.28 €	48.46 €	49.40 €	47.14 €	46.82 €	48.10 €	54.94 €	67.18 €	**578.16 €**
Factura con autoconsumo	20.79 €	17.98 €	19.85 €	19.21 €	19.85 €	19.21 €	19.85 €	19.85 €	19.21 €	19.85 €	19.25 €	20.48 €	**235.41 €**
Ahorro en la factura	54.25 €	32.45 €	16.42 €	8.87 €	6.42 €	29.25 €	29.55 €	27.29 €	27.61 €	28.25 €	35.69 €	46.70 €	**342.75 €**
% Ahorro sobre total factura	72%	64%	45%	32%	24%	60%	60%	58%	59%	59%	65%	70%	**59.28%**
Valoración Excedente FV real	11.45 €	16.55 €	21.82 €	45.06 €	41.96 €	38.92 €	44.50 €	38.34 €	29.92 €	29.07 €	16.82 €	9.41 €	**343.83 €**
Valoración aplicable Exc. FV	-1.58 €	-0.08 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	-0.06 €	-1.06 €	**-2.79 €**
Excedente no aprovechado	9.87 €	16.47 €	21.82 €	45.06 €	41.96 €	38.92 €	44.50 €	38.34 €	29.92 €	29.07 €	16.75 €	8.36 €	**341.04 €**

PV SELF-CONSUMPTION ENGINEERING

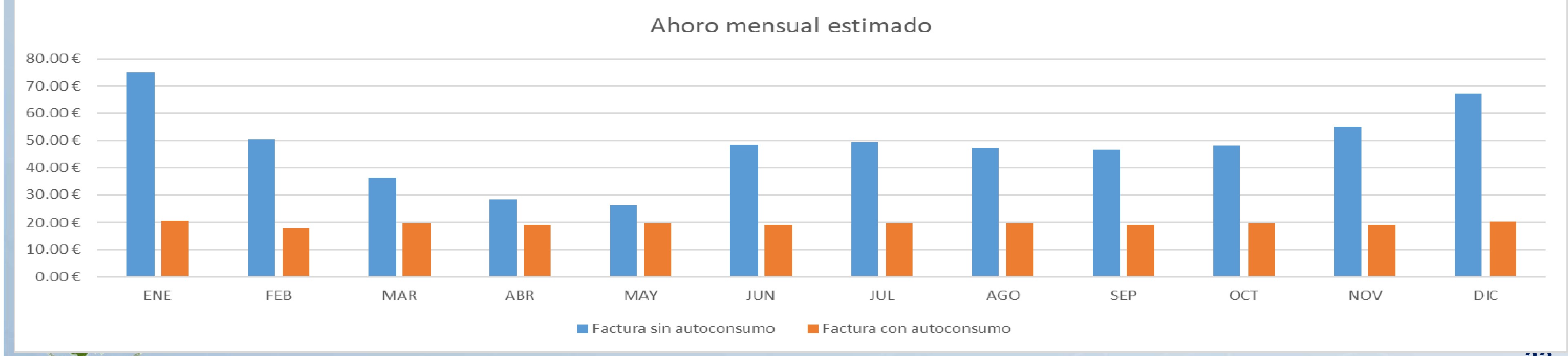
Real example done with PVSYST simulator for domestic PV self-consumption

5º Annual resume of savings using PV self-consumption.

Without Battery



With Battery



PV SELF-CONSUMPTION ENGINEERING

When must be used storage system in the PV self-consumption?
If the synchronization is very bad between PV generation curve vs User load curve, is interesting think in batteries

It is important the legal frame and the local regulation for the PV self-consumption spread?
Is critical, because a bad incentives or not comfortable regulation can be a great obstacle to develop this strategy

It is easy the economical calculation to define the money saving forecast?
No, is complicated the economical calculation because need know perfectly the administrative and legal local frame, and a very good hourly simulation is required

Is profitable the PV self-consumption for the user?
Yes of course

A business opportunity: Grid connected PV self consumption

GLOBE

VECTOR ILLUSTRATION

Thank you very much!

Rafael Jiménez Castañeda

Inoma renovables,sl
Co-funded by the Erasmus+ Programme of the European Union
DALILA
www.inoma.es
www.dalilaproject.eu