OPTICUBE

EASY & LARGE SOLAR THERMAL KIT

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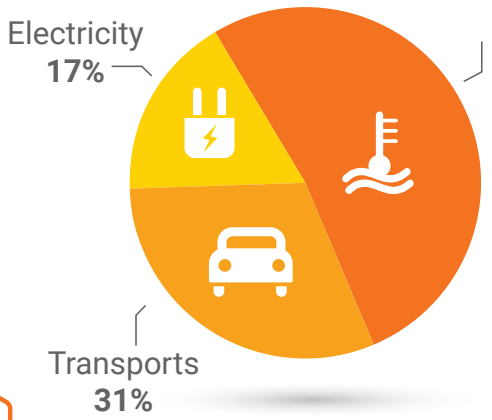
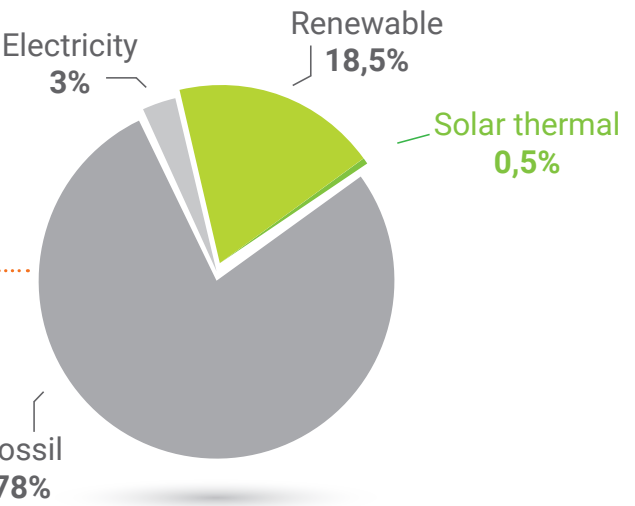
ALL IN ONE
SOLAR THERMAL KIT

The Opticube is an easy and large « all-in-one » solar thermal kit, removing the barriers to solar thermal industry development. All the technical complexity has been considered and integrated in a 20 feet container. The hydraulic part is entirely pre-assembled: what remains to be done on site is the mounting of the metallic structure and the collectors, which can be handled quickly and easily by anyone. Such as a well known Swedish furniture, you just have to follow the guidebook! This system brings up to 40% total cost reduction in relation to a classic solar thermal installation, resulting in a 100% green energy, lower than 20€/MWh. Save the planet, save your money!

OPTICUBE
EASY & LARGE SOLAR THERMAL KIT

THE CHALLENGE





1

The heat demand

Heat is an absolute necessity all over the world. It's so important that it represents more than half of the world energy demand.

2

Fossil energies

Heat is mainly produced by means of fossil energies. Those are harmful for our planet and are more and more expensive.

3

Using of green energies

As part of the energy transition, we strongly have to reduce our greenhouse gases emissions.

4

Solar thermal: the "noblest" energy

Among all those renewable energies, solar thermal is the most ideal on paper:

- Free energy source (the sun)
- High efficiency (>85%)
- Proven technology
- High reliability (>30 years)
- No deforestation
- Preservation of cultivable fields
- Self-consumption

5

And yet...

Despite the advantages of this technolgy, the participation of solar thermal to the global heat demand is less than 0.5%. Because of:

- Complexity (specialists needed)
- High set-up time
- Cost of the installation
- Integration to the building

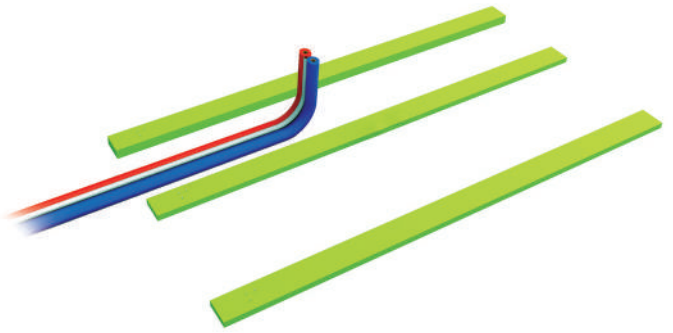
Solar thermal: an ideal

6

Opticube: revolutionary solution !

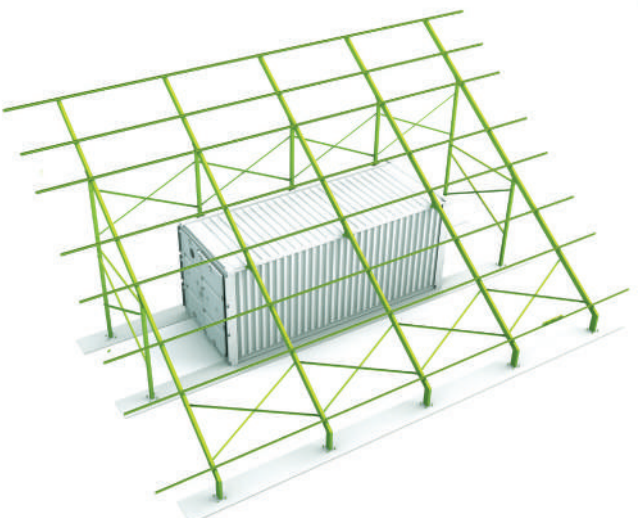
Sunoptimo has designed a product able to solve the barriers to the development of solar thermal. The technical complexities are bypassed thanks to this «all in one» kit. Solar thermal technolgy becomes mountable by anyone, and the set-up time of the installation is incredibly low.

AN EASY, QUICK AND EFFICIENT MOUNTING



1| Concrete studs to support the container and its metallic structures. Two pipes come from the boiler room, and will be linked to the Opticube.

2| A truck crane lays the container down on the concrete. The pipes from the boiler room are linked to the container through to a trap door.



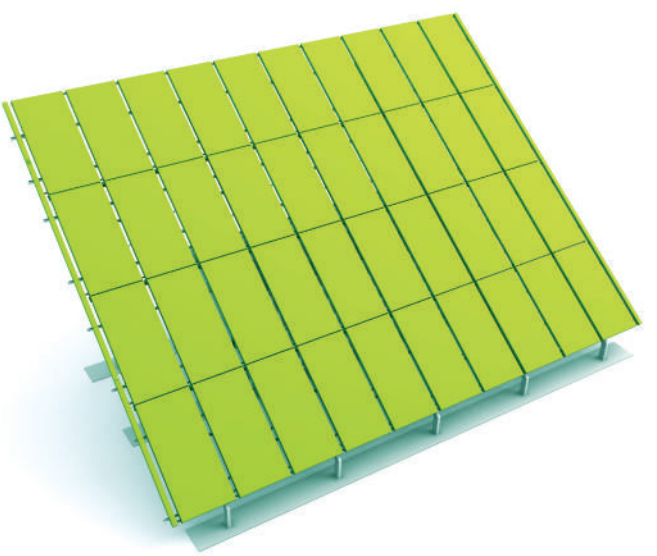
3| Mounting of the primary structure on the container and individual supports. Aluminium rails are then fixed to the primary structure.

4| Last step: the collectors are put on the aluminium rails, wich are linked together and connected to the pre-mounted primary circuit connections, waiting for the flow.

The mounting of the collectors starts from the bottom. The following collectors simply line up above the first ones.

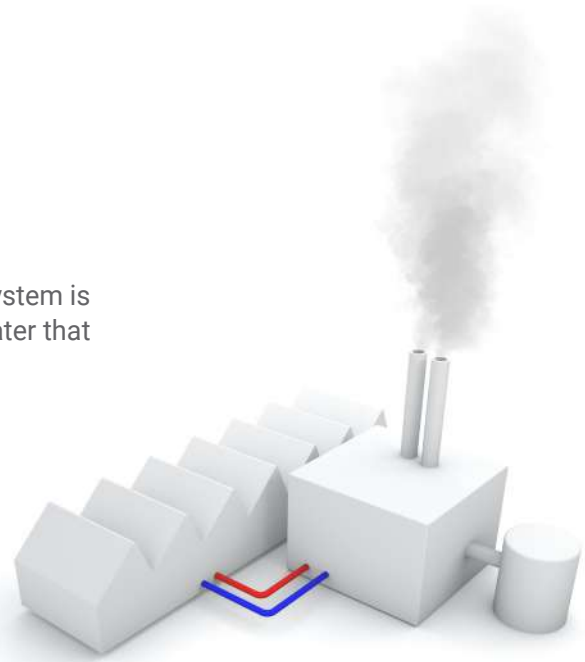
Each collector is linked to the previous one, mechanically due to specific fixings, and hydraulically with Opticonnect, allowing for absorption of the dilation and the movements of each collector.

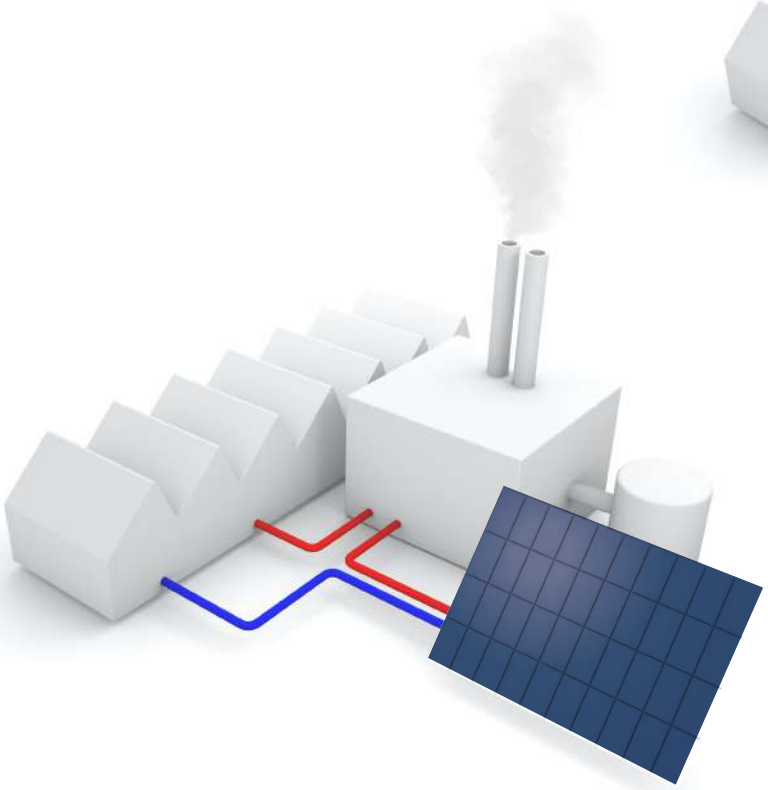
Once the collectors are set, the pre-isolated piping directly links the collectors lines to each other and further to the container.



Through such "all in one" kit, Sunoptimo has chandged the solar thermal dynamics. Previously considered as a technology requiring particular skills and an important set-up time, it is now synonym of simplicity and rapidity. The observed timing for the installation of the collectors and the linking is about five collectors per hour (with two persons working on it). It means approximately 3 days for the total mounting of an Opticube 100.

The integration of the Opticube into the existing heating system is very easy and can be done by diverting all or part of the water that is entering cold into the boiler room, through the Opticube.





An Opticube, how does it work ?

OPTIMUM SIZING

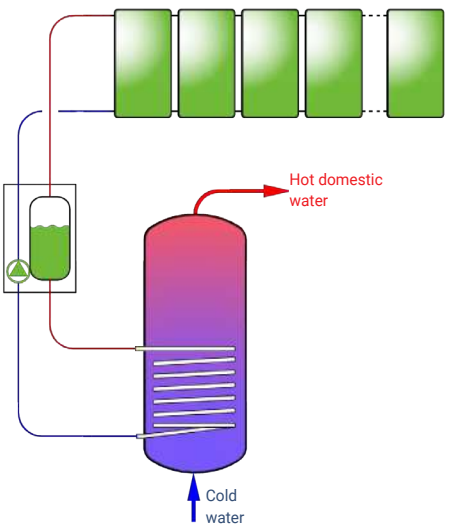
The functioning of a solar thermal system:

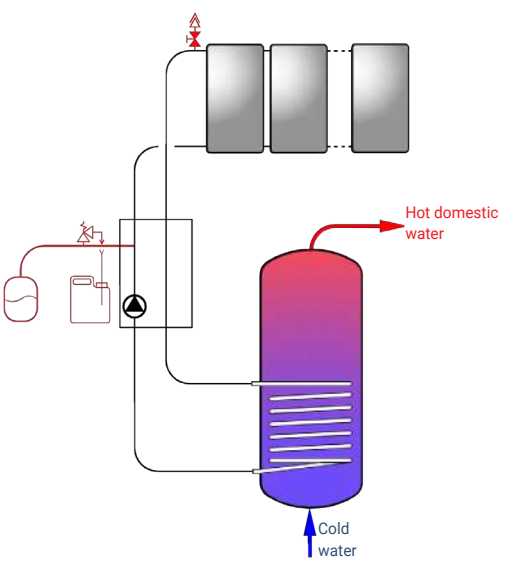
The sunbeams heat up the absorber of the solar collectors. The heat is transmitted to a heatconducting fluid, thanks to the coil which is brazed on the absorber. The heated up fluid is carried off by a pump in a closed piping circuit. Progressively, it will exchange the heat from the collectors to the water which is situated in the tanks. This free hot water, heated up by solar energy, will be brought to the hot water supply network.

Two types of technology:

Drainback Sunoptimo

- The pump is off, the air takes place in the collectors, instead of the fluid
- No overheating of the fluid: no worsening of it
- No technical limits: Optimum Sizing is possible
- Passive protection of the system
- Low technical maintenance





Pressurized systems

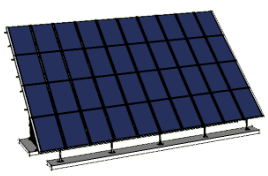
- The pump is off, the fluid stays in the collectors
- Overheating, the fluid deteriorates
- Technical limit due to overheating: sizing limit is about 45%
- Lot of technical maintenance

Optimum Sizing principle is simple:

The more we consider collectors
The more the heat demand is covered by the energy provided by the sun
The more we reduce the cost of the auxiliary energy

The ideal number of collectors to install is calculated to reach an economic optimum.

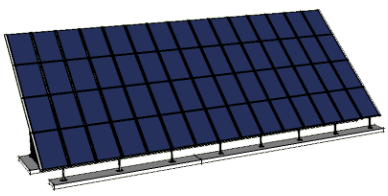
● 100 m²



Fossil energy

Solar energy
50%

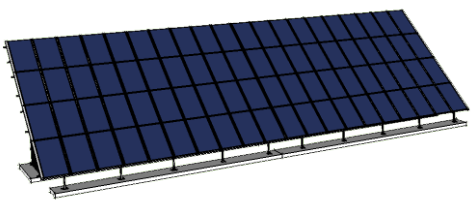
● 150 m²



Fossil energy

Solar energy
70%

● 200 m²

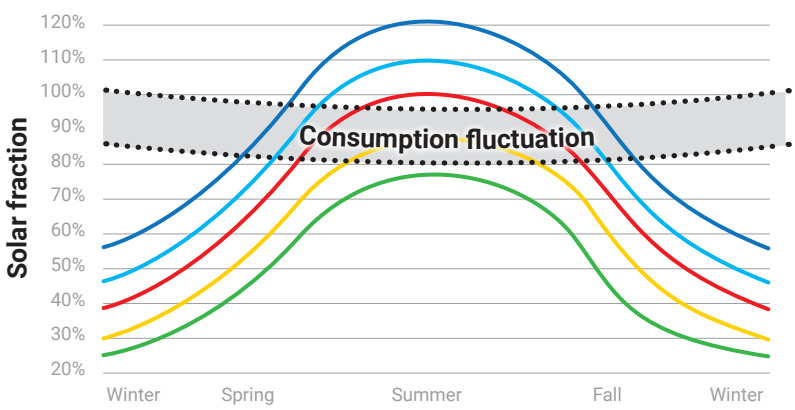


Fossil energy

Solar energy
80%

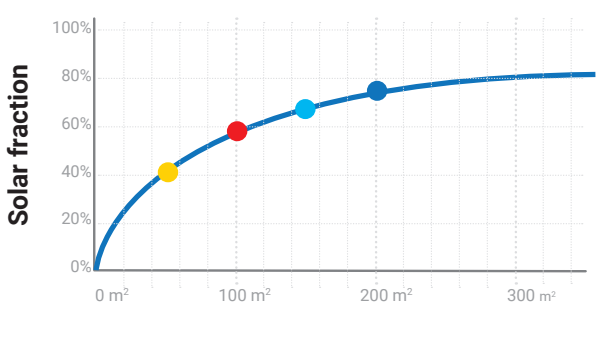
The drainback makes it possible to avoid the overheating of the system. More collectors can be placed to cover a higher part of the heat need in case the economic calculation advises so.

A pressurized system which would reach 100% of the energy needs at the best time of the year (red line) would suffer from serious damages. This wouldn't happen with a drainback system (blue line).



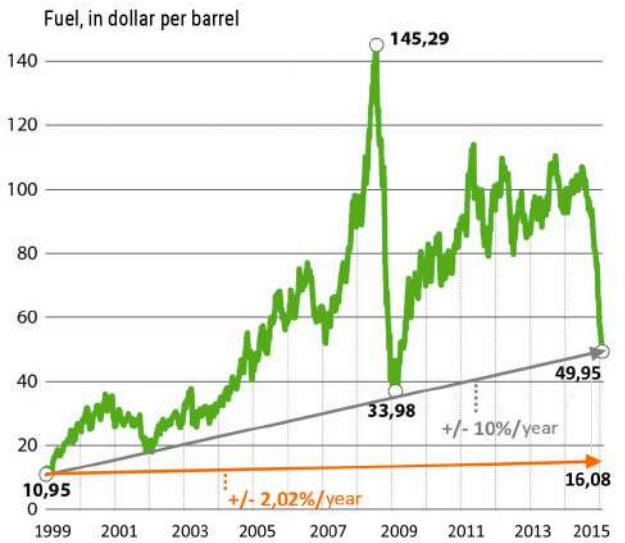
The Optimum Sizing is calculated through different datas.

The yellow dot represents the solar fraction which is reached by a pressurized system throughout the year. It's far lower than the performances of a Sunoptimo installation with drainback (blue dot).



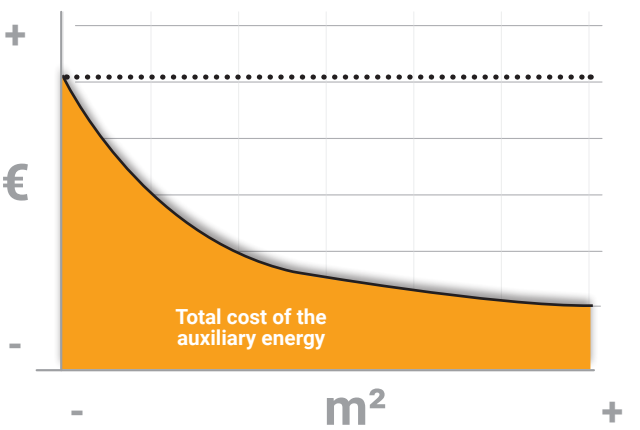
1| Analyse of the auxiliary energy cost

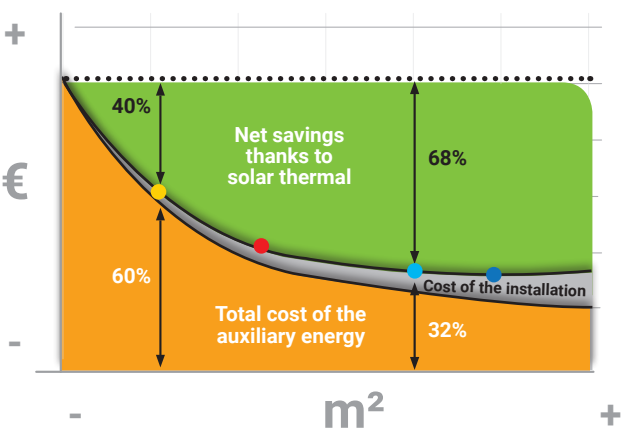
with regard to the collectors surface. The smaller the installation size is, the higher the residual cost to heat water with fossil energy will be. Taking into account the different scenarios of the fossil energies prices evolution, the cost of the necessary auxiliary energy (depending on the installed surface) can be calculated. Traditional energies are submitted to speculation and the law of supply and demand. In the last 15 years, the fuel prices increased by 10,4% on average each year. With an important collectors surface, the cost per m² is low, because there are a lot of fixed costs for the set-up of a solar thermal system. The total value of the installation will be added to the fossil energy spendings, to get the total cost for the water heating.



2| Calculation of the water heating cost

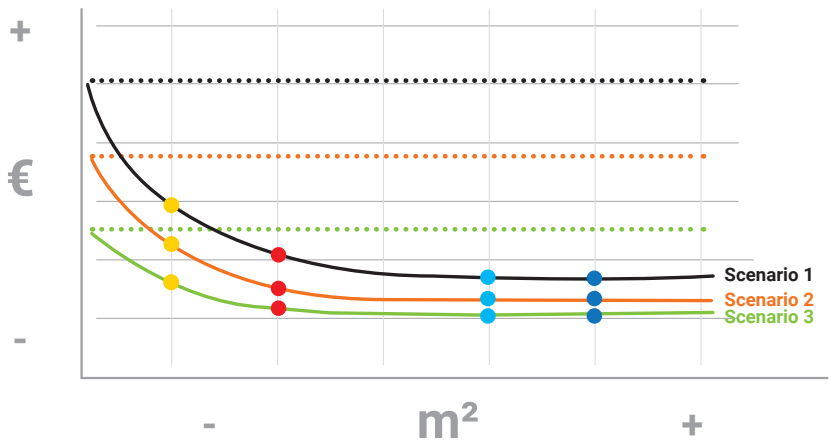
and the net savings. The difference between the total cost with a solar system and the total cost without solar system corresponds to the profit which is generated thanks to solar thermal energy (after return on investment). The graphic shows that the Sunoptimo drainback and the Optimum Sizing make it possible to save up 68% (for the given example) on the total energy bill dedicated to heat production, taking into account the cost of the solar system. The "classic" pressurized system limits the savings, due to its technical constraints.





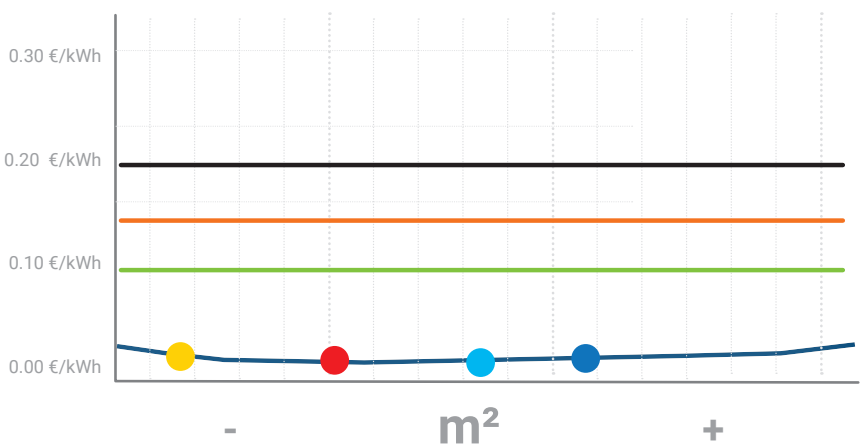
3| The MWh price is fixed for the next 20-30 years. By cross-checking the cost of the installation and the auxiliary energy (according to the 3 cost evolution scenarios), we get a precise idea of the total cost for water heating. The graphic below shows that the higher the collector surface, the lower the cost for water heating (until a certain point, corresponding to the Optimum Sizing). Financially speaking, we can observe that even in the case in which the evolution of fuel prices wouldn't be outrageous, the solar thermal solution remains the best option:

Total cost (solar + auxiliary, for the 3 evolution scenarios)



It's easy to cross-check this information with the hot water consumption, to fix the net price of a solar MWh. Once again, even if the least favorable scenario happens, the economic advantage which is brought by solar thermal technology remains important:

Net cost solar MWh



How to size your Opticube?

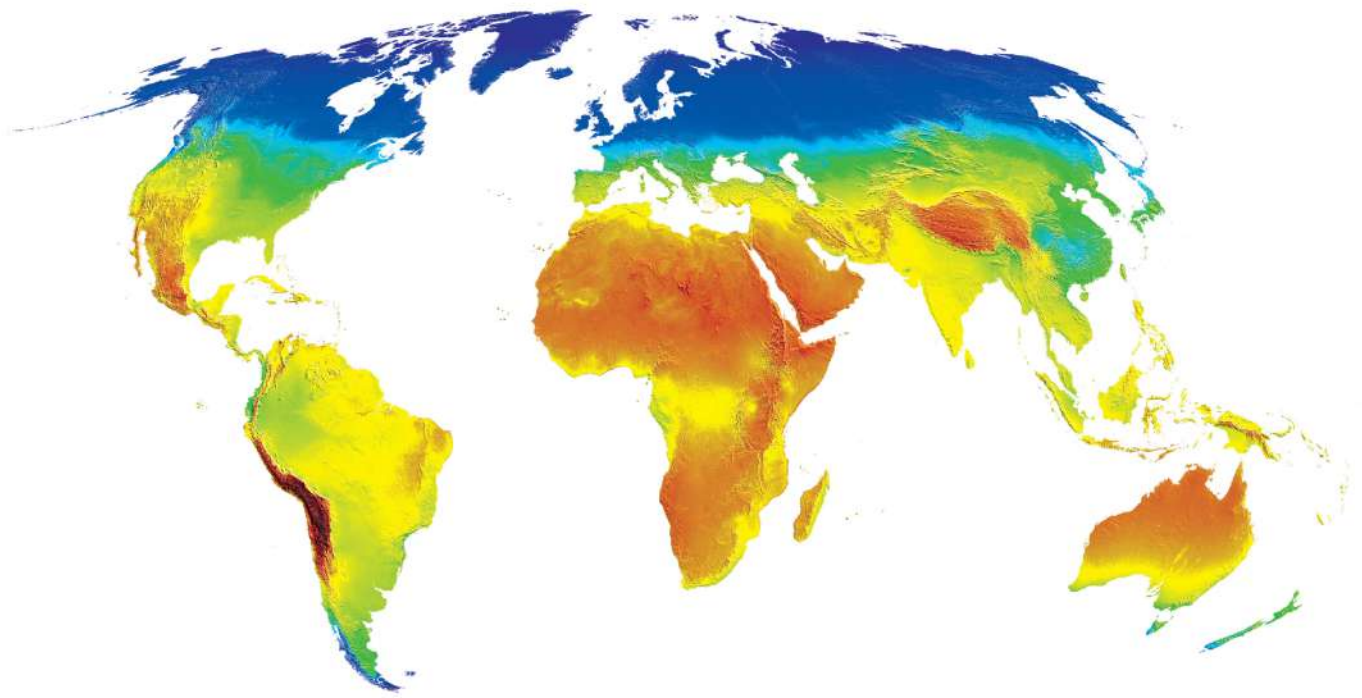
CALCULATION METHOD

Step 1 : Locate the geographic area of the project

Area 1
<1300 kWh/m²/year

Area 2
1300-1500 kWh/m²/year

Area 3
1500-2000 kWh/m²/year



Identify the geographic area of your project in order to determine the approximate amount of energy the sun provides in your area. The 3 zones are shown in the graphs on the following page and give you an idea of how much energy the sun can bring you according to the size of the selected Opticube model.

Step 2 : Assess the energy needs

Your needs in energy are key information to choose the Opticube size.
If you know your daily hot water consumption or your annual kWh (or MWh) need, use the known data. Otherwise, here are some examples often used to assess your consumption.
The results are then reported on the x-axis of the graph on the next page corresponding to your zone.

Daily hot water consumption (60°c)	
Shower :	35 liters/shower
Bath :	80 liters/bath
Hotel room with shower :	75 liters/night
Company restaurant :	4 liters/tableware
Rest-home:	30 liters/bed
Hospital :	55 liters/bed
Camping :	12 liters/shower
Swimming pool (shower) :	15 liters/swimmer
Swimming pool (water renewal) :	10 liters/swimmer

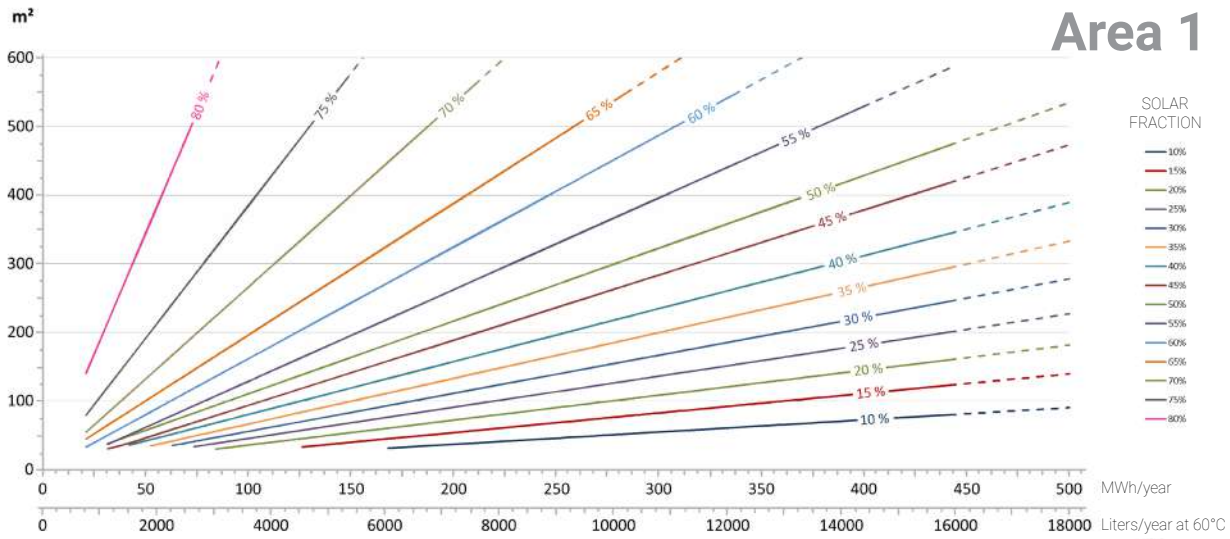
Conversion in useful kWh (or MWh) according to a gas or fuel consumption

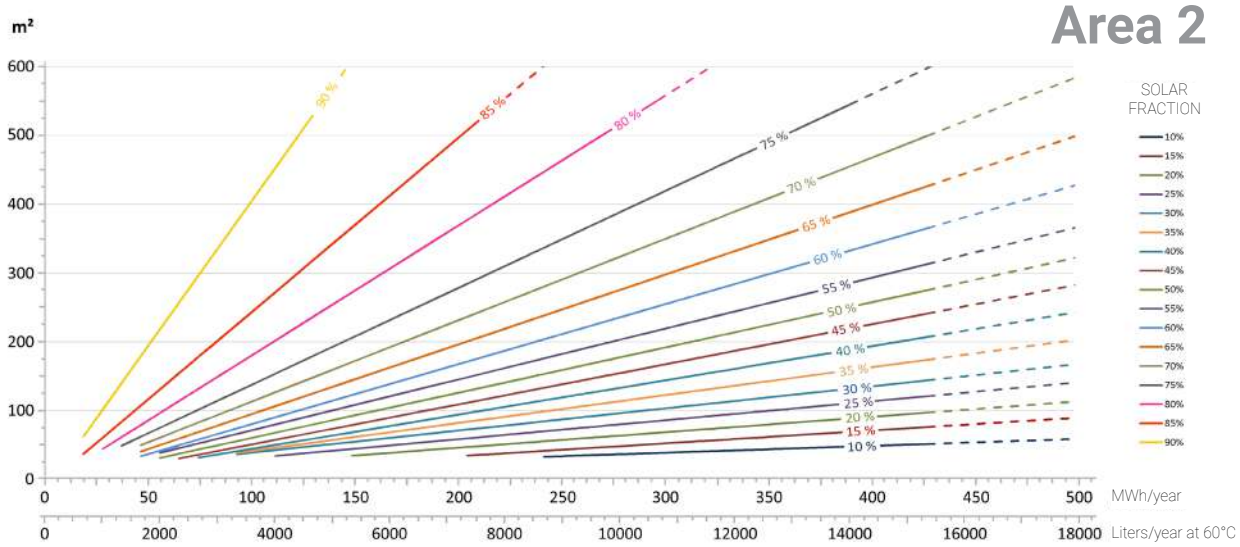
(Taking to account the average efficiency of boilers)

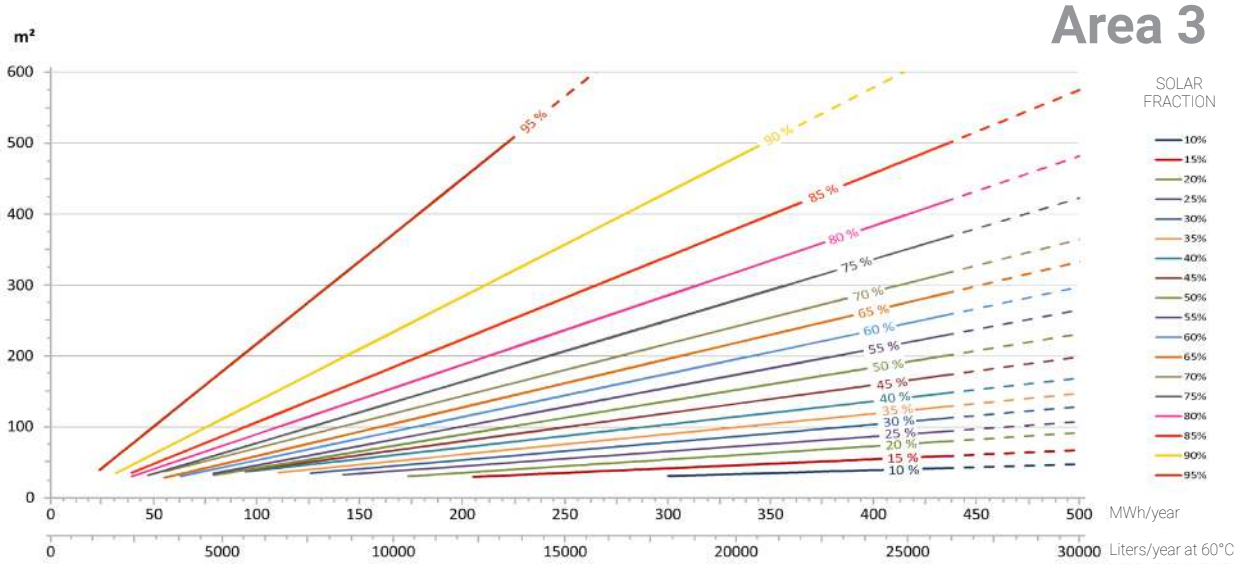
Fuel
Consumption [Kwh] = Used liters x 8

Gas:
Consumption [Kwh] = Invoiced kWh x 0.8
1000kWh = 1 MWh to report on the x-axis of the next page graphic.

Step 3 : Finding the best solar surface according to the desired savings (solar fraction)







PRACTICAL EXAMPLES

With the different sizing steps, it's easy to determine which Opticube is perfect.

In Brazil, a hotel with 150 rooms with an average occupancy rate of 60% wants to generate 80% savings on the heating of its sanitary water. Its consumption is 6750 liters per day. (150 x 0.6 x 75 liters)

With a 100 m² Opticube, the economic objective of this hotel will be achieved.

In Italy, a sports complex consumes annually 315 MWh of gas for heating water. It wants an installation able to produce more than half of its needs for the next 20 years.
Its energy requirements are 250 MWh. (315 MWh x 0.8)

With 250 m² of solar collectors, the gas consumption of this entity will be reduced by 70%!

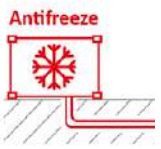
In the south side of Spain, a plant uses 25 m³ of hot water for its process. Anticipating an increase in the price of energy, this plant wishes to take advantage of the sunshine in its region to produce its heat economically, and respectful of the environment.

With two Opticube of 300 m², this company will cover almost 90% of its need for hot water!

With an annual consumption of 2000 MWh of heat, this agro-food industry near Lille wants to reduce the cost of its process. By equipping itself with a solar surface of 1200m ², the company drastically dropped its price of the MWh.

The total savings generated will be more than one million euros.

THE OPTICUBE:
A LARGE PRODUCT RANGE



Antifreeze option

In addition to the reinforced insulation of the container, an electric convector is activated if there is any risk of freezing. A recirculation pump (coupled to an electrical resistor) is activated to avoid the freezing of the pipes.

Cooling option

It ensures a maximum temperature of 40 ° C inside the container. A mechanical ventilation system is activated when the threshold temperature is reached. This ventilation will cool the interior of the container using outdoor air.

Electric auxiliary option

Two immersed electric resistors hold a technical water tank at temperature. The water is preheated by the solar system and, if ther is a lack of energy, the electrical resistances are switched on. In this case there is no need for a back-up storage tank.

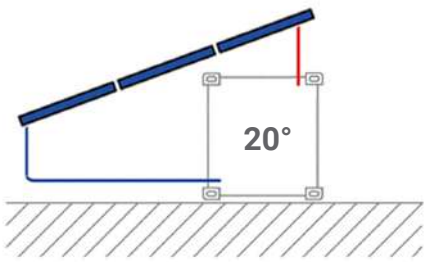
Hydraulic auxiliary option

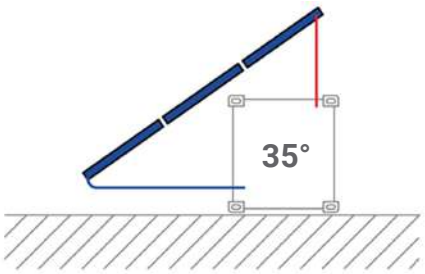
The last technical water tank is kept warm thanks to an immersed coil. The auxiliary energy source can be a gas boiler, oil, wood, pellet or even a heating pump. The water is preheated by the solar system and, if ther is a lack of energy, the boiler switches on by itself.

Hydro-electric option

This option is a mix of the electric backup and Hydraulic power supply options.

The different versions of this system make its set-up possible everywhere.
The Opticube is available in two inclinations:





Version with 4 collectors high

Version with 3 collectors high

A parking version of the Opticube also exists (3 collectors high):

OUR REFERENCES

Our Opticube references

Wherever it is set up, the Opticube is source of satisfaction. It makes possible to strongly reduce the spendings on water heating, all this with integrating perfectly to the environment.

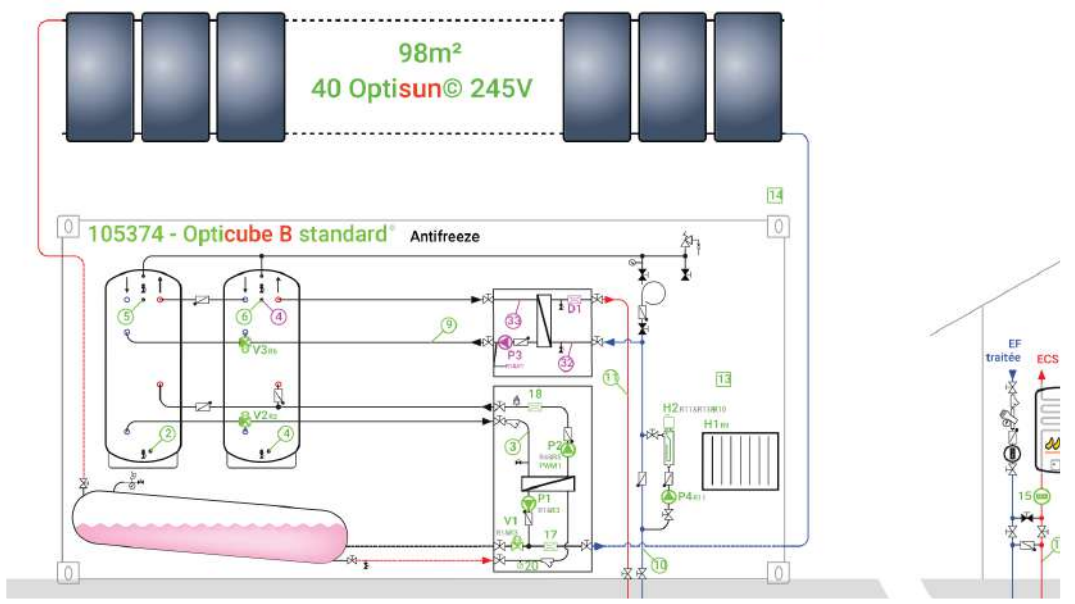
Our traditional references

Sunoptimo has become a major player in the sphere of large scale solar thermal systems.

Lots of building owners from whole Europe have already choosen for a Sunoptimo installation.

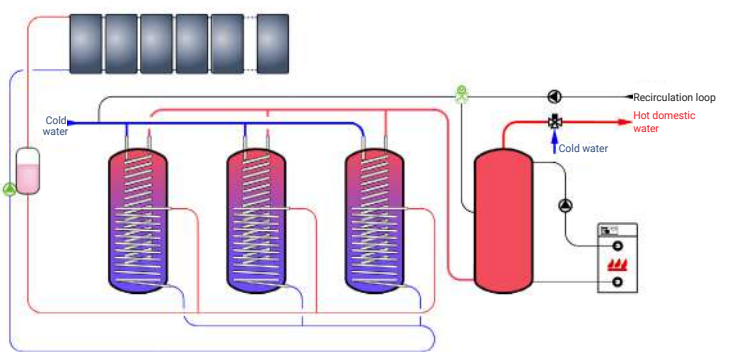
For sure, it is possible to visit our diferent systems.

MONITORING & INSURANCE OF GOOD FUNCTIONING

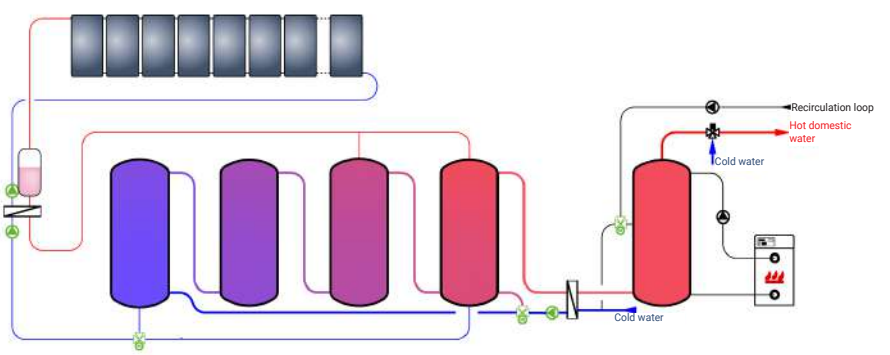


Energy	Day	Week	Total
Solar primary	105 kWh	231 kWh	5317 kWh
Solar secondary	89 kWh	186 kWh	4789 kWh
Sanitary (S11)	37 kWh	137 kWh	3684 kWh
Sanitary (S12)	35 kWh	129 kWh	5024 kWh

Collective schema with technical water: Optitank Combi tanks. Ideal for middle scale installations



Collective schema with technical water: Optitank Steel tanks. Ideal for large scale installations



Solar collector: **Optisun 245™**

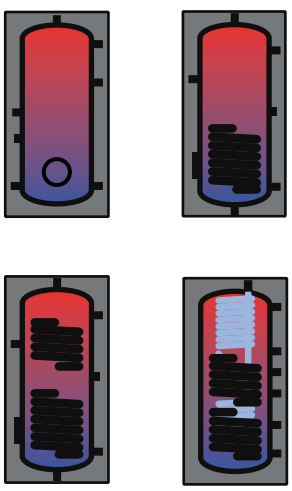
The Optisun 245 is the ideal collector for large scale solar thermal installation. The ergonomy of this collector and its outstanding performances make it easy to deal with huge solar projects. it is the collector used in most Opticube projects

Hydraulic group: **Optiflow™**

Thanks to the Optiflow, the flow of the fluid is optimized. The role of the draining bottle which is linked to the station is to store the fluid when the system is off, and the air when it's working. The Optiflow range is adapted for installations from 4 to 200 collectors, with standard or custom made versions (beyond 500 m²). A specific version of the Optiflow is used in all Opticube.

Solar tanks: **Optitank™**

The Optitank range consists in 4 sections: Email, Combi, Steel and Inox. The Optitank tanks, it's the certitude that every requirement will be satisfied, no matter the construction site. Those tanks make every solar project possible, from the smallest to the most ambitious one. Specific versions of Optitank are used in all Opticube.



Hot domestic water supply: **Optiaqua™**

Those systems supply domestic hot water at the required temperature, for flow from 40 liters/minute to 21 m³/hour. In the case of simultaneous water intake,, it's possible to combine those systems to modulate the production ad infinitum. The Optiaqua range consists in 5 versions, which include their own integrated regulation. A specific version of Optiaqua is used in all Opticube.

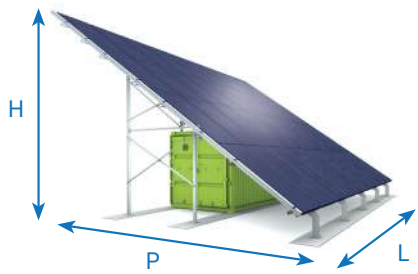
THE OPTICUBE PRODUCT RANGE

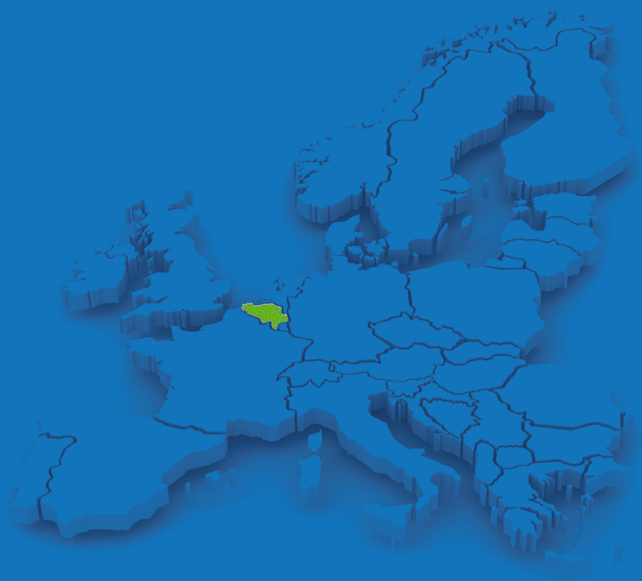
Number of collectors	Surface in m²							Container type
		L x P x H L x 6,7 x 4	L x P x H L x 8,95 x 4,85	L x P x H L x 6,7 x 4,8	L x P x H L x 5,85 x 4,75	L x P x H L x 7,85 x 6,1	L x P x H L x 5,85 x 6,45	
16	39		L=6,1			L=6,1		A
18	44	L=7,7		L=7,7	L=7,7		L=7,7	
20	49		L=6,5			L=6,5		
21	51	L=8,9		L=8,9	L=8,9		L=8,9	B
24	59	L=10,1	L=7,7	L=10,1	L=10,1	L=7,7	L=10,1	
27	66	L=11,3		L=11,3	L=11,3		L=11,3	
28	68		L=8,9			L=8,9		
30	73	L=12,5		L=12,5	L=12,5		L=12,5	
32	78		L=10,1			L=10,1		
33	81	L=13,7		L=13,7	L=13,7		L=13,7	
36	88	L=14,9	L=11,3	L=14,9	L=14,9	L=11,3	L=14,9	
39	95	L=16,1		L=16,1	L=16,1		L=16,1	
40	98		L=12,5			L=12,5		
42	102	L=17,3		L=17,3	L=17,3		L=17,3	C
44	107		L=13,7			L=13,7		
45	110	L=18,4		L=18,4	L=18,4		L=18,4	
48	117	L=20,1	L=14,9	L=20,1	L=20,1	L=14,9	L=20,1	
52	127		L=16,1			L=16,1		
54	132	L=22,5		L=22,5	L=22,5		L=22,5	
56	137		L=17,3			L=17,3		
60	146	L=24,9	L=18,4	L=24,9	L=24,9	L=18,4	L=24,9	
64	156		L=20,1			L=20,1		
66	161	L=27,3		L=27,3	L=27,3		L=27,3	
72	176	L=29,7	L=22,5	L=29,7	L=29,7	L=22,5	L=29,7	
78	190	L=32,1		L=32,1	L=32,1		L=32,1	D
80	195		L=24,9			L=24,9		
84	205	L=34,5		L=34,5	L=34,5		L=34,5	
88	215		L=27,3			L=27,3		
90	220	L=36,9		L=36,9	L=36,9		L=36,9	
96	234		L=29,7			L=29,7		
104	254		L=32,1			L=32,1		
112	273		L=34,5			L=34,5		
120	293		L=36,9			L=36,9		

Version with 3 collectors high

Version with 4 collectors high

Parking version - 3 collectors high





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