Water is Life
The Local Approach

JESUÏTES Bellvitge
Centre d'Estudis Joan XXIII

Use of rainwater collected in schooll

Photography by **Lin Chen**
Winner
World Day of Water 2016
Agència Catalana de l'Aigua

Our project

Presentation

This is the first year that our school, Centre d'estudis Joan XXIII, participate in the Water Conference, so we are very glad for collaborating. Our team is formed by four students of First of Baccalaureate who are Carlos Martín (Technology), Ainhoa Martínez (Technology), Lidia Ponce (Science) and Lin Chen (Economy). Everyone of us has different aptitudes and specialities so our contribution in this project is different too, all of us do our bit to help.

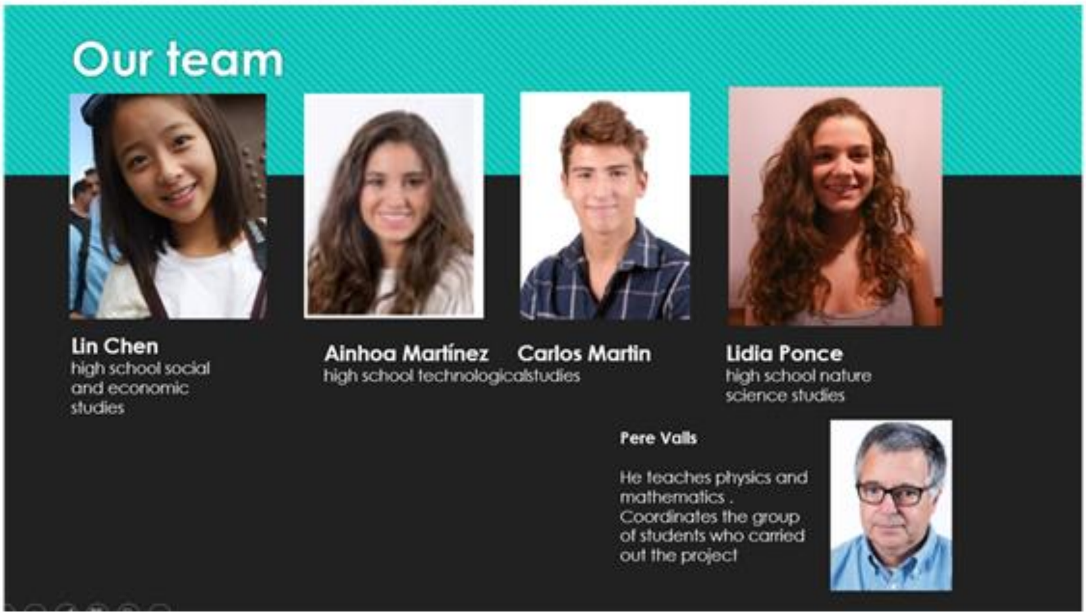
Our objective is to reduce water consumption using rainwater for the school sanitation system: Rainwater will be captured on the roof of the school, this water will go to a subterranean water storage; then we are going to maintain this water without chemical products, so it must have a nanomembrane filter. Later this water will be propelled by a bomb that works with renewable energy produced by photovoltaic panels.

To reduce water consume, to reduce water's costs of the school and to use water with intelligence is our proposal. For making it reality, we must look for the best, the most ecological and the most economic method. We interview experts to have different views about this project and we choose every part of the structure with details for making it with exactitude and perfection.

Our main goal is to give water life like it gives us, to take the maximum profit of this resource, because ''water is life''; literally, water gives us well-being, we grow thanks to water,

the photosynthesis can't be done without water, we couldn't be here if it wasn't for it.''Water is our mum'' says a chinese proverb, because without it all the species would not be able to survive in this planet, hence this planet wouldn't exist. So we must be aware of the importance of water and take care of it. Love water like you love yourself!


Water is Life
The Local Approach
JESUÏTES Bellvitge
Centre d'Estudis Joan XXIII
5-11 June 2016
Our Project
involves the use of rainwater collected in school.
Evaluate technically and also from the economic and environmental point of view , the possibility of using this water for toilets downloads.


Our team
Lin Chen
high school social and economic studies
Ainhoa Martínez
high school technologicalstudies
Carlos Martin
Lidia Ponce
high school nature science studies
Pere Valls
He teaches physics and mathematics .
Coordinates the group of students who carried out the project

Advantages and disadvantages of the rainwater harvesting

Rainwater harvesting has lots of advantages. There are some of them:

- **It's easy to maintain**. On the one hand, it's so important to re-use the water because is so difficult to regenerate it and this technique has a simple use. On the other hand, this technique is better than water purification or the pumping system because maintenance requires less energy. Besides, this kind of water is used without being purified.

- **Reducing water bills.** The rainwater harvesting has different functions where potability is not necessary, so this may cause a reduction in utility bills.

- **Suitable for Irrigation.** The rain water doesn't contain many of the chemicals presented on the groundwater so it is suitable for watering gardens. It can also be used in forest fires, because this kind of water is easy to collect for the after use.

- **Reduces Demand on Groundwater**. Due to population growth, demand for water is also increased. This has caused a massive extraction of groundwater. For this reason, many of these waters have or are about to disappear.

- **Floods and Reduces Soil Erosion**. During the rainy season, the water storage prevents flooding in low lying areas. Also, by the rainwater harvesting, pollution of surface waters with pesticides and fertilizers is avoided.

But it has some disadvantages, too:

- **Unpredictable Rainfall.** Rain is difficult to perceive and it cannot rain during a few months. Relying only water is not very reliable.

- **Initial High Cost**. Depending on the system's size, the initial cost can be very high. Recover all costs may take 10-15 years.

- **Regular Maintenance.** These systems require regular maintenance because there are many factors that can influence the filtration processes like animals, leaves....

- **Roof Types Certain Chemicals May Seep or Animal Droppings.** Some kind of filters are unable to remove certain chemicals, dirt or excrement. Then, this influences their future use.

- **Storage Limits.** The water collection tanks have a limit. If this limit is exceeded, the water collected ends up in sewers and rivers.

seeking expert advice

Mrs. Antonia Sentias is a building technician of the Catalan Institute of Energies (ICAEN), who has been working in ICAEN for nine years.

- Do you think that our project may be feasible and can be interesting from both the economical and ecological point of view? Yes, from the ecological point of view it is very interesting considering that this building uses the water from rain for the WC's downloads, but the only difference is that we use an electric bomb. From the economical point of view, you should take into account the area that the panel needs and other costs.

- What could we improve from our project? Do you have any advice? You must consider how to clean the water from chemical elements, because it is really difficult, and the stagnant water can be dangerous for the health if you don't take care of the maintenance.

-What difficulties do you think we could find when implementing the project? I think that this project can be performed without any problem, maybe you should consider all the factors that this project can involve.

-In which ways could these types of projects be financed? Nowadays it's complicated to ask for a grant. First of all, you should calculate all the costs to compare which option is worthwhile.

-Could your institution donate any kind of support to the project? Either technical or any other kind… Yes, we can show you our system, all the installations that this project includes. Therefore, you will have an example of this project done.

-Would you license us to mention your institution in our project? Could we mention that, in some way, you are giving support to our initiative? I need to ask to the communication department because I can't decide about it.

- Could a project like this take profit from any kind of support from other institutions that may be interested? Some private business may be interested in doing the pilot test.

-Could you tell me something about your institution? It is a public company which was created in 1991. The main purpose of this company is to encourage the responsible use of energies, to promote energy savings and the renewable energies in Catalunya.

Mr. Samuel Reyes, the associate director at Agència Catalana de l'Aigua (ACA), graduate in Environmental Science, who has been working in this institution for a year and a half.

- Do you think that our project may be feasible and can be interesting from both the economical and ecological point of view?
From the ecological point of view it is interesting; however, from the economical point of view, you should assess the costs from the deposit, the energetic cost and the whole cost of the project. But it is a very interesting project.
- What could we improve from our project? Do you have any advice?
You could take into account other necessities that can be fulfilled with the use of rain water, like watering the gardens, heatings…
The most interesting would be to have the deposit on the roof and, this way, you can save up the energetic cost (the bomb and the plate). If it was very heavy, you could make a larger and flatter deposit, as well as reinforcing the roof. Otherwise, you cannot only depend on rain water, as the Mediterranean climate is very changing; so, what you could do is to mix the rain water with drinkable water, so that the nitrate and the hydrogen blend half and half in order to get drinkable water too.
-What difficulties do you think we could find when implementing the project?
The installation of solar panels, as nowadays the govern has set a rate if electricity is produced in an independent way; that would imply a great economical and ecological cost. The other problem you could face is that there is only one water network for all the installations, what it means that the same network will be used to distribute the water for the showers, for the taps, for the toilets and for the other needs. So you should watch if it is possible to divide the networks or you will need to mix the water.

-In which ways could these types of projects be financed?
First of all, you have to implement saving measures in the school in order to carry out this project. Later, you could ask for funds to the Education Department, or you could also ask for other European financial aid.

-Could your institution donate any kind of support to the project? Either technical or any other kind…
Most of the technicians (Forestry Agronomists) are geared towards the schedule of dams; we are not experts in water distribution, that is what you will need.

-Would you license us to mention your institution in our project? Could we mention that, in some way, you are giving support to our initiative?
Sure, I could write you a letter of support.
- Could a project like this take profit from any kind of support from other institutions that may be interested?
I would say that maybe from the Education Department. I suppose that the water bill from the school is paid by the government; that is why the public administration could be interested in this project, to reduce the expenses.

-Which is your position in this company?
I am the associate director and I give technical support to the director. I monitor all the processes with the town halls; I deal with the departments of press and media, web design, transparency, R+D, Citizen's Advice Service, internal projects, etc.
-Could you tell me something about your institution?
It is a public company which was created 15 years ago and it is controlled by the Department of Territory. The director is Mr. Jordi Agustí.
-What could you tell me about the history of this institution?
ACA was the outcome of the fusion of two different companies, which had two different roles: one was in charge of sanitizing and the other one of the infrastructures. ACA was created to make the water cycle complete. Thanks to this institution it has been possible to build sanitizing machines in places where it would have been impossible, like in small villages which do not have the economical capacity to build a purification system in order to have drinkable water; this is a display of solidarity among the territory (nowadays there are 5000 sanitizing machines).
- Which projects are you giving support to?
Projects about the Ter fluvial, about the efficiency of water in the resource control, about the climate change in Delta del Ebro, or about the ICTs for the management of water resources. All of them related to the ecosystem and the pollution.

*Mr. **José Antonio López Rodríguez**, the **Manager of General Services** at Jesuïtes Bellvitge-Centre d'estudis Joan XXIII, is responsible of janitor, student's pick up service, library service, cafeteria and dining room services, cleanliness service, security service and furniture control and purchase.José Antonio has been in the centre for **31 years**.*

-How many litres of water are used for the flushes of the toilets at school?
In the girl's room it is used the Fluxor Presto 1000M that flushes 8.4 litres in every flush. The urinals that use Pulsador Presto 12A, 1.6 litres are flushed every time.

-How many toilets are there in the center? 103 toilets and 28 urinals.

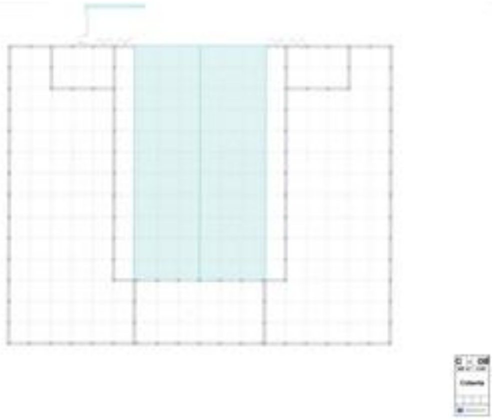
-Do you think that our project of saving water by using rainwater could be used to compensate the water expenses?
Using rainwater would help to save up greatly in the water waste, as we normally have 2000 users daily in our facilities. We can make an approximation of between 800-1000 flushes daily, taking into account the duration of the stay and the scholar calendar.

-What difficulties do you think we can face when carrying out this project (economical, technical…)?
The most complicated part of this project is to search for funds in order to carry it out; it is also complicated to study deeply all the technological, biological and economical part that involves the project.
-Would you give us any advice to make the project?
It could might be raised the idea of providing water to only some of the parts, to some of the floors of the building, or to some toilets or urinals that require less bombing installation; for example at the playground, on the first floors and the dining room. That would cheapen the installation costs.
If the installation was accompanied by the renovation of fluxors and push buttons by some others ecological, there would be less flush to perform the same service; therefore, we will also save up in the daily consumption.
-How could this project be sponsored?
To sponsor this project we should research if the European Union, the Autonomous Community or the State subsidize projects for saving energy or water. Otherwise, we should research if they stablish special funds through the appropriate institutions to carry out those projects; like for example IDEA (Institute for the Energy Diversification of the Ministry of Industry and Energy),

ICAEN (Catalan Institute of Energy of the Generalitat), ICF (Catalan Institute of Finance of the Generalitat), among others.

School data

In all our school we have 103 baths. We use 8,4 liters per each discharge. Also, we have 28 urinaries which use 1,6 liters of water in each discharge. Every day there are around 800-100 discharges in all the school, That mean that we waste around 5000 liters of water diary. Every month we use 100000 liters of water just for toilets.



School's Roof:
In the school's roof we have around 250m^2 for the solar panels installation. We have 3 accesses to go up to the roof.We should take care about the weight of our equipment: solar panels, converters, batteries, etc. Because the roof is not ready at all for resist so many weight.

weather :

how often it rains ?

how much water can rain in one episode ?

Things to consider for the rainfall study

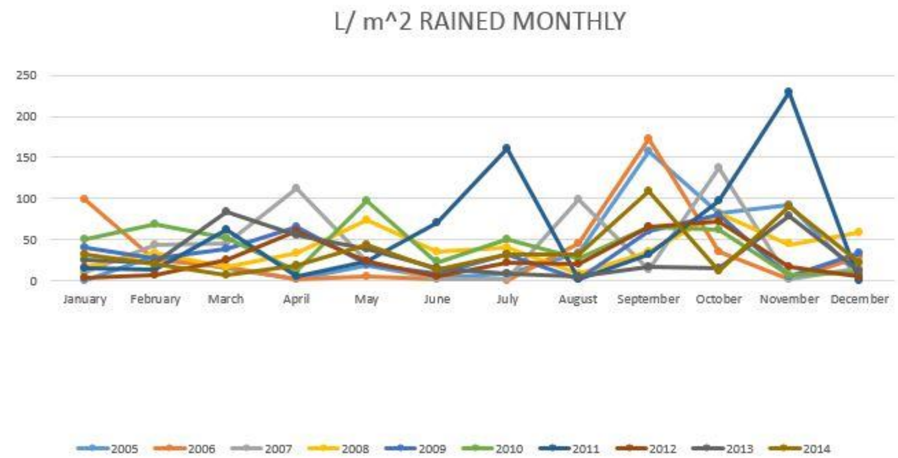
- The rainfall is not stable, in some months there can be lot of rain and in the others less water. Nowadays, it’s isn’t reliable the general patron of rain.
- The pollution these days we have is increasing and it is affecting directly to the climate and the water of our world.
- The general studies have to be done for a long time, so 2015 cannot be included in the study because the year’s documents are not finished yet.
- The study is only made in L’Hospitalet de Llobregat.

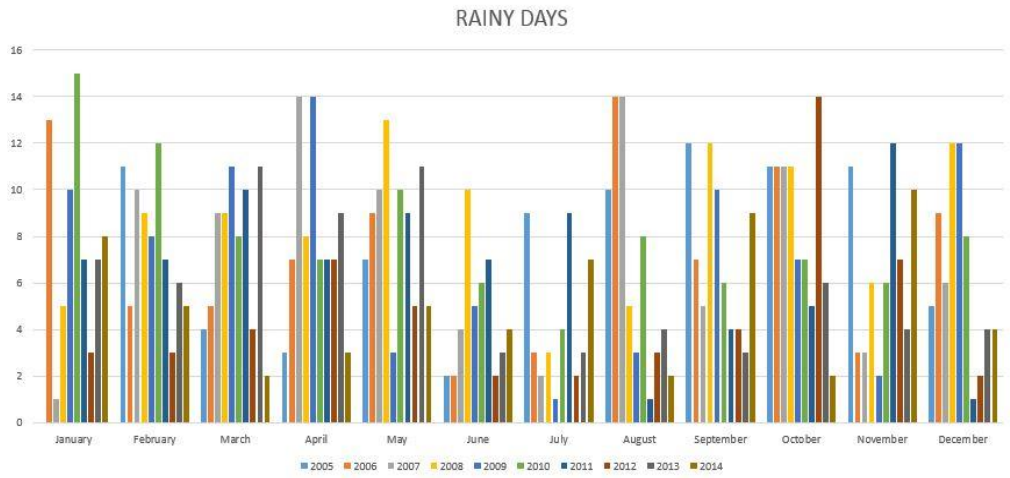
General information of the rain

	2005		2006		2007		2008		2009	
	L/ m^2	S.D	L/ m^2	S.D	L/ m^2	S.D	L/ m^2	S.D	L/ m^2	S.D
January	0	0	99	13	10,1	1	16,8	5	40	10
February	30	11	25	5	42,4	10	33,4	9	26,8	8
March	14	4	15,8	5	45,6	9	17	9	38,4	11
April	1,8	3	2	7	111,4	14	33,2	8	64,6	14
May	18,3	7	4,2	9	23,3	10	73,8	13	20,2	3
June	3,4	2	1,8	2	0,8	4	35	10	7,2	5
July	7,2	9	0,1	3	0,8	2	40,4	3	31,2	1
August	32,8	10	45,4	14	98,2	14	7,2	5	0,8	3
September	157,6	12	172,6	7	12,8	5	34	12	59,4	10
October	81	11	35	11	136,4	11	81,4	11	79,6	7
November	91,8	11	1,8	3	1	3	44	6	3,8	2
December	5,2	5	27,4	9	15,4	6	58,6	12	33,8	12

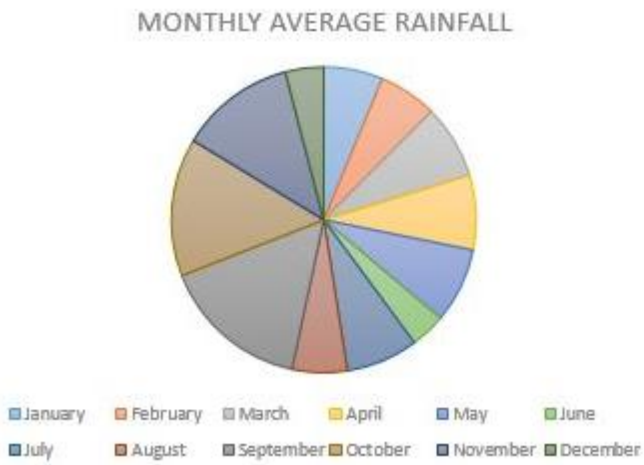
	2010		2011		2012		2013		2014
	L/ m^2	S.D	L/ m^2	S.D	L/ m^2	S.D	L/ m^2	S.D	L/ m^2
January	49,4	15	14,6	7	2,8	3	24	7	32
February	68,8	12	12,2	7	5,8	3	21	6	19,2
March	52,2	8	62,2	10	24,2	4	83,8	11	6,4
April	11,8	7	4,8	7	60,6	7	54,6	9	18,2
May	97,6	10	23,2	9	23,8	5	38	11	42,8
June	22,2	6	69,8	7	4,8	2	14,2	3	12,6
July	50	4	160	9	22	2	8,6	3	32
August	26,4	8	1,6	1	20	3	5	4	30,8
September	64,4	6	32	4	65,4	4	15,6	3	108
October	62,2	7	97	5	72,4	14	14,8	6	12
November	6,8	6	228,9	12	17	7	79	4	90,4
December	9,4	8	0,3	1	5,2	2	10,6	4	21

S.D= Sent days





Monthly average rainfall



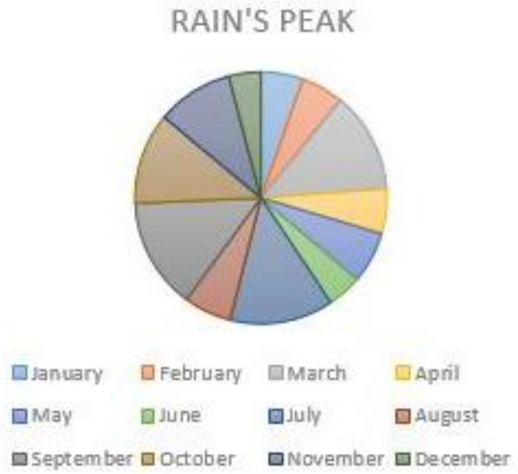
	CALCULATION	FINALLY RESULT
January	(0+99+0,1+16,8+40+49,4+14,6+2,8+24,0+32)/10	28,9 L/ m^2
February	(30+25+42,4+33,4+26,8+68,8+12,2+5,8+21+19,2)/10	28,46 L/ m^2
March	(14+15,8+45,6+17+38,4+52,2+62,2+24,2+83,8+6,4)/10	35,96 L/ m^2
April	(1,8+2+111,4+33,2+64,6+11,8+4,8+60,6+54,6+18,2)/10	36,3 L/ m^2
May	(18,3+4,2+23,2+73,8+20,2+97,6+23,2+38+42,8)/10	36,5 L/ m^2
June	(3,4+1,8+0,8+35+7,2+22,2+69,8+4,8+14,2+12,6)/10	17,18 L/ m^2
July	(7,2+0,1+0,8+40,4+31,2+50+160+22+8,6+32)/10	35,23 L/ m^2
August	(32,8+45,4+98,2+7,2+0,8+23,4+1,6+20+5+30,8)/10	26,82 L/ m^2
September	(157,6+172,6+12,8+34+59,4+64,4+32+65,4+15,6+108)/10	72,18 L/ m^2
October	(81+35+136,4+81,4+79,6+62,2+97+72,4+14,8+12)/10	67,18 L/ m^2
November	(91,8+1,8+1+44+3,8+6,8+228,9+17+79+90,4)/10	56,45 L/ m^2
December	(5,2+27,4+15,4+58,6+33,8+9,4+0,3+502+10,6+21)/10	18,69 L/ m^2

Rain's peak

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
January	0/0=0	99/13= 7,62	10,1/1=10,1	16,8/5=3,36	40/10=4	49,4/15=3,3	14,6/7=2,09	2,8/3=0,93	24/7=3,43	32/8=4
February	30/11=2,72	25/5=5	42,4/10=4,24	33,4/9=3,71	26,8/8=3,35	68,8/12=5,73	12,2/7=1,74	5,8/3=1,93	21/6=3,5	19,2/5=3,84
March	14/4=3,5	15,8/5=3,16	45,6/9=50,7	17/9=1,89	38,4/11=3,49	52,2/8=6,53	62,2/10=6,22	24,2/4=6,05	83,8/11=7,62	6,4/2=3,2
April	1,8/3=0,6	2/7=0,29	111,1/14=7,96	33,2/8=4,15	64,6/14=4,61	11,8/7=1,69	4,8/7=0,69	60,6/7=8,66	54,6/9=6,07	18,2/3=6,07
May	18,3/7=2,61	4,2/9=0,47	23,2/10=2,32	73,8/13=5,68	20,2/3=6,73	97,6/10=9,76	23,2/9=2,58	23,8/5=4,76	38/11=3,46	42,8/5=8,56
June	3,4/2=1,7	1,8/2=0,9	0,8/4=0,2	35/10=3,5	7,2/5=1,44	22,2/6=3,7	69,8/7=9,97	4,8/2=2,4	14,2/3=4,73	12,6/4=3,15
July	7,2/9=0,8	0,1/3=0,03	0,8/2=0,4	40,4/3=13,47	31,2/1=31,2	50/4=12,5	160/9=17,78	22/2=11	8,6/3=2,87	32/7=4,57
August	32,8/10=3,28	45,4/14=3,24	98,2/14=7,01	7,2/5=1,44	0,8/3=0,27	26,4/8=3,3	1,6/1=1,6	20/3=6,67	5/4=1,25	30,8/2=15,4
September	157,6/12=13,13	172,6/7=24,66	12,8/5=2,56	34/12=2,83	59,4/10=5,94	64,4/6=10,73	32/4=8	65,4/4=16,35	15,6/3=5,2	108/9=12
October	81/11=7,36	35/11=3,18	136,4/11=12,4	81,4/11=7,4	79,6/7=11,37	62,2/7=8,89	97/5=19,4	72,4/14=5,17	14,8/6=2,47	12/2=6
November	91,8/11=8,34	1,8/3=0,6	1/3=0,33	44/6= 7,33	3,8/2=1,9	6,8/6=1,13	228,9/12=19,08	17/7=2,43	79/4=19,75	90,4/10=9,04
December	5,2/5=1,04	27,4/9=3,04	15,4/6=2,57	58,6/12=4,88	33,8/12=2,82	9,4/8=1,18	0,31=0,3	5,2/2=2,6	10,6/4=2,65	21/4=5,25

All the results are L/d (litre for day rained)

	CALCULATION	FINALLY RESULT
January	(0+7,62+10,1+3,36+4+3,3+2,09+0,93+3,43+4)/10	3,88 L/d
February	(2,72+5+4,24+3,71+3,35+5,73+1,74+1,93+3,5+3,84)/10	3,87 L/d
March	(3,5+3,16+50,7+1,89+3,49+6,53+6,22+6,05+7,62+3,2)/10	9,24 L/d
April	(0,6+0,29+7,96+4,15+4,61+1,69+0,69+8,66+6,07+6,07)/10	4,08 L/d
May	(2,61+0,47+2,32+5,68+6,73+9,76+2,58+4,76+3,46+8,56)/10	4,69 L/d
June	(1,7+0,9+0,2+3,5+1,44+3,7+9,97+2,4+4,73+3,15)/10	3,17 L/d
July	(0,8+0,3+0,4+13,47+31,2+12,5+17,78+11+2,87+4,57)/10	9,48 L/d
August	(3,28+3,24+7,01+1,44+0,27+3,3+1,6+6,67+1,25+15,4)/10	4,35 L/d
September	(13,13+24,66+2,56+2,83+5,94+10,73+8+16,35+5,2+12)/10	10,14 L/d
October	(7,36+3,18+12,4+7,4+11,37+8,89+19,4+5,17+2,47+6)/10	8,36 L/d
November	(8,34+0,6+0,33+7,33+1,9+1,13+19,08+2,43+19,75+9,04)/10	6,99 L/d
December	(1,04+3,04+2,57+4,88+2,82+1,18+0,3+2,6+5,65+5,25)/10	2,93 L/d


RAIN'S PEAK
January
February
March
April
May
June
July
August
September
October
November
December

Calculations:

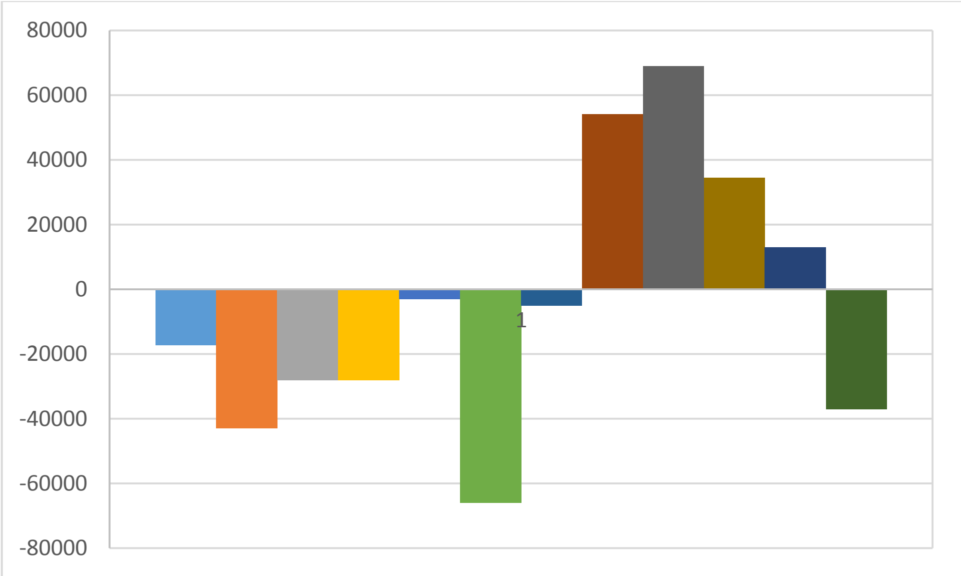
TOTAL SURFACE FOR WATER CAPTATION (M2)
2000

DAILY COSUMPTION (L)
5000

MONTH	RAINFALL (L/M2)	WATER COLLECTED (L)	SCHOOL DAYS	CONSUMATION (L)	BALANCE (L)
1	28,9	57800	15	75000	-17200
2	28,5	57000	20	100000	-43000
3	36	72000	20	100000	-28000
4	36	72000	20	100000	-28000
5	36	72000	15	75000	-3000
6	17	34000	20	100000	-66000
7	35	70000	15	75000	-5000
8	27	54000	0	0	54000
9	72	144000	15	75000	69000
10	67,2	134400	20	100000	34400
11	56,5	113000	20	100000	13000
12	19	38000	15	75000	-37000

900000	**-19800**
CONSUM ACTUALY (L)	CONSUM PROJECT (L)

Monthly balance



Graphic shows the monthly balance.

Zero → Water consummation in a month = Rainfall

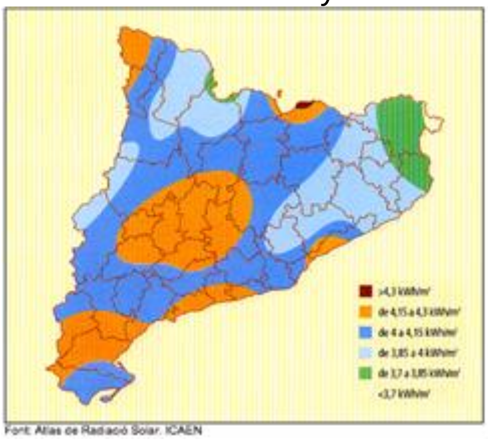
Each year we have a water deficit of 19800 liters

We need storage 70000 liters of water from rainfall → 7x10X1 m tank

cycling and water lift

Websites looked:
http://ioc.xtec.cat/materials/FP/Materials/0801_IEA/IEA_0801_M06/web/html/media/fp_iea_m06_u1_pdfindex.pdf
For any kind of subvention for the solar panels:
http://www.coac.net/mediambient/documentacio/sub_municipal.htm
If we present some documents, information and more, we are able to demand a subvention to the state and they would pay us the 25% of all this equipment.
Perfect place for buying solar panels and accessories: http://grupsolar.com

Atlas Solar de Catalunya:

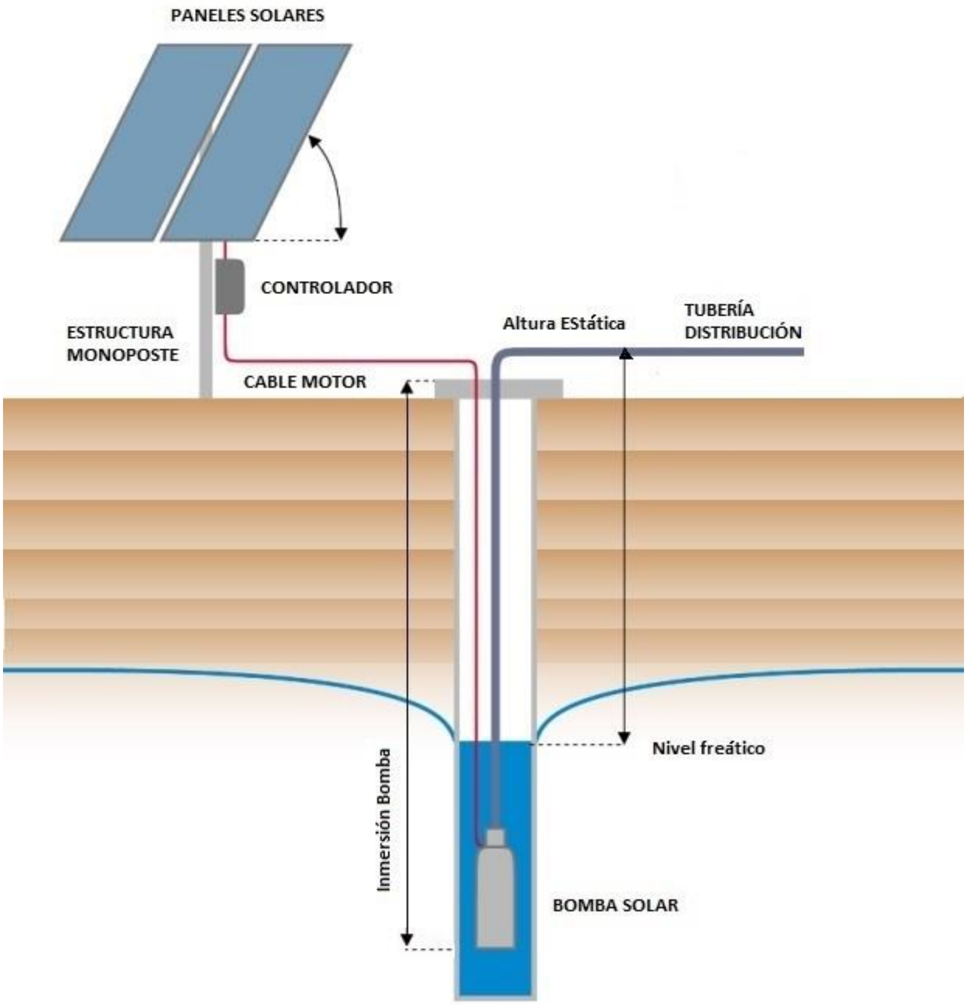


Font: Atlas de Radiació Solar. ICAEN

Here in Hospitalet we have an irradiation between 4-4,15 Kwh/m^2. In the school's roof we have around 250m^2 for the solar panels installation.

The rain will be on the roof which should be make a slope so that the water falls into pipes in which there will be a system of filtering of barros or objects such as leaves or anything else.

Collected water will go for some pipes from the roof of the school to the tank which was found under the playground.



The arrangement and form of the connection of the panels (series or parallel), will be depending on the rated voltage and intensity of current necessary to drive the electric motor of the pump.

Solar panels will be located on the roof of the school.

Regulator or charge controller: electronic device responsible for controlling the optimal performance of the water pump. The driver helps to maximize the energy efficiency of solar panels, allowing water pump to operate also during periods of lower solar irradiation.

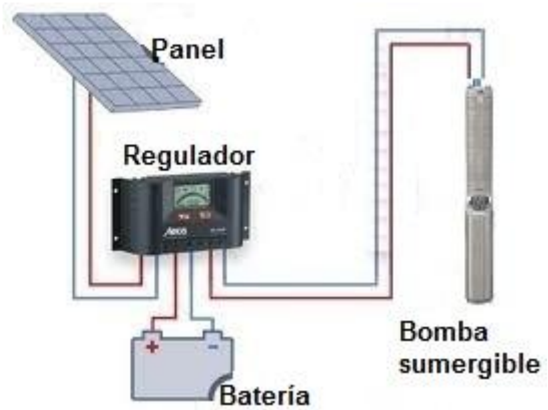
The controller also regulates the operation of pump, by switching off when the reservoir where the water is pumped has reached its maximum capacity either, because the level of the water in the well has fallen below a set limit of safety, in order to avoid that the pump suction inlet is uncovered.

Likewise, the charge controller has a control system with connectors "Plug & Play" unique position, that allows the ignition or system shutdown (in rainy season is disconnected, by placing the switch in the "Off" position).

Submersible water pump: connected to the regulator or charge controller will be submerged in the pit. The value of minimum submergence, expressed in meters, which must have the bomb will be approximately: NPSHbomba (m) - 10 (m). Solar pumps operate on DC power and tend to be manufactured in stainless steel to withstand better the aggressiveness of the groundwater.

Charge controller

A regulator or charge controller is an electronic equipment charge control and regulate, hence its name, the passage of power from photovoltaic modules for water pump. It is a device that prevents overloads from occurring and simultaneously limited the supply voltage to the pump to values appropriate for your operation.



On this way, a charge controller is responsible for controlling the power to the pump, making this safe when for example, solar panels are getting much sunlight avoiding excessive loads by current peaks from occurring.

In a simple way, a regulator can be understood as a switch placed in series between the solar panels and the pump, which is closed and connected to the process of the pump power, and open when the voltage or current levels are not adequate to feed the pump motor terminals.

Also currently most charge controllers have a feature that allows you to maximize the energy captured by the PV generator by the use of a specific technology for monitoring and search for the maximum power point of operation of the Maximum Power Point (MPP) generator, also called MPP-tracking or MPPT.

The charge controller is selected so that it is able to withstand without damage values of rated voltage and maximum current according to the configuration of installed photovoltaic generators.

In this way, the regulator or charge controller must be dimensioned to withstand the maximum intensity of current generated in the system, the input line to the regulator from the PV generators, both in the line of exit charges that feeds

Regulador de carga
y bomba sumergible

In this sense, the maximum current provided by the line of input to the regulator from the photovoltaic generators is the corresponding to the short circuit current (ISC) of the PV generator more a safety margin (usually 25%), to take into account possible peaks of irradiance or temperature changes.

On the other way, the maximum current specified by the starting line is given by the consumption of loads of the system (in this case, the electric pump motor) also increased by 25%. When we have these two facts we can choose what kind of regulator of most suited to our needs.

As already indicated, the controller will also act by disrupting the supply of electricity from photovoltaic panels into the pump when, due to a lack of sunlight, the voltage at the terminals of motor power supply is less than its minimum voltage value (that is usually their nominal voltage less than 10%), in order to avoid damage to the pump motor.

Also during periods of maximum insolation where solar panels are generating electricity and voltage to a maximum limit value, the regulator may interrupt the connection between the photovoltaic modules and pump if it could be harmful to the integrity of the pump, either may act also gradually reducing the average current delivered by the panels to the pump motor.

All installed current controller must be suitably protected against short circuits occurring online consumption of the pump, as well as against the possibility to produce is an accidental disconnection of the same while the panels are generating power.

Internal voltage drops of the regulator between your solar generator and pump terminals will be lower than 4% of the nominal voltage (0.5 V for 12 V nominal voltage), for systems less than 1 kW and 2% of the nominal voltage for systems greater than 1 kW, including terminals.

In any case, the daily energy losses caused by consumption of the controller in normal operating conditions should be less than 3% of the daily consumption of energy.

Also, the charge regulator will have a control system with connectors "Plug & Play" unique position, that allows the ignition or system shutdown (in rainy season is disconnected, by placing the switch in the "Off" position).

Finally, indicate that all controller used in any installation should be tagged correctly, with at least the following information:

• Nominal voltage (V)

• Maximum current (A)

• Manufacturer (name or logo) and serial number

• Polarity of terminals and connections

Solar submersible pump

Solar pumps usually work without batteries, directly connected to the photovoltaic panels through the regulator or charge controller.

They are pumps in stainless steel to withstand the aggressiveness of the groundwater (although in our case are rainwater and additionally filtered), and have an electric motor of direct current (DC/DC), at a rated voltage that can cover from pumps which operate to 12/24V to models of pumps designed for high flow rates and pressures with nominal value between 300 and 500 volts.

They tend to be submersible pumps that are immersed in water wells, in which case, the installation of sensors of water level in well inside will be necessary to avoid that the water level can descend during pumping below the mouth of the pump, thus avoiding is the pump working dry.

The risk of cavitation is very low in submersible pumps. However, you should check the NPSH of the pump in its operating point. Then, the value of the minimum immersion in water, expressed in meters, which must have the bomb will be approximately: NPSHbomba (m) - 10 (m).

Complete pump must work near its maximum performance, which is reached only in a narrow range of flow, that will be the criteria used for the selection of the pump type. This information will be shown in the curves of the pump must be supplied by the manufacturer in the technical catalogues.

Therefore, the operating point of the pump shall be that whose flow supplied is as close as possible to its point of optimal performance, or slightly to the right of this.

Energy consumption (in kWh) can be calculated using the following expression of the pump, in function of its performance (η), the supplied flow rate (Q) and the height or discharge (H) pressure:

$$KWh = \frac{Q \cdot H}{367 \cdot \eta}$$

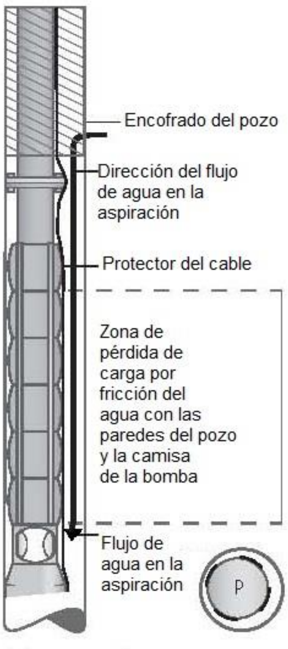
where,

Q is the flow rate supplied by the pump, in m3/h

H is the height of drive, in m

η is the performance of the pump.

Another aspect that influences the performance of a submersible type pump is its diameter, i.e. how wide that proves. In general, the greater the diameter of a submersible pump better is their performance, so most of the time, it will tend to choose pumps the widest possible.



However, the maximum width of a pump is limited by the diameter of the well where are immersed, so width that is well.

In this regard, the performance of a submersible pump will be influenced significantly by the free space between the wall of the well and the pump housing.

This is so because in a narrow well, where the pump is very fair space, being walking distance between the walls of the borehole and pump shirt, will be produced important losses by friction of water due to turbulence occurring in the small gap between the pump and the walls of the borehole that will make the performance of the pump falling.

In general, it is recommended to install pump more focused as possible into the hole of the pit so this is surrounded on all sides by water, and must be a minimum lateral distance between the perimeter of the pump and the inner wall of the well.

In addition, another reason to maintain a sufficient water that surrounds to the shirt of the pump is ensure an efficient cooling of the pump motor that absorbs the heat generated during operation.

In this regard, the following formulation allows to obtain the minimum recommended between the inner wall of the well and the pump sleeve:

$$v = \frac{Q \cdot 354}{(D^2 - d^2)}$$

where,

v (m/s) is the speed of the water in the gap around the pump. To avoid large losses of head by friction it should be limited to 3 m/s.

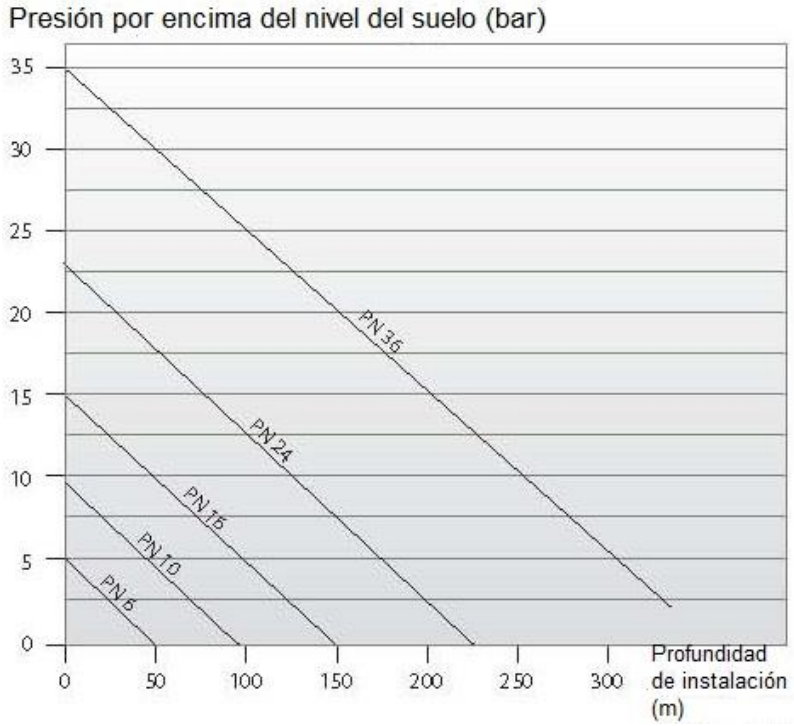
Q (m3/h) is the flow that pumps the pump at its point of design.

D (mm) is the internal diameter of the walls of the borehole.

d (mm) is the outside diameter of the pump sleeve.

In another order of things, upstream of the pump tubing, or delivery pipe will be conditioned by the diameter of the pump outlet, depending on pump model selected for flow rate and operating pressure established.

On the other hand, the choice of the resistant type for the vertical pump discharge pipe will depend on several factors, as they may be, pressure discharge and the installation depth, the aggressiveness of the water, the loss of head by friction, etc.



The figure attached help to select the pressure required for the pipeline of drive depending on the depth of the installation of the pump and the discharge pressure.

To the aggressiveness of the majority of the groundwater, the use of stainless steel for the ascending pipe is sufficient, or even steel galvanized or coated, a cheaper option, may be acceptable. If the aggressiveness of the water were important installing replaceable zinc anodes to protect the motor and the pump is recommended.

As a replacement to the stainless steel pipe, much more expensive, you can use type hoses flexible hoses as Wellmaster. These are hoses manufactured with a high strength polyester jacket, knitted circularly without seams and extruded inside and out, by means of elastomer polyurethane or synthetic rubber.

Due to the design of this type of flexible hose, diameter will expand slightly when it is under pressure and will thus reduce pressure loss by friction by increasing its diameter of step. At the same time, prevents the accumulation of lime in the surface of the hose, since the constant change of the diameter during water pumping force detachment of lime.

Lorentz PS150 C-SJ5-8 Solar pump

Lorentz PS centrifugal pumps are high quality products designed for applications of potable water supply of high flow, drinking bowls for cattle, tanks and irrigation management. They provide a large volume water economical, sustainable and anywhere using solar energy. These highly efficient pumps can reach flows of up to 79 m^3/h. Each system consists of a pump, a motor and a driver. This modular concept maintains all electronic components above the surface, enabling easy maintenance, easy access and low cost for the property.

Applications:

• Potable water supply

• Management of the water tank

• Construction

• Drinking trough for cattle

• Compression systems

Features:

• Fast, fault-free installation

• Excellent functionality

• High reliability and service life

• Short cycle of the return on investment (ROI)

• Lower total cost of operation (TCO)

Technical data:

• Dynamic height Max. 20 m

• Flow Max. 4,0 m^3/h • Vmp * > 17 V

• Voc Max. 50 V

Driver: PS150:

• Monitoring and controlling

• Control inputs for operation protection in dry, remote control, etc.

• Protected against reverse polarity, over load and temperature execiva

• Integrated MPPT

• Disconnect low voltage in battery operation mode

Engine: ECDRIVE 200-C

• CD brushless - maintenance-free motor

• Filled with water

• No electronic elements in the engine

• Dip Max. 250 m, IP68

Pump head: PE C-SJ5-8

• High reliability and service life

• Non-return valve

• Material Premium

• Optional: protection against dry operation

Driver 1.2 kg

Purchased pump 11 kg

Engine 7.0 kg

Head of unit 4.2 kg

Conclusions

http://grupsolar.com/19-kit-solar-fotovoltaico-7-con-inversor-de-700w.html

This is the bomb necessary to go up all the water we need from the playground to the roof.

In this case, to supply of electric energy this water bomb, we would need 4 solar panels of 12V each. Also, we would need an oscillator to change from direct current to alternating current. Some batteries, connectors and one regulator.