

# CS 620 Course Project

## Appliance Scheduling In Solar Decathlon Home



Solar  
decathlon

2014  
EN FRANCE



TEAM  
**SHUNYA**  
I N D I A

SUSTAINABLE HABITAT FOR AN URBANIZING NATION BY ITS YOUNG ASPIRANTS

# Team Details

- Rajdeep Sardar 123050071
- Rohit Gupta 124050002
- Swadesh Jain 123050085

# Objectives

- The objective of the project is maximizing the point score in the Solar Decathlon Home.
  - Use the load elasticity of the home appliances to reduce the peak power consumption.
  - Scheduling of background loads (eg. HVAC, Refrigerator).
  - Generating a schedule (Possible slots) for usage of interactive appliances (eg. Washing machine).

## MONITORING TYPES

### ELECTRICAL

#### CONTINUOUS MONITORING

- 4. Electrical Energy Balance
  - 4.1 Electricity Autonomy
  - 4.2 Temporary correlation
  - 4.3 Electricity use per measurable area

### INSTRUMENTATION

#### CONTINUOUS MONITORING

- 5. Comfort Conditions
  - 5.1 Temperature
  - 5.2 Humidity
  - 5.3 Indoor Quality air
- 6. House Function
  - 6.1 Refrigerator
  - 6.2 Freezer

#### MONITORING TASK

- 5. Comfort Conditions
  - 5.4 Workstation Lighting
  - 5.5 Accoustic
  - 5.4 Workstation Lighting
- 6. House Function
  - 6.3 Clothes Washer
  - 6.4 Clothes Dryer\*
  - 6.5 Dish Washer
  - 6.6 Oven
  - 6.7 Hot water draws\*
  - 6.8 Cooking\*
  - 6.9 Home electronics
  - 6.10 Dining
  - 6.11 Water

## MONITORING TYPES

### ELECTRICAL

#### CONTINUOUS MONITORING

- 4. Electrical Energy Balance
  - 4.1 Electricity Autonomy
  - 4.2 Temporary correlation
  - 4.3 Electricity use per measurable area

### INSTRUMENTATION

#### CONTINUOUS MONITORING

- 5. Comfort Conditions
  - 5.1 Temperature
  - 5.2 Humidity
  - 5.3 Indoor Quality air
- 6. House Function
  - 6.1 Refrigerator
  - 6.2 Freezer

#### MONITORING TASK

- 5. Comfort Conditions
  - 5.4 Workstation Lighting
  - 5.5 Accoustic
  - 5.4 Workstation Lighting
- 6. House Function
  - 6.3 Clothes Washer
  - 6.4 Clothes Dryer\*
  - 6.5 Dish Washer
  - 6.6 Oven
  - 6.7 Hot water draws\*
  - 6.8 Cooking\*
  - 6.9 Home electronics
  - 6.10 Dining
  - 6.11 Water

**Chart 2. Solar Decathlon Europe 2014: Points distribution**

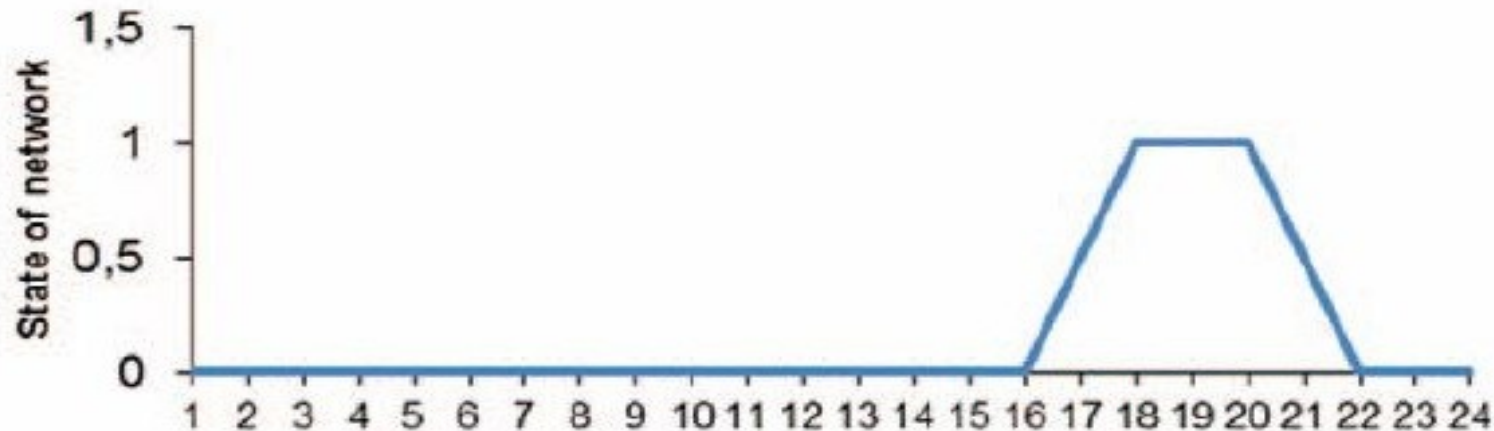
No.	Contest/Sub-contest Name	Contests Points	Sub Contests Points	Assigned by
1	Architecture	120		Jury
2	Engineering & Construction	80		Jury
3	Energy Efficiency	80		Jury
4	Electrical Energy Balance	120		
	4.1 Load consumption per surface area		40	Monitored performance
	4.2 Positive electrical balance		15	Monitored performance
	4.3 Temporary Generation-Consumption Correlation		25	Monitored performance
	4.4 House adjustment to network load state		25	Monitored performance
	4.5 Power peaks		15	Monitored performance
5	Comfort Conditions	120		
	5.1 Temperature		50	Monitored performance
	5.2 Humidity		10	Monitored performance
	5.3 Indoor Air Quality – CO2		15	Monitored performance
	5.4 Indoor Air Quality - VOC		10	Test
	5.5 Natural Lighting		20	Test
	5.6 Acoustic		15	Test
6	House Functioning	120		
	6.1 Refrigeration		5	Monitored performance
	6.2 Freezing		5	Monitored performance
	6.3 Clothes Washer		20	Task + Monitored
	6.4 Clothes Drying		10	Task Completion
	6.5 Dishwashing		10	Task + Monitored
	6.6 Home Electronics		5	Task + Monitored
	6.7 Oven		5	Task + Monitored
	6.8 Cooking		5	Task Completion
	6.9 Hot Water Draws		20	Task Completion
	6.10 Dinner		15	Guests evaluation
	6.11 Water Balance		20	Counting
7	Communication and Social Awareness	80		Jury
8	Urban design, Transportation and Affordability	120		Jury
9	Innovation	80		Jury
10	Sustainability	80		Jury

**Chart 2. Solar Decathlon Europe 2014: Points distribution**

No.	Contest/Sub-contest Name	Contests Points	Sub Contests Points	Assigned by
1	Architecture	120		Jury
2	Engineering & Construction	80		Jury
3	Energy Efficiency	80		Jury
4	Electrical Energy Balance	120		
	4.1 Load consumption per surface area		40	Monitored performance
	4.2 Positive electrical balance		15	Monitored performance
	4.3 Temporary Generation-Consumption Correlation		25	Monitored performance
	4.4 House adjustment to network load state		25	Monitored performance
	4.5 Power peaks		15	Monitored performance
5	Comfort Conditions	120		
	5.1 Temperature		50	Monitored performance
	5.2 Humidity		10	Monitored performance
	5.3 Indoor Air Quality – CO2		15	Monitored performance
	5.4 Indoor Air Quality - VOC		10	Test
	5.5 Natural Lighting		20	Test
	5.6 Acoustic		15	Test
6	House Functioning	120		
	6.1 Refrigeration		5	Monitored performance
	6.2 Freezing		5	Monitored performance
	6.3 Clothes Washer		20	Task + Monitored
	6.4 Clothes Drying		10	Task Completion
	6.5 Dishwashing		10	Task + Monitored
	6.6 Home Electronics		5	Task + Monitored
	6.7 Oven		5	Task + Monitored
	6.8 Cooking		5	Task Completion
	6.9 Hot Water Draws		20	Task Completion
	6.10 Dinner		15	Guests evaluation
	6.11 Water Balance		20	Counting
7	Communication and Social Awareness	80		Jury
8	Urban design, Transportation and Affordability	120		Jury
9	Innovation	80		Jury
10	Sustainability	80		Jury

# Peak Network Load

Power consumption should be reduced during the peak load period.



An evaluation indicator will be calculated according to the following equation:

$$\gamma = (E_p(t) - E_c(t)) \times F(t)$$

where:

$E_p(t)$  = Energy produced at time (t)

$E_c(t)$  = Energy consumed at time (t)

$F(t)$  = function representing the network load, shown above

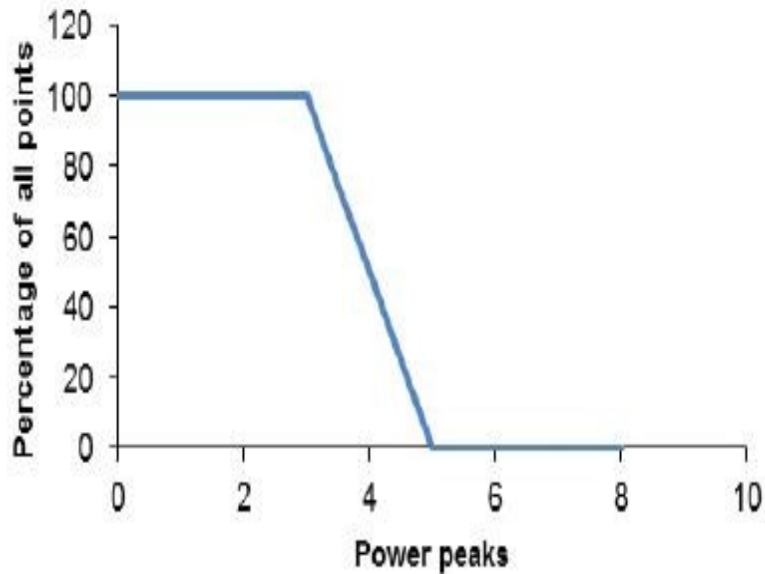


# Peak Power Consumption

## Sub Contest 4.5: Power peaks

Avoiding peak power calls on the electrical grid is another important aspect of energy load management. The peaks power sent and called on the network will be monitored.

The points distribution is represented by the following figure:



# Project TimeLine & Status

<b>Milestones</b>	<b>Tentative Completion Date</b>	<b>Status</b>
System Requirement Analysis	20 February 2013	Completed
Literature Survey	5 March 2013	Completed
Historical Data Collection	15 March 2013	Completed
Design	25 March 2013	In Progress
Coding	5 April 2013	Not Started
Testing	10 April 2013	Not Started
Documentation and Handover	15 April 2013	Not Started

THANK

YOU