SESAME

SESAME

The First Light Source Ever to Run Completely on Renewable Energy

4th Workshop on Energy for Sustainable Science at Research Infrastructure

Yasser Khalil

SESAME

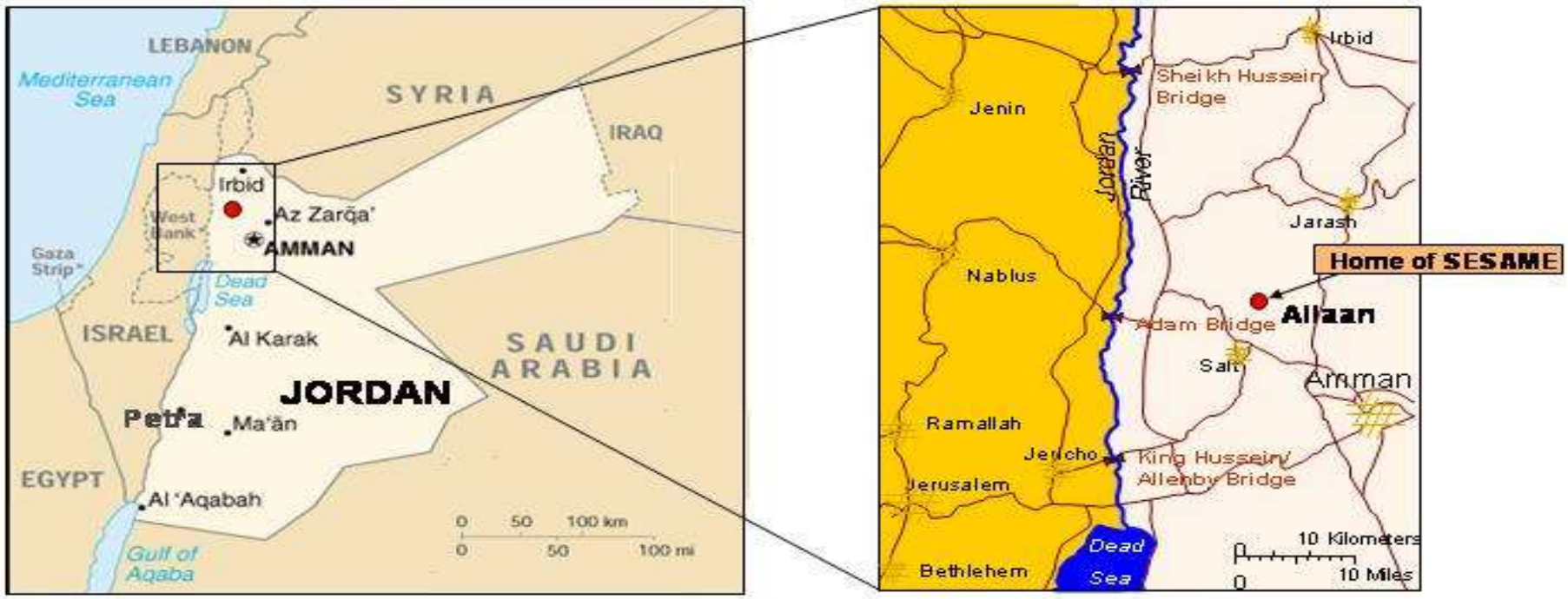
SESAME = Synchrotron-light for Experimental Science and Applications in the Middle East

SESAME Members and Observers

Members:
Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, Turkey.

Observers:
Brazil, Canada, China, EU, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russia, Spain, Sweden, Switzerland, UK and USA.

Location of SESAME



SESAME location in Allan, Jordan

Why Build a Synchrotron Facility?

- **International collaboration is obvious way for countries with relatively small scientific communities and/or limited science budgets to build a synchrotron-light source**
- **Broad programs make synchrotron-light sources ideal facilities for building scientific capacity**
- **SESAME will be a user facility: scientists will typically go to SESAME two or three times a year for a week or two to carry out experiments, in collaboration with scientists from other institutions/countries**

SESAME Budget

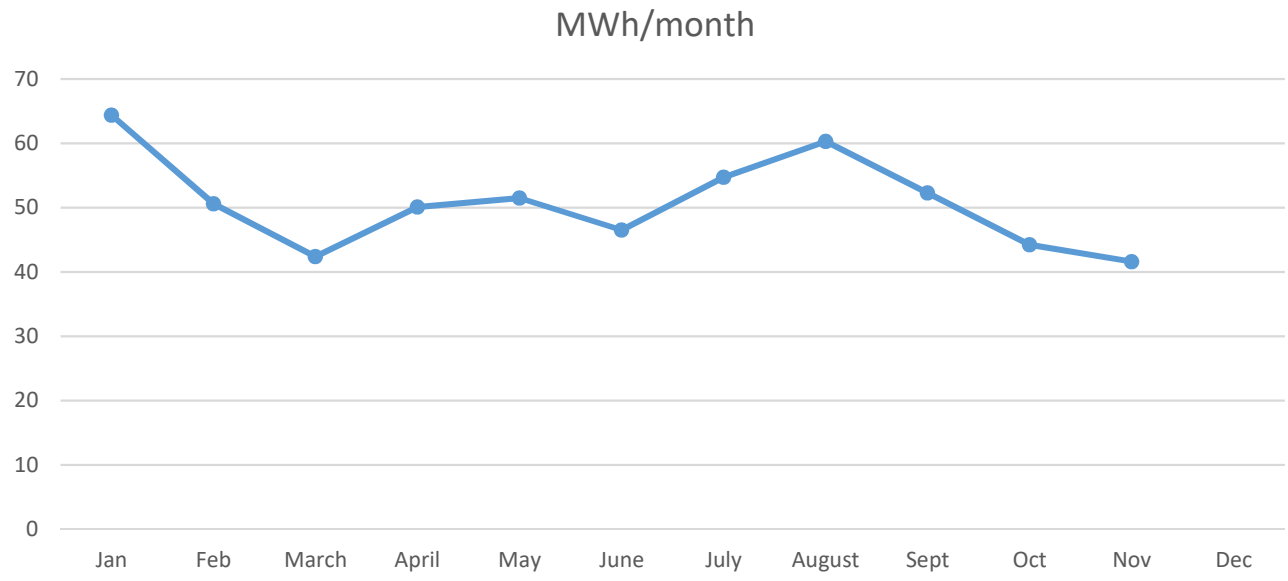
OBJECT OF EXPENDITURE				2017	2018
	EXPENDITURE			$4,385,742	$5,821,357
	1	PERSONNEL		$2,001,747	$2,163,947
		1	Staff Salaries	$1,717,122	$1,897,142
		2	Other Personnel Costs	$284,625	$266,805
	2	RECURRENT		$2,168,615	$3,420,492
		1	Consumables	$65,844	$374,426
		2	Services	$169,365	$112,560
		3	**Electricity**	**$1,650,636**	**$2,599,751**
		4	Other Recurrent Costs	$282,771	$333,755
	3	Capital		$215,380	$236,918
		1	Fixed Assets	$215,380	$236,918

SESAME Budget

OPERATIONAL BUDGET 2017-2019 (in US$K)		
Budgets by Major Objects of Expenditure		
YEAR	**2017**	**2018**
Electricity Consumption for Comparison (GWhr)	**4.2***	**6.4***
PERSONNEL	$2,002	$2,164
RECURRENT	$2,169	$3,420
FIXED ASSETS	$215	$237
Total budget	**$4,386**	**$5,821**
Percentage increase on previous year		**32.7%**

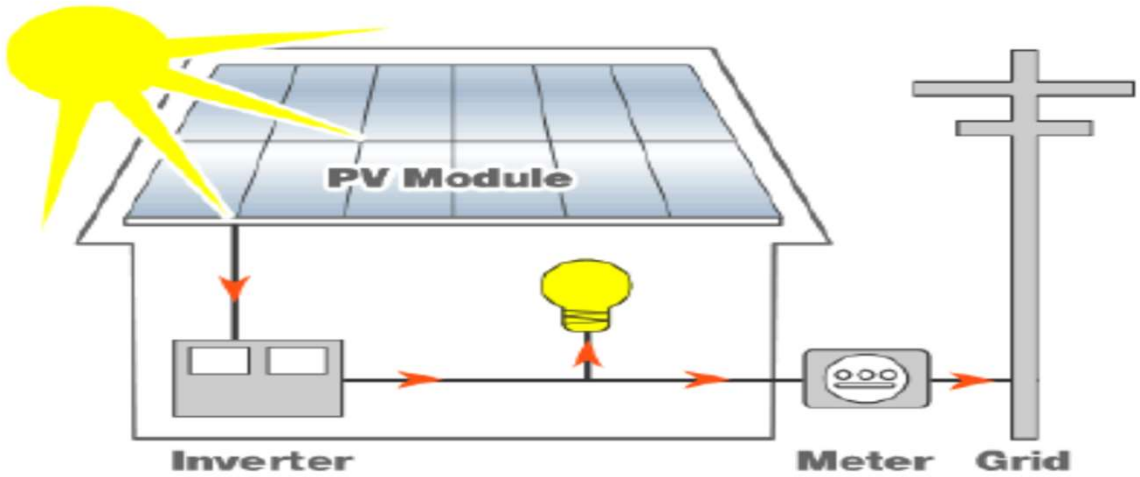
Building Electricity Consumption

MONTH	MWh
Jan	64.4
Feb	50.6
March	42.4
April	50.1
May	51.5
June	46.5
July	54.7
August	60.3
Sept	52.3
Oct	44.2
Nov	41.6



Study of Solar Power Plant

- Primary objective is to supply electricity using on-grid PV system with total peak power of 1000 kWp.



SITE PLAN for PV System

Generated Output Energy

- The annual daily average of solar radiation at the site received at 10^0 tilt angle is **5.81 kWh/m²**

Irradiation (Horizontal)	Irradiation (10°deg Tilted) per year	Normalized Production	Output into Grid (annual)
2005.8 kWh/m²	2122.2 kWh/m²	4.59 kWh/kWp/day	1676.73 MWh

Installed PV Capacity (KWp)	Average Monthly Generation (KWH)	Average Monthly Savings / 2015 (JD) (0.266 JD/kWh)	Payback period (Years)	Return on Investment (JD)
1000	139,728	37,167	2.7	9,023,442

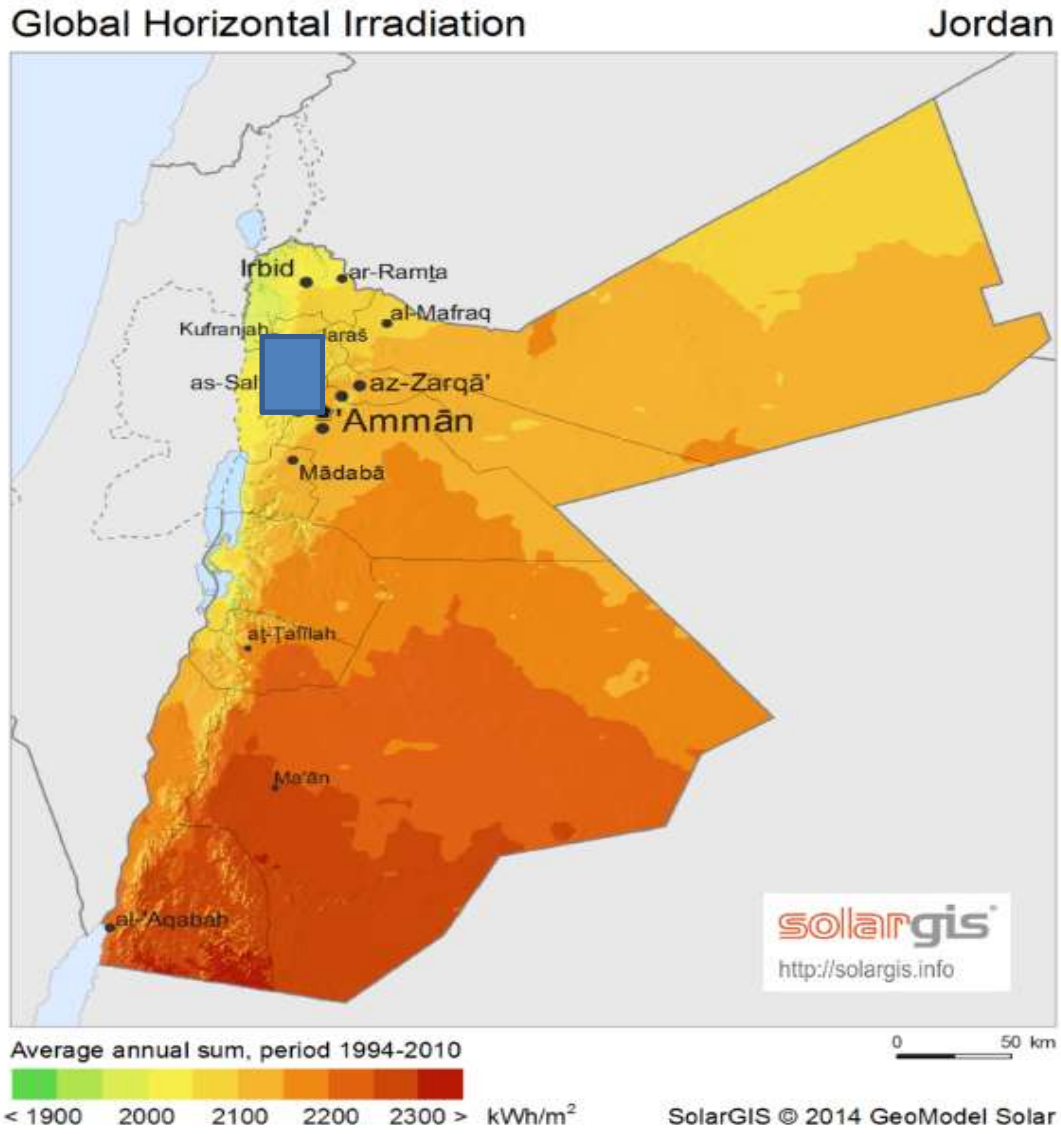
Estimated cost = 1 – 1.2 M JD

EU Funding of the PV Plant

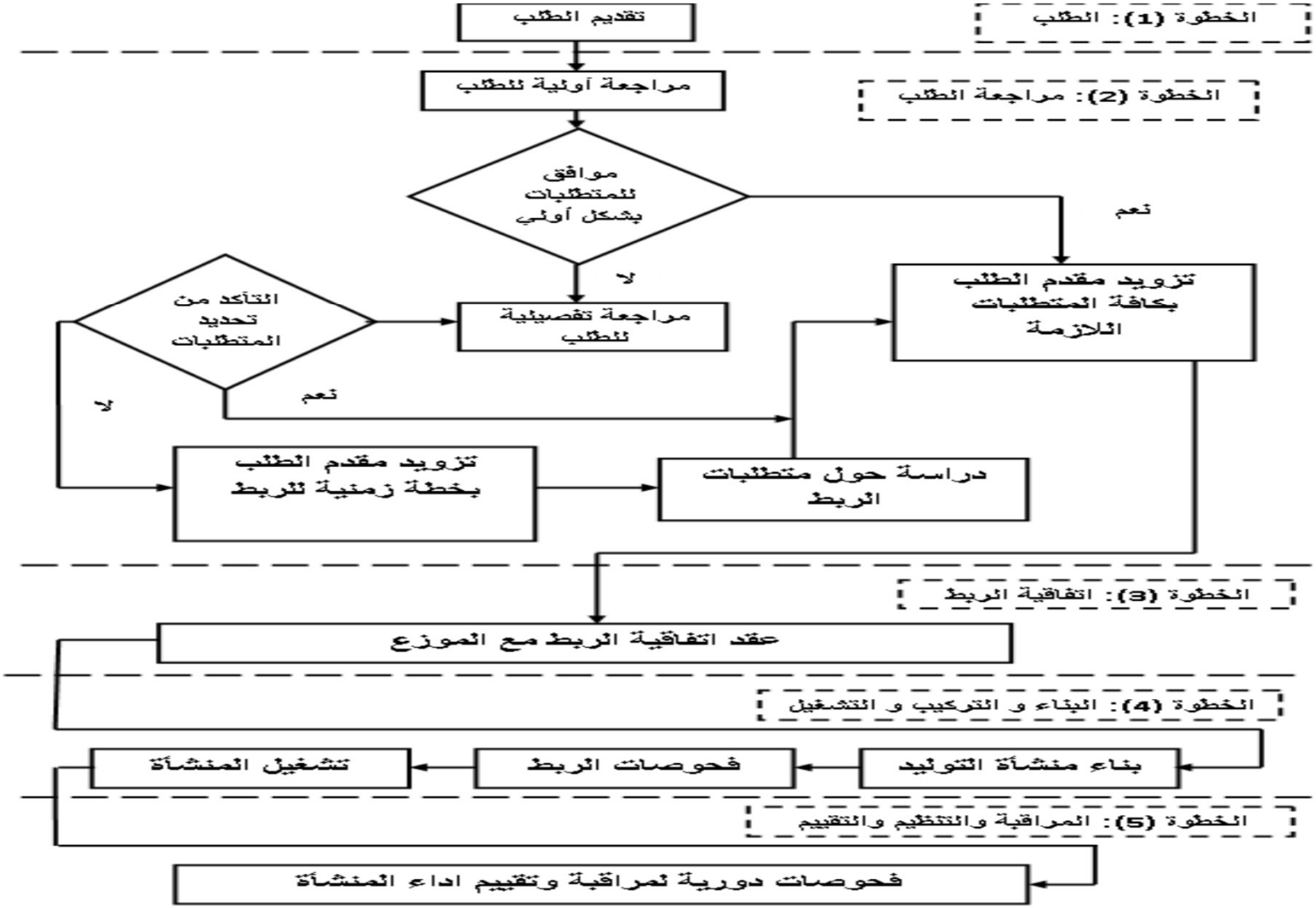
The EU Delegation is about to start its second support programme for Jordan on renewable energy and energy efficiency, in which many indicators are set to enhance the development and applications of renewable energy and energy efficiency in Jordan. Under this new programme, a special indicator is designed to support installation of PV roof-top systems in Jordan. The Government of Jordan is mandated to achieve this measure and the Ministry of Energy and Mineral Resources is taking the lead under the EU budget support programme.

As there are synergies between your request and our new EU funded programme, we recommend that you contact the Ministry of Energy to identify how to best partially cover your proposed PV solar facility under the new sector support programme.

Solar Map of Jordan



Steps of Approval



PV Plant Site

Time Table

- Tender issued — April 2017
- Bid Deadline — June 2017
- Bid Decision — September 2017
- Contract Signature — October 2017
- Plant Commissioning — June 2018

Monocrystalline Silicon Solar Cells

Advantages

Monocrystalline solar panels have the highest efficiency rates (16-20%)

Monocrystalline silicon solar panels are space-efficient

Monocrystalline solar panels live the longest (manufacturer guaranteed for 25 years)

perform better than similarly rated polycrystalline solar panels at low-light and low-temperature conditions.

Disadvantages

Monocrystalline solar panels are the most expensive

Monocrystalline solar panels tend to be more efficient in cold weather. Performance may suffer as temperature goes up.

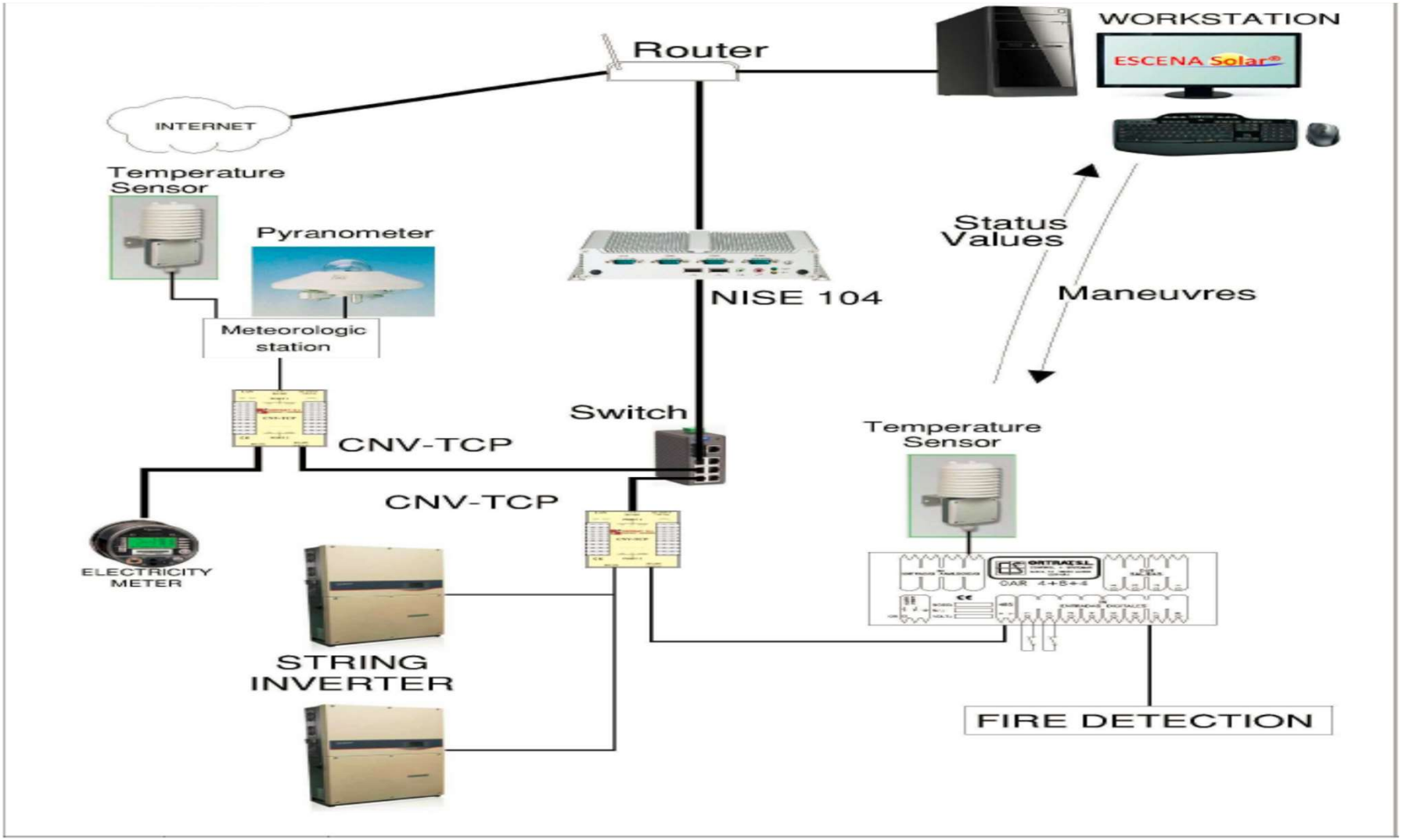
Supervisory Control and Data Acquisition

SCADA

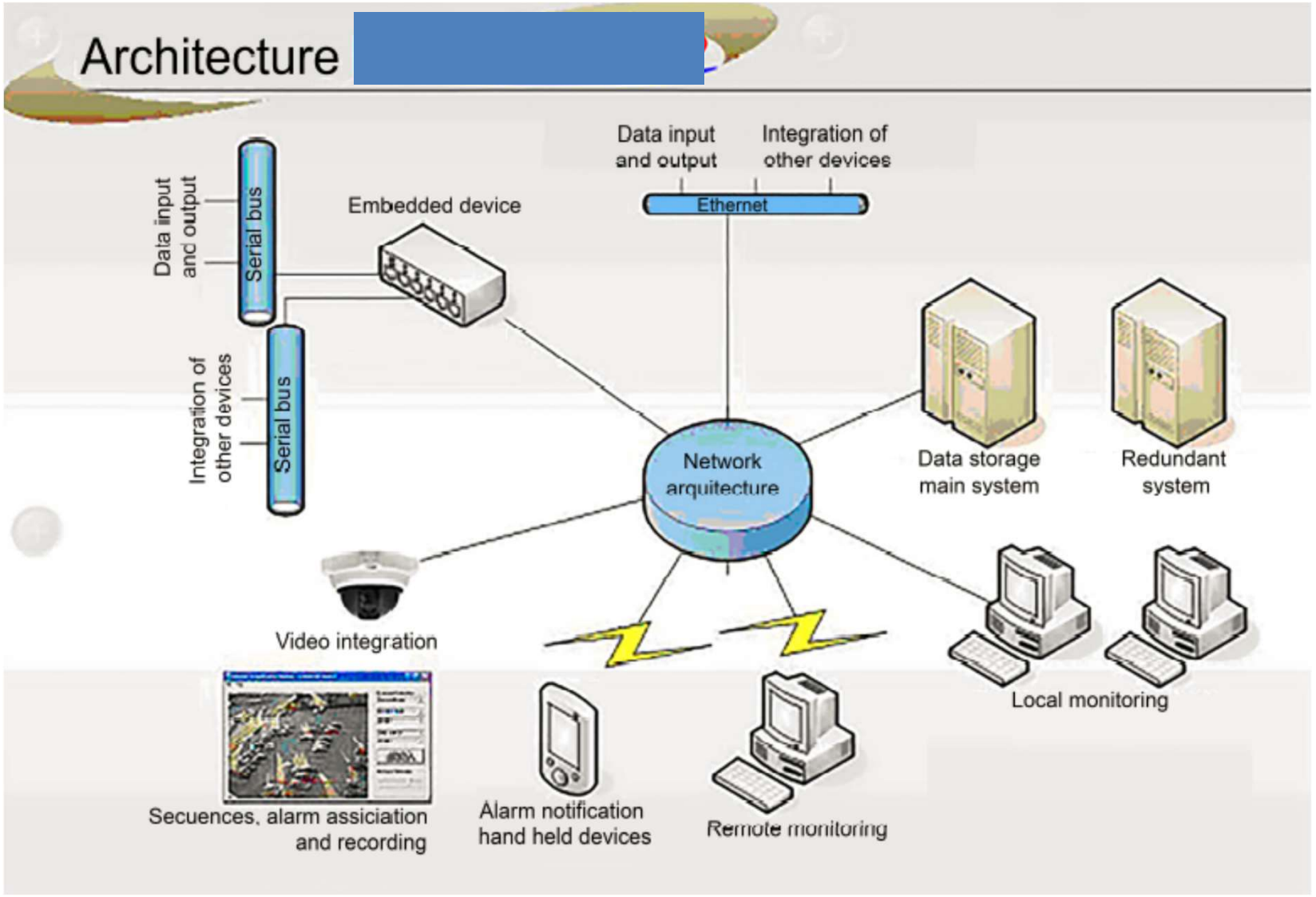
The following functions will be implemented in the SCADA, as detailed below:

1. Data capture of the relevant data of the energy meter over its communications interface
2. Supervision of all inverter on site,
3. Captured data will be stored for at least 2 years
4. Graphic presentation of the most relevant data in a single view of the plant, including: communication status, energy production, setpoints and real time active power of each inverter and total values read out of the energy meter
5. Alarm registration (communication failures, alarms, production data, etc.)
6. Local and remote monitoring
7. System prepared for integration in a control center (at any time)

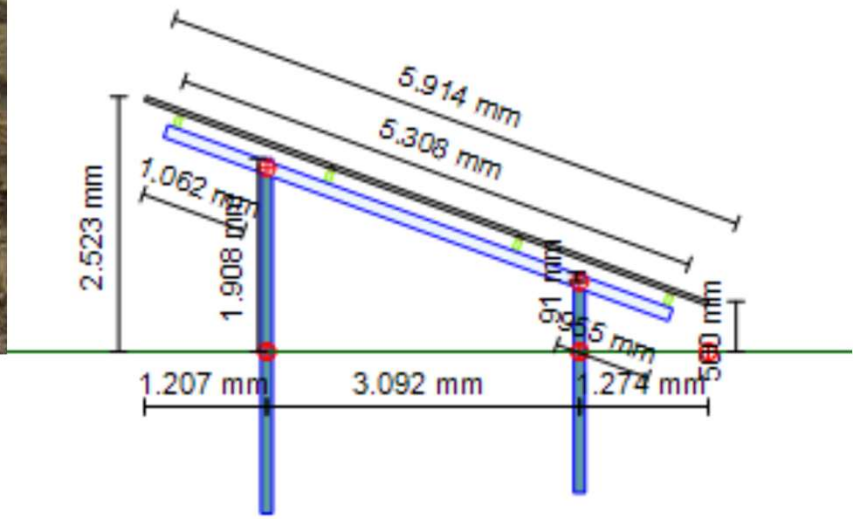
SCASA


Router
WORKSTATION
ESCENA Solar
INTERNET
Temperature Sensor
Pyranometer
Meteorologic station
NISE 104
Status Values
Maneuvres
Switch
CNV-TCP
CNV-TCP
Temperature Sensor
ELECTRICITY METER
STRING INVERTER
FIRE DETECTION

SCADA


Architecture
Data input and output
Integration of other devices
Ethernet
Embedded device
Data input and output
Serial bus
Integration of other devices
Serial bus
Network arquitecture
Data storage main system
Redundant system
Video integration
Local monitoring
Secuences, alarm assiciation and recording
Alarm notification hand held devices
Remote monitoring

supporting structure



Total dimensions of the solar modul

L = 21.27 m Rack length
B = 5.56 m Projection of the module area
H = 5.91 m Height of module area
h = 2.52 m Rack height

Most Relevant Features of the Cleaning System

- Automatic sensors regulate the pressure of the brushes on the solar panel, even on hard land irregularities conditions.
- Material of brushes: synthetic, UV resistant brushes for cleaning with water and brushes for a dry cleaning.
- Water consumption: between 0.15 and 0.20 L/ m^2.
- Professional water filters can be installed to improve water´s quality.

SESAME

Please visit SESAME web site :

www.sesame.org.jo

SESAME

Thank you