Aptitude of Kuwait to Third Industrial Revolution

By: Ravi Armoudjian

Factfile

History of industrial revolution

1.0

1780 – Mechanisation
Industrial production based on machines powered by water and steam

2.0

1870 – Electrification
Mass-production using assembly lines

3.0

1970 – Automation
Automation using electronics and computers

3.5

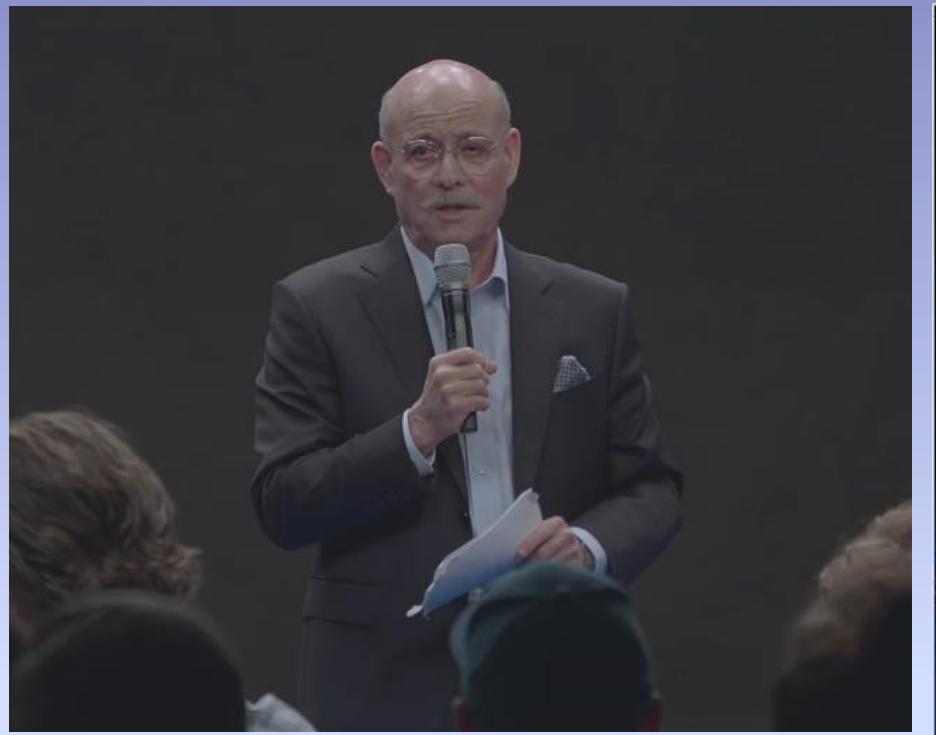
1980 – Globalisation
Offshoring of production to low-cost economies

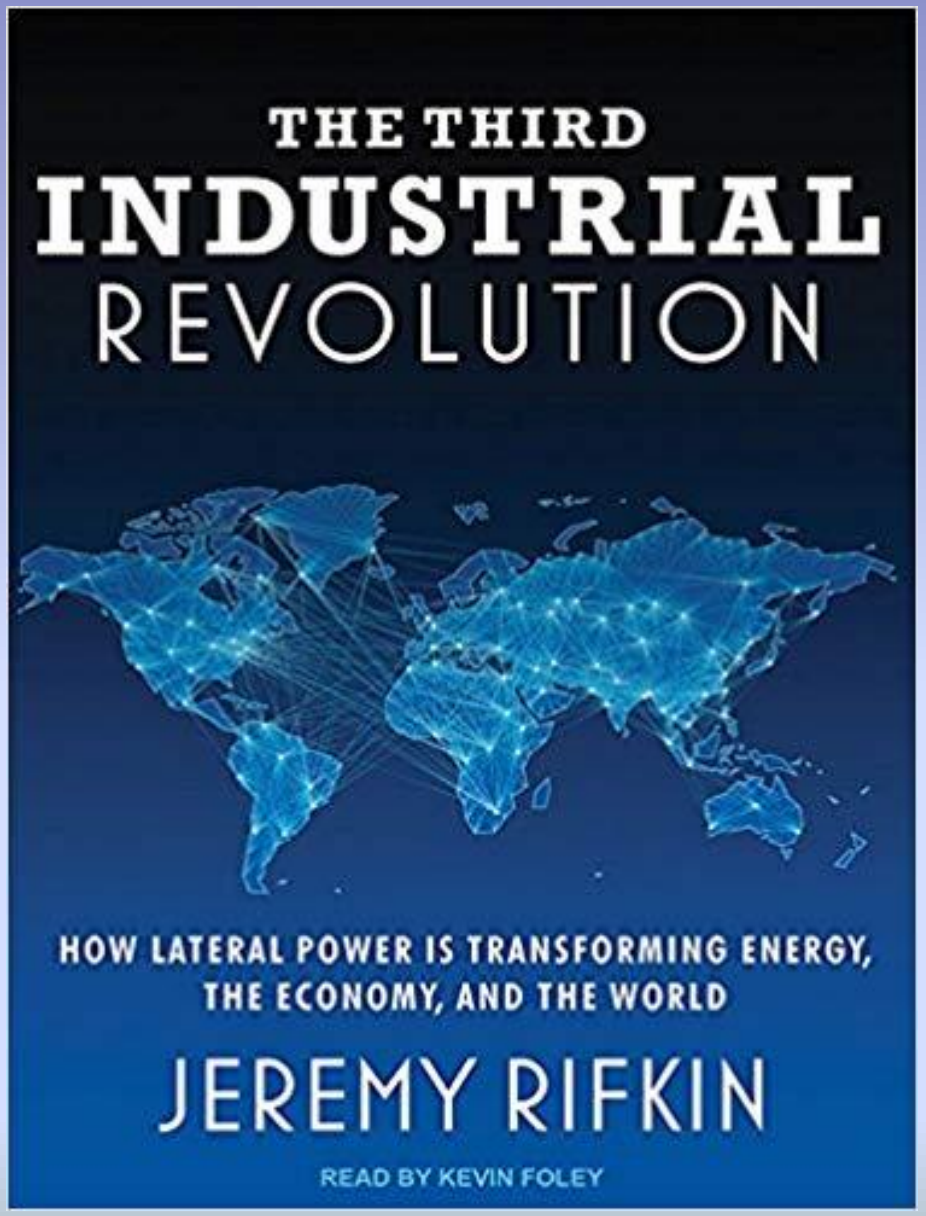
4.0

Today – Digitalisation
Introduction of connected devices, data analytics and artificial intelligence technologies to automate processes further

5.0

Future – Personalisation
The fifth industrial revolution, or Industry 5.0, will be focused on the co-operation between man and machine, as human intelligence works in harmony with cognitive computing. By putting humans back into industrial production with collaborative robots, workers will be upskilled to provide value-added tasks in production, leading to mass customisation and personalisation for customers




THE THIRD
INDUSTRIAL
REVOLUTION
HOW LATERAL POWER IS TRANSFORMING ENERGY,
THE ECONOMY, AND THE WORLD
JEREMY RIFKIN
READ BY KEVIN FOLEY

New communication technologies

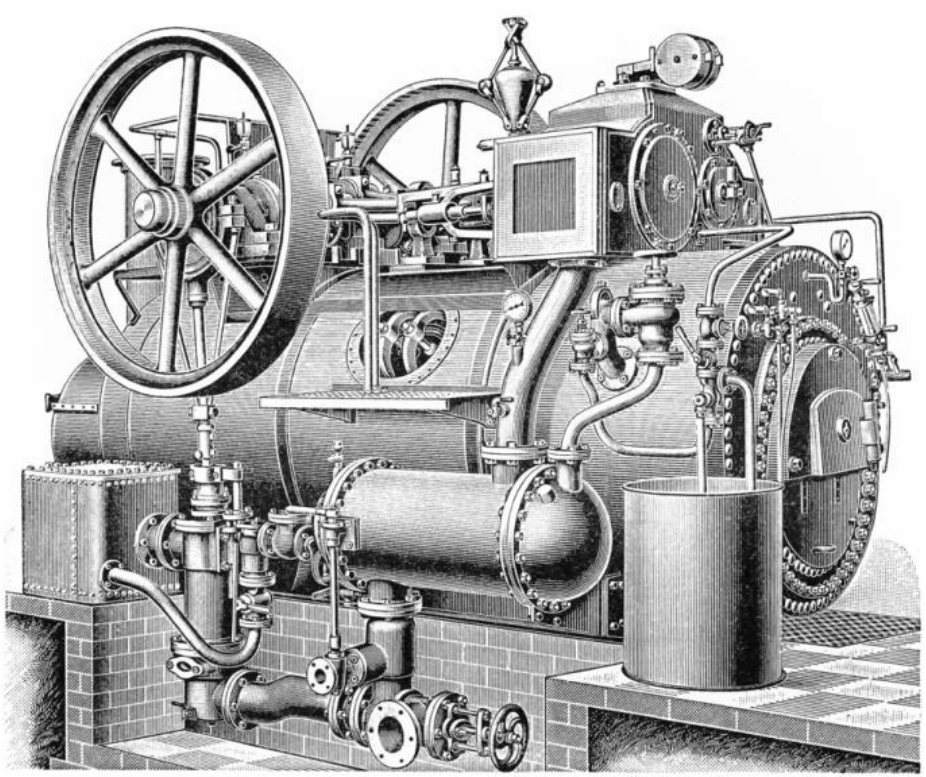
+

New discovered energy systems

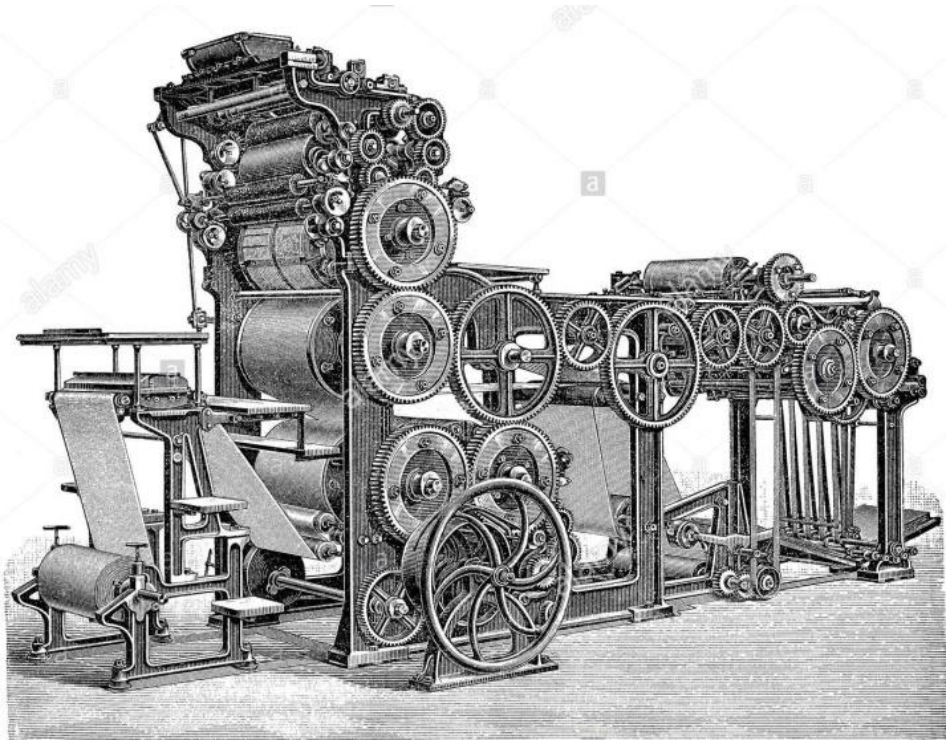
=

Industrial Revolution

First industrial Revolution

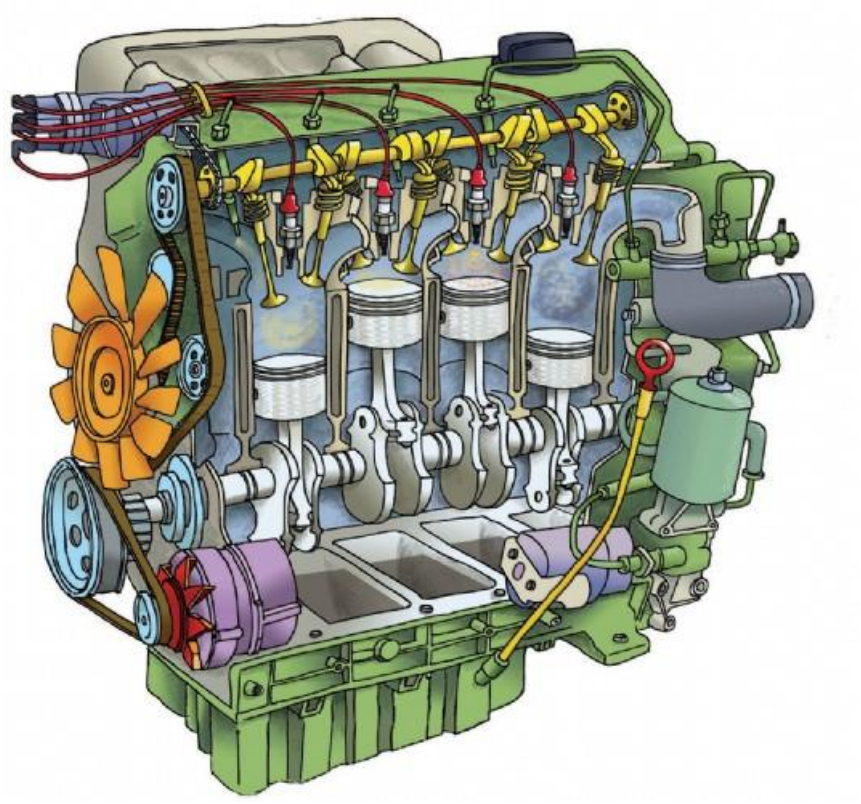


Steam engine
(steam + coal)



Steam printing machine
with rollers

Second industrial Revolution

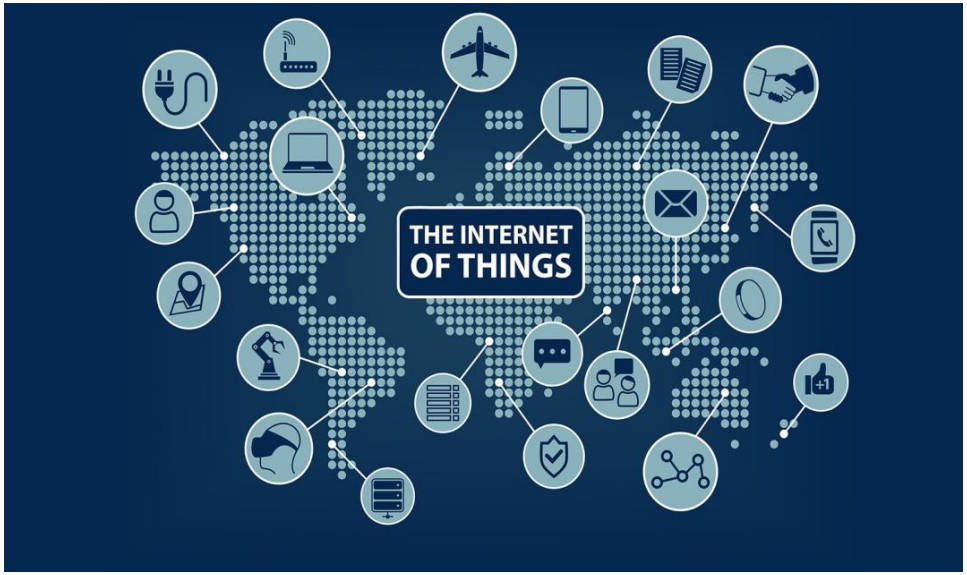


Internal combustion engine (oil)

Electrical communication

Third industrial Revolution

Renewable energies
(Sun + wind + hydropower + geothermal + etc.)



Internet communication technologies

Five pillars of Third Industrial Revolution

1- Shifting to renewable energy sources

2- Converting buildings into green mini-power generation plants

3- Deploying energy storage technologies in buildings and throughout infrastructure to store intermittent energies for later use

4- Using internet technology to transform the electricity grid to an 'energy internet' to share energy

5- Transforming all transportation mediums to electricity plug-in vehicles

Lohner – Porsche (first hybrid car)

2nd pillar of 3rd industrial revolution

converting every building to mini power generation plant

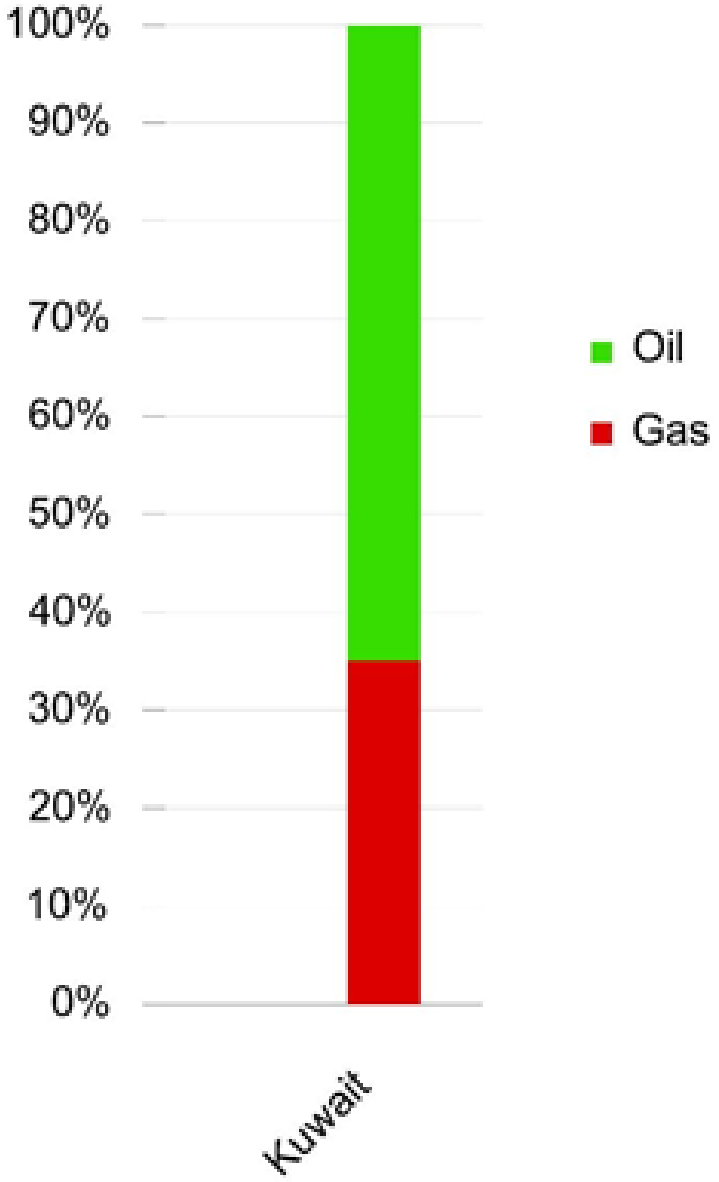
- democratizing energy
- fair distribution for world's wealth
- making money from saving energy-

Control over energy production and distribution will - shift from giant fossil fuel based energy companies to millions of individuals

KUWAIT

1/3 of energy generation comes from natural gas

2/3 comes from oil



IRENA
International Renewable Energy Agency

RENEWABLE ENERGY RESOURCES:

High Medium Low Unknown Not applicable

Wind	Solar	Hydro	Biomass	Geothermal	Ocean
Medium	High	Unknown	Medium	Unknown	Unknown

Daily horizontal solar radiation per month in KWh/m2 In Kuwait

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.40	4.37	5.20	5.92	6.88	7.96	7.59	7.26	6.52	5.07	3.60	3.07

The amount of solar energy that 1m2 of Kuwait receives in one day in June

=

the power that 26W fluorescent light bulb consumes in 300 hours

Photovoltaic systems

Research objectives:

1- Investigating the potential of reducing national carbon emission in Kuwait for the next 30 years by applying PV system on residential buildings

2- Investigating the potential of cast saving from energy generation in Kuwait for the next 30 years by applying PV system on residential buildings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Google earth

2004


Image © 2015 DigitalGlobe
Google earth

2015

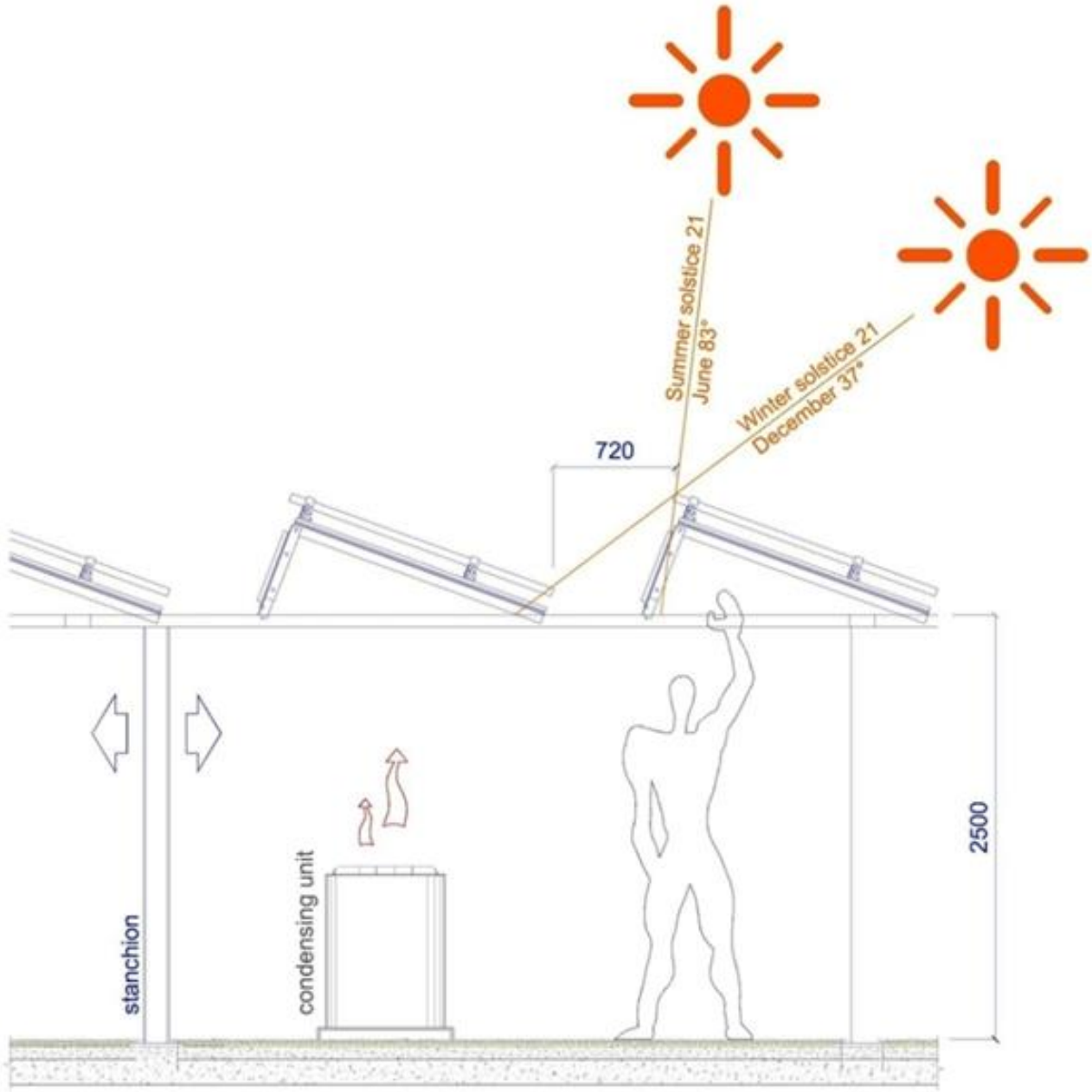
1- cellular antennas
2- satellite dishes
3- external condenser unites
4- Vent pipes
5- Electric cable trays
6- Water supply pipes from water tanks

2.5m high steel supports are suggested for mounting PV modules above roof surface to:

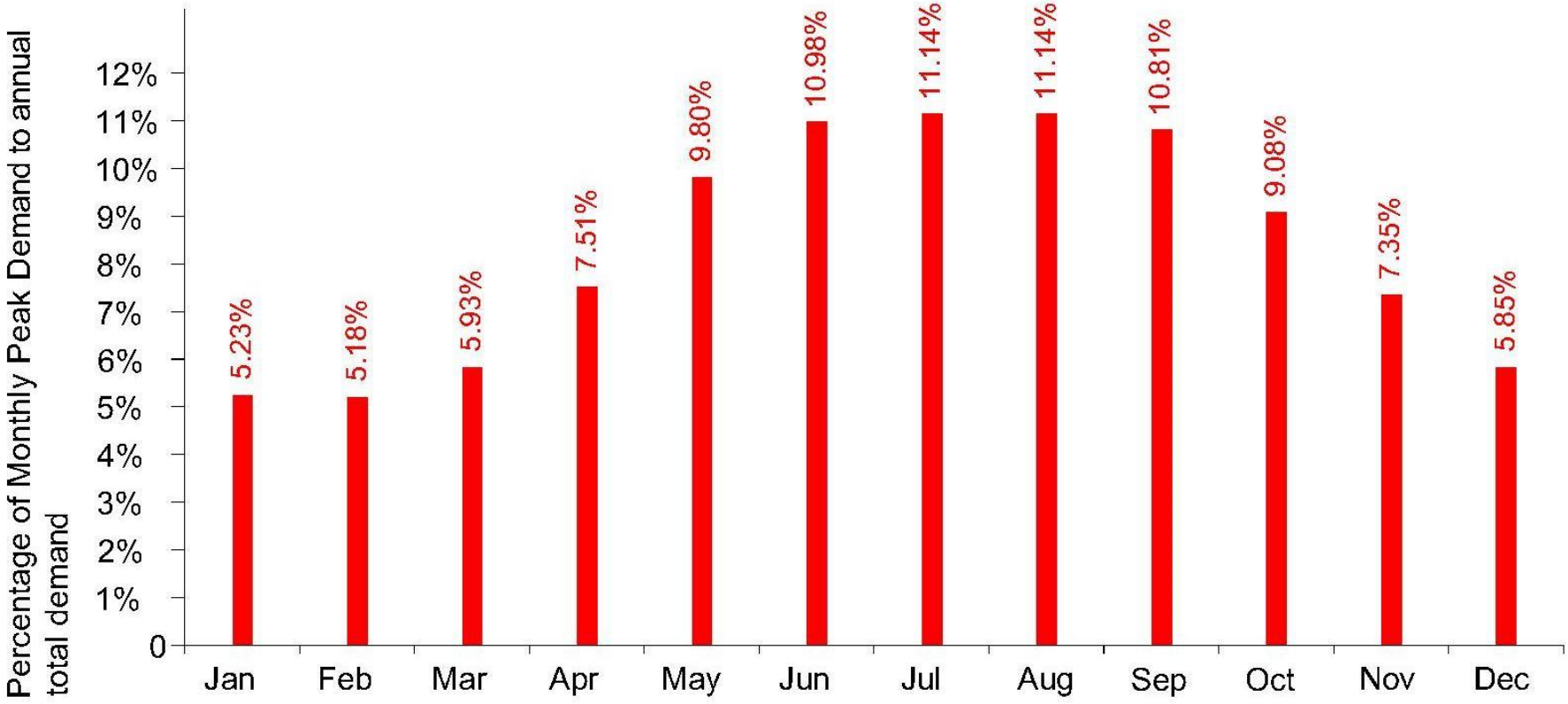
1- avoid
congestion of equipment beneath which would reduce the usable roof area for PV panels in case of mounting to roof surface

2- minimize the
effect of the upright blown hot exhaust air from the condensing units which reduce PV modules efficiency

3- make supports
stiff and resist wind pressure and suction Loads



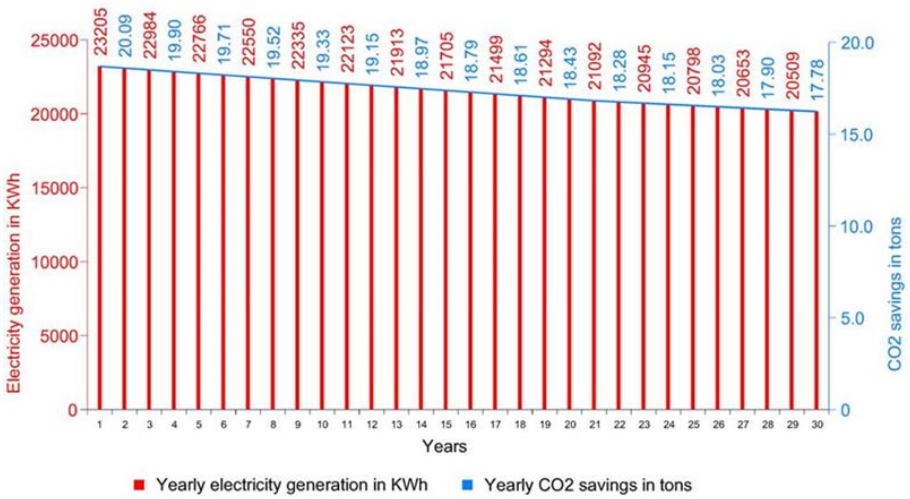
Monthly percentages of peak electricity demand to annual total electricity consumption



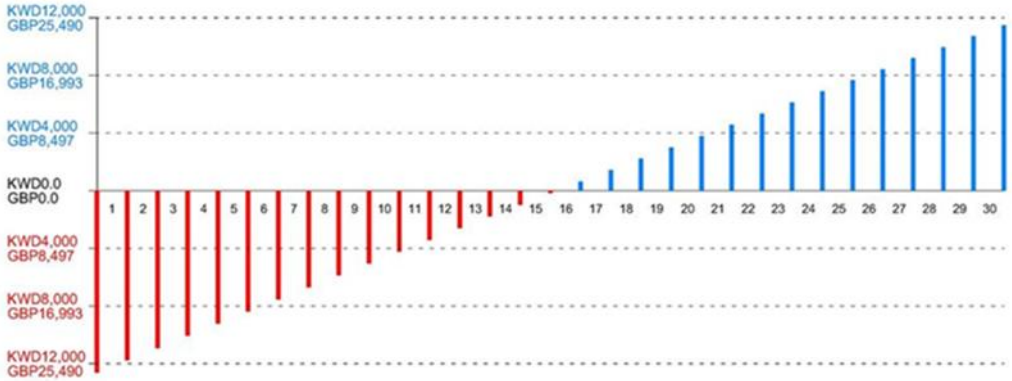
1- Annual electricity generation through lifetime of the PV system (30 years):

$$E_{module} = P_{max} \times f_{temp} \times f_{dirt} \times f_{man} \times H_{tilt} / 1000 \times \eta_{pv\_inv} \times \eta_{inv} \times \eta_{inv\_sp}$$

2- Annual CO2 emission savings through lifetime of the PV system (30 years):



3- The cumulative financial balance of investment after 30 years:



Our recommendations to increase energy self-sufficiency for future residential buildings include:

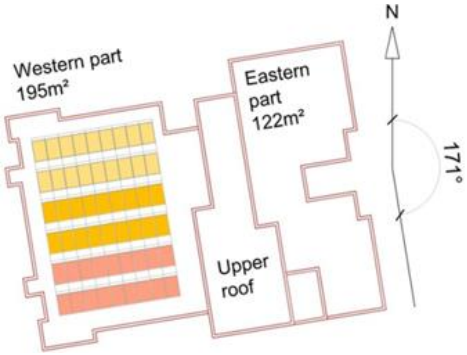
1- Arrange satellite dishes, cable trays, condensing units, water pipes and all other equipments in confined spaces to maximize area for PV installation and avoid using steel supports thus saving 11% of the overall cost.

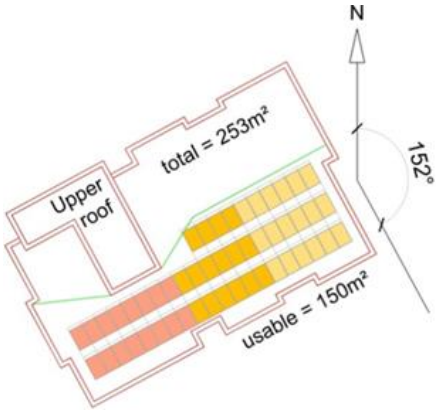
2- Legislations should determine building heights at different districts of investment residential buildings to avoid juxtaposing of high buildings next to low building and reduce overshadowing of roofs.

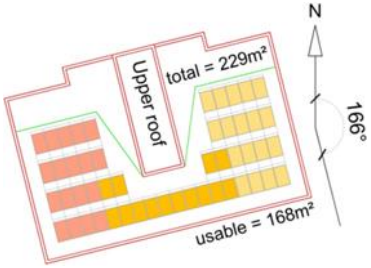
3- Legislations should determine the minimum accepted roof area to net leasable area based on studies of different power consumption patterns and wages rates at each district.

Investment residential buildings:

Self sufficiency ratio ranges between 4-17%

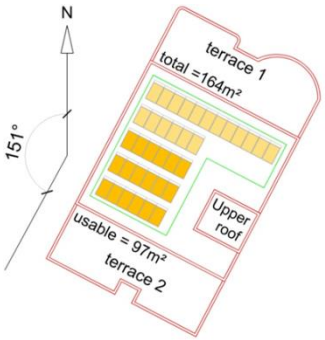


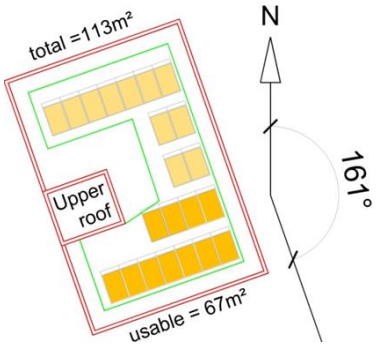




Villas:

Self sufficiency ratio ranges between 9-12%





First objective:

After applying power output from 5 cases to their relevant percentages of residential buildings and Private villas, then to the share of residential sector to total national energy consumption, then considering the worst scenario, the percentage of expected future carbon emission reduction from residential sector by applying PV installation on roofs **=5. 5%**

Second objective:

The reduction in public power generation cost after comprehensive application of PV systems on all residential buildings **=2.6%**

Thank you