Sistemas de Energia
Energy Systems

2016-2017

Killian Lobato

Evaluation

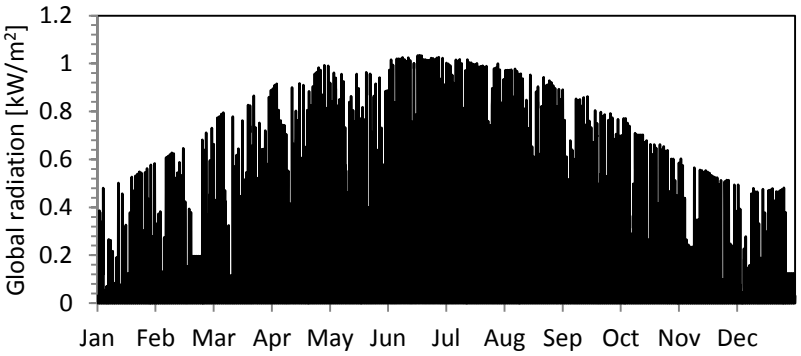
- 4 themes
- For each theme
  - 1 group presentation
  - 1 group report

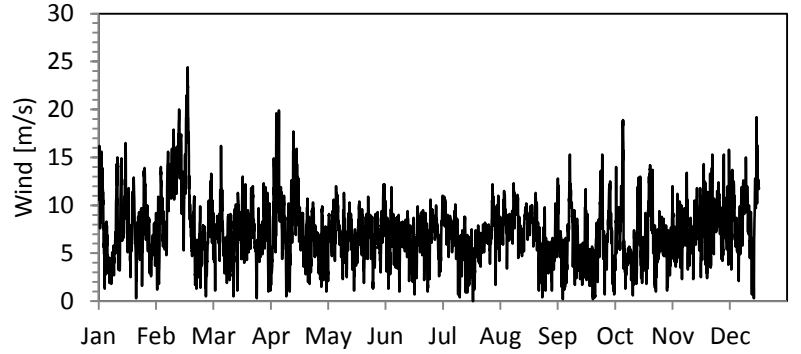
- *There is 1 optional final test – if test is taken grades will be altered.
  - Objective is to substitute 3 of the worst grades from the 8. Therefore worth 37.5% of final grade.
  - Date of test is the first exam date.

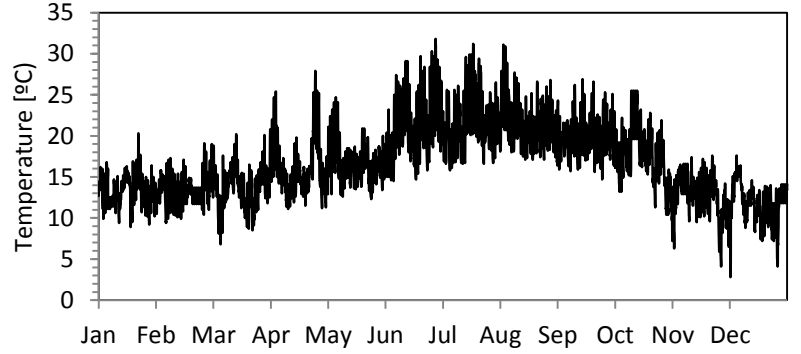
Theme		
1	Presentation	12.5%
	Report	“
2	Presentation	“
	Report	“
3	Presentation	“
	Report	“
4	Presentation	“
	Report	“
	Test*	37.5%

Theme 1: Energy Supply

- We start by defining an imaginary island
- Its own weather
  - Solar Radiation
  - Wind
  - Precipitation
  - Temperature
- And Landscape
  - Watersheds or river systems
  - Available arable land (farming)
- Determines the potential for the use of RENEWABLE ENERGY SOURCES (RES)



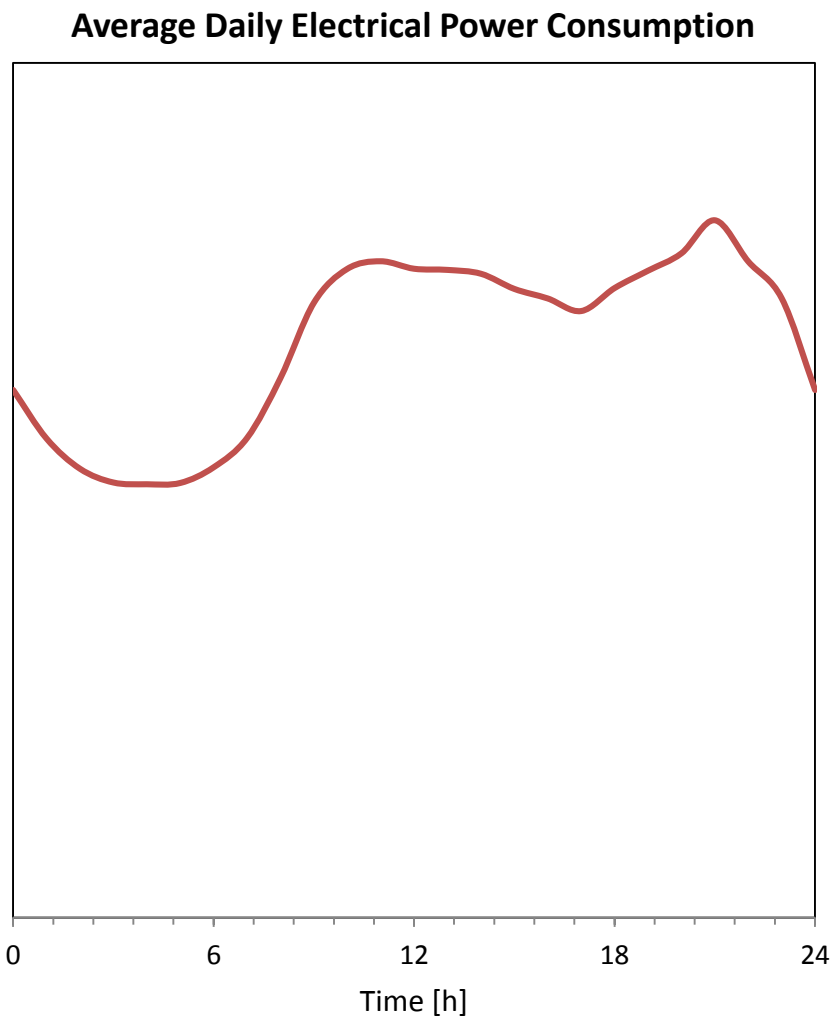




Theme 2: Energy Demand

- The habitants
  - 50,000 people
  - Population density of 100/km^2
  - 0.5 cars/person
  - 2.5 people/house

- Determine **Energy Consumption**
  - **Electrical**
  - **Heating**
  - **Cooling**
  - **Transport Fuels**



Theme 3: Energy Storage and Transmission

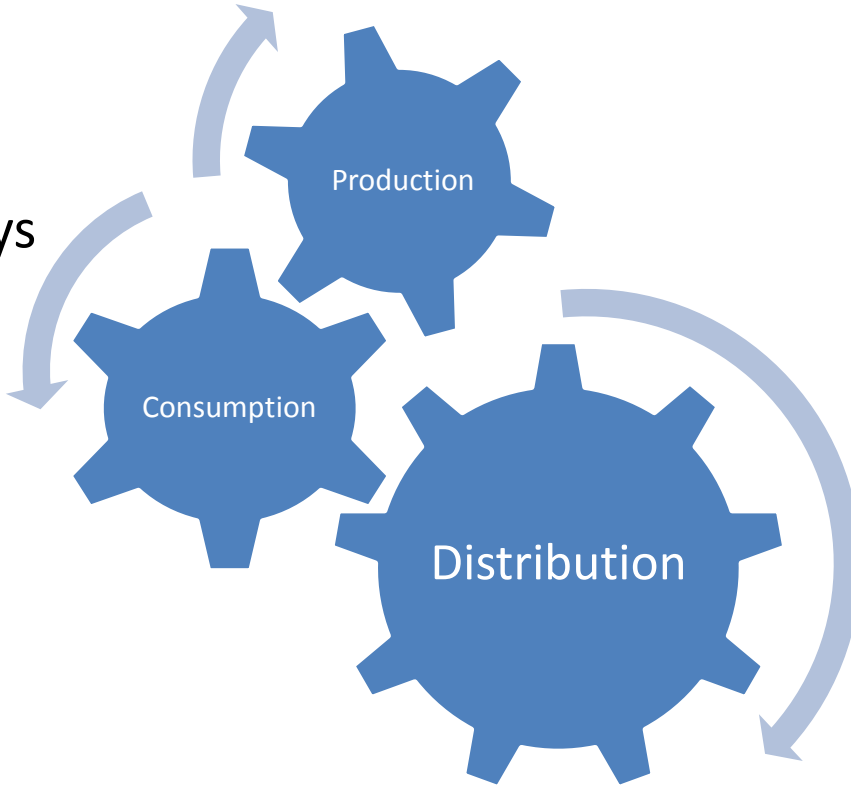
- Energy not only is produced
  - Electricity, heat

- but has to be stored
  - Dams/Hydro
  - Electric Vehicles or batteries
  - Or imported and exported

- And also has to be transmitted
  - Electric power lines
  - District heating

Theme 4: Integration

- RES: How do we size and determine
  - Which
  - How much
- Make sure demand of energy is always met
  - **Demand <= Supply**
- Will explore some different scenarios
  - Allowing for import/export of energy
  - Changing the behaviour of people



Theme and topic Distribution

Topic 1: Energy Supply

Group Topic	Theme	Energy	Topic: Source	Observations
1	Supply	Transport	Biofuels	
2		Electricity	Wind	Onshore, may offshore
3			Solar	Rooftop, municipal
4			Hydro	Run of river - small scale
5		Heat	Biomass	Co-generation of electricity and heat
6			Solar Thermal	Hot water
7			Waste	Biogas for water heating or electricity

Topic and Subtopic Distribution

Topic 2: Energy Demand

Group	Topic	Application	Observations
1	Demand	Transport	Individual or colective transport, comodoties, internal combustions vs EV
2		Electricity	Demand load and demand conditioning
3		Heating	Hot water
4			Comfort

Topic and Subtopic Distribution

Topic 3: Transmission and Storage

Group	Topic	Energy	Application	Questions
1	Transmission and Storage	Heat	District Heating	€/kWh/km, losses/efficiency
2		Electricity	AC/DC, air/underground/sea	
3			Hydro	kW and kWh
4			EV	

Topic and Subtopic Distribution

Topic 4: Integration

Group	Topic	Observations
1 2 3	Integration	All different islands will be compared

Literature

- Good starting points are:
  - David JC MacKay, *Without the hot* air [www.withouthotair.com] 2009
  - Bent Sørensen, *Renewable Energy - Its physics, engineering, use, environmental impacts, economy and planning aspects*, 3rd Ed, Elsevier Science, 2004
  - Roadmap 2050 – A practical guide to a prosperous low carbon Europe (Technical Analysis) [www.roadmap2050.eu] 2010
  - M Centeno Brito, K Lobato, P Nunes, and F Serra, "Sustainable energy systems in an imaginary island," *Renew. Sustain. Energy Rev.*, v.37, p.229–242, Sep. 2014, DOI:10.1016/j.rser.2014.05.008
- Previous years' reports are also available and are an excellent starting point. These are available online at the course's website (Fenix or moodle to be confirmed).

Practical Aspects

- Groups
  - 3 to 5 people
  - Up to you to decide

- Presentations
  - **Topics 1,2 and 3**: 10m max with 5m discussion
  - **Topic 4**: 15m max with 10m discussion

- Reports
  - Based on feedback of presentation
  - 3 pages of text absolute maximum – template defined
  - Figures and tables on separate individual sheets – max 2 pages
    - Figures and tables have to be well edited and if possible created originally.

Practical Aspects

- There will be 2 classes

- TP1 – Wednesday 14h30
- TP2 – Monday 14h30
- T – Wednesday 16h30
  - Will be when topics are presented and will also be used as an extra for contact with teacher.

Other info

- Class participation will be monitored.
- 1 weekly office hour to be confirmed but should be Thursday or Friday.
- Emails: May be answered if possible and if URGENT!