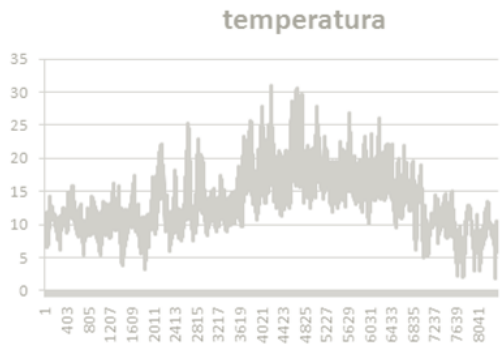
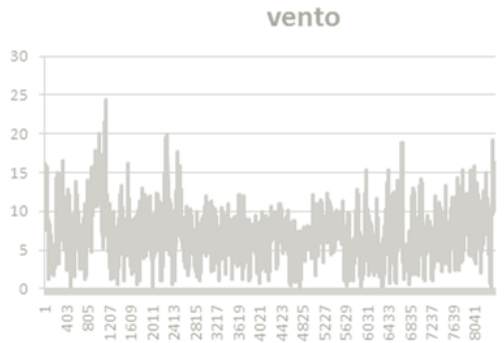
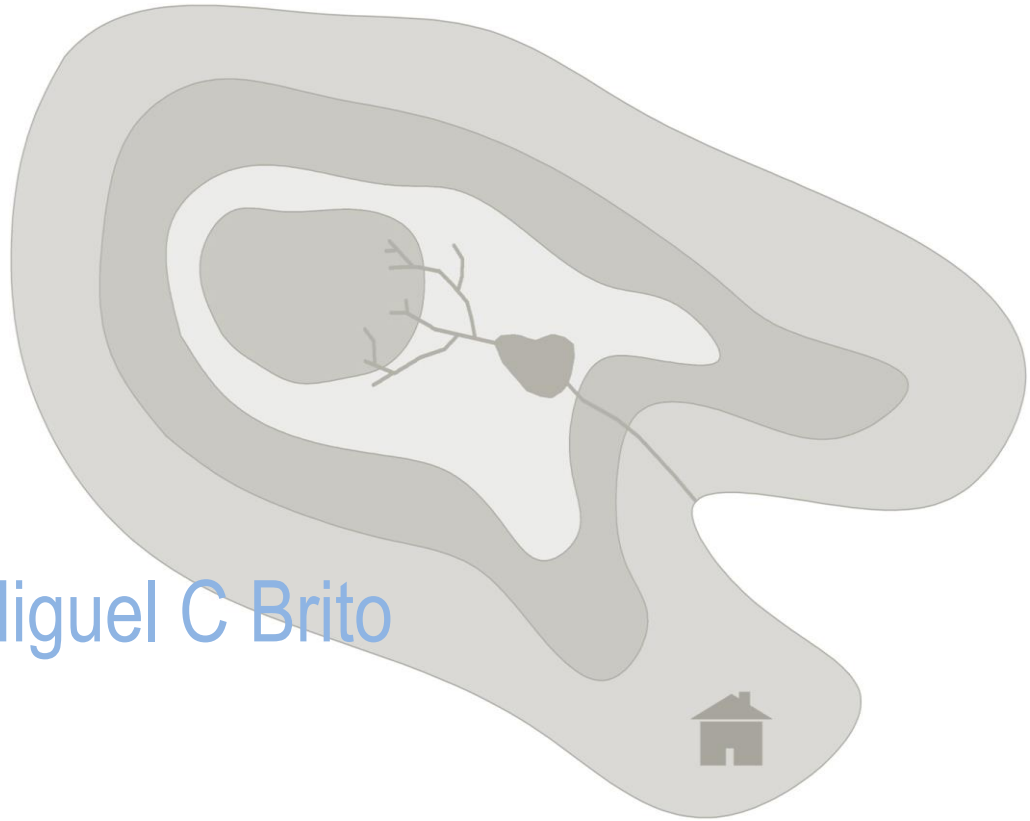
Energy systems







Miguel C Brito

Class	Topics	Deliverables
1	**Energy Supply**.	
2	Tutorial work	Biblio revision
3	Students' presentations (1).	PPT1 & DOC1
4	Students' presentations (2).	
5	**Energy demand.**	DOC1_final
6	Tutorial work	Biblio revision
7	Students' presentations	PPT2 & DOC2
8	**Energy storage and transmission**	
9	Students' presentations	PPT3 & DOC3
10	**Energy system**	
11	Tutorial work	
12	Students' presentations	PPT4 & DOC4

Application	Details	Questions
Mobility	Individual and public transport using EV and biofuel cars	kWh/year
Electricity	Load diagram and instruments for energy demand management	kWh(t)*
Heat	Shower hot water	
	Thermal comfort	

Mobility

Objectives:

- Estimate **demand** (kWh and kWh/person)
- Demand **elasticity** for different mobility scenarios
- Effect of **electrification** of transports

Individual transport

How much energy does a person need for transport?

20 km/person/day

10 litres/100km

10kWh/litre

How much embodied energy

in a car?

25k€

0.05 €/kWh

10 years

Mobility

Objectives:

- Estimate **demand** (kWh and kWh/person)
- Demand **elasticity** for different mobility scenarios
- Effect of **electrification** of transports

Public transport

How much energy does a person need for transport?

20 km/person/day

40 litres/100km

10kWh/litre

30 passengers

Usually presented as kWh/100 p-km

Underground?

Trolley/tram?

Bicycle?

TRANSPORTES

Objectives:

- Estimate **demand** (kWh and kWh/person)
- Demand **elasticity** for different mobility scenarios
- Effect of **electrification** of transports

Further questions (1)

- if we replace individual cars by electric vehicles, what is the increment to the daily electricity load? (kWh/day/person)

Assume 10, 50 and 100% replacement

Eletric vehicles electricity demand, cost and battery capacity and lifetime.

TRANSPORTES

Objectives:

- Estimate **demand** (kWh and kWh/person)
- Demand **elasticity** for different mobility scenarios
- Effect of **electrification** of transports

Further questions (2)

- using biofuels, how much land is required for 10, 50 and 100% of penentration of EV?

Heat

Objectives:

1) Estimate demand for hot water and thermal comfort (kWh and kWh/person)
2) Effect of **electrification** of heat production

Hot water

60 litres @ 45ºC /day/person

Calculate and discuss

electricity/biogas/heat from CHP

demand to complement solar thermal.

Heat

Objectives:

1) Estimate demand for hot water and thermal comfort (kWh and kWh/person)
2) Effect of **electrification** of heat production

Thermal comfort

Each house 2x10x10 m^3.

$Q=A \Delta T/R$

(average R-value 2 m^2K/W)

+ ventilation: 1 renovation per hour

COP = 3

Degrees-hour from Temperature time series

Heat

Objectives:

1) Estimate demand for hot water and thermal comfort (kWh and kWh/person)
2) Effect of **electrification** of heat production

Thermal comfort

Electricity demand: 100 units of energy today:

50% gas + 25% electric Joule (COP=1) + 25% electric AC (COP=3)

Replacing all heating/cooling by heat pumps (COP = 3),

0% gas + 0% electric Joule (COP=1) + 100% electric AC (COP=3)

Electricity

Objectives:

1) Estimate the **load diagram**

2) Identifity and discuss electricity demand sectors

2) **Elasticity** of electricity demand

Load diagram

Annual e weekly, for typical weeks

REN/EDIA

- Correct for population and island (e.g. Madeira & Açores)

Calculate:

- Energy (MWh), Average power (MW), Peak power (MW), Capacity factor

Electricity

Objectives:

1) Estimate the **load diagram**

2) Identifity and discuss electricity demand sectors

2) **Elasticity** of electricity demand

Main electricity usage

Annual estimates only

How much electricity for heat production (talk to the 'heat' group)

Residencial night demand (2 lamps x 3 hours+ ½ TVh/person x ½ population)?

Public lighting

Industry and services (ERSE?)

Electricity

Objectives:

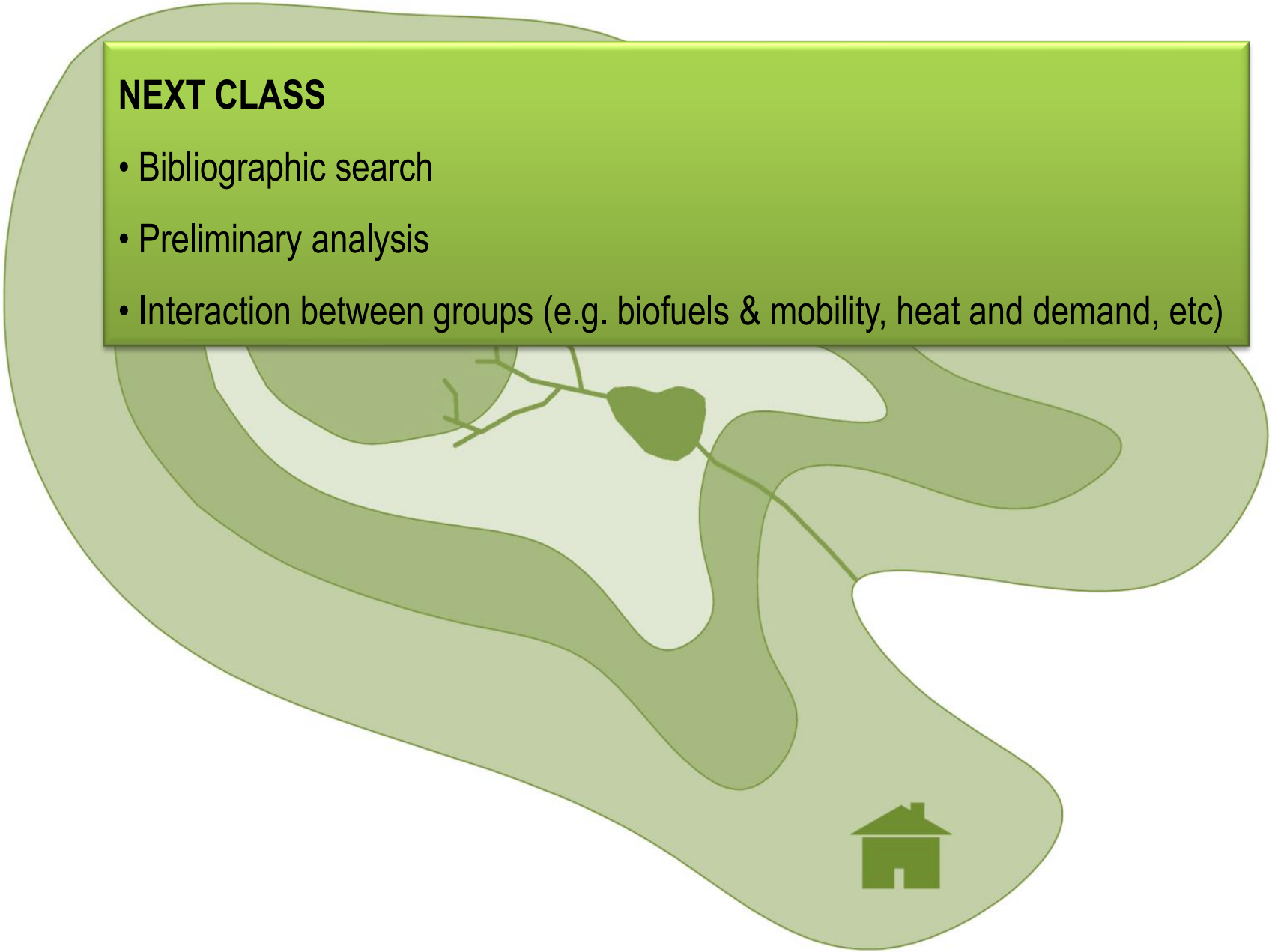
1) Estimate the **load diagram**

2) Identifity and discuss electricity demand sectors

2) **Elasticity** of electricity demand

Electricity demand management

- Pricing (10% reduction at all times)
- Daylight saving (explain, probably already included in load diagram)
- Variable pricing (10% peak demand shifts to more favourable times)
- Demand response (discuss*; can only be modelled when we know the production)*



NEXT CLASS

- Bibliographic search
- Preliminary analysis
- Interaction between groups (e.g. biofuels & mobility, heat and demand, etc)