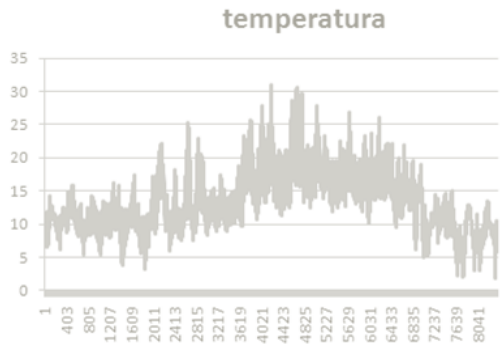
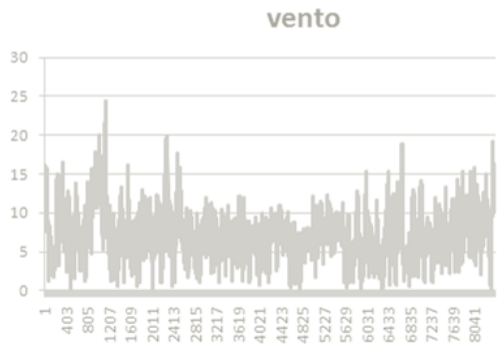
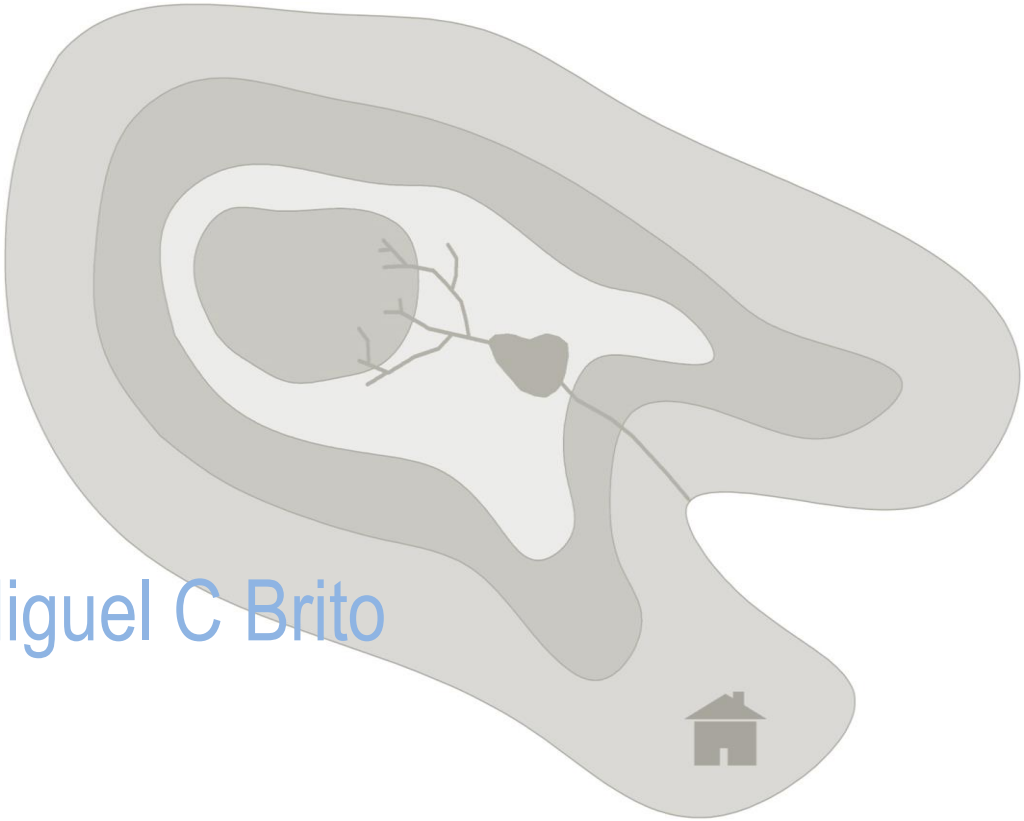
Energy systems





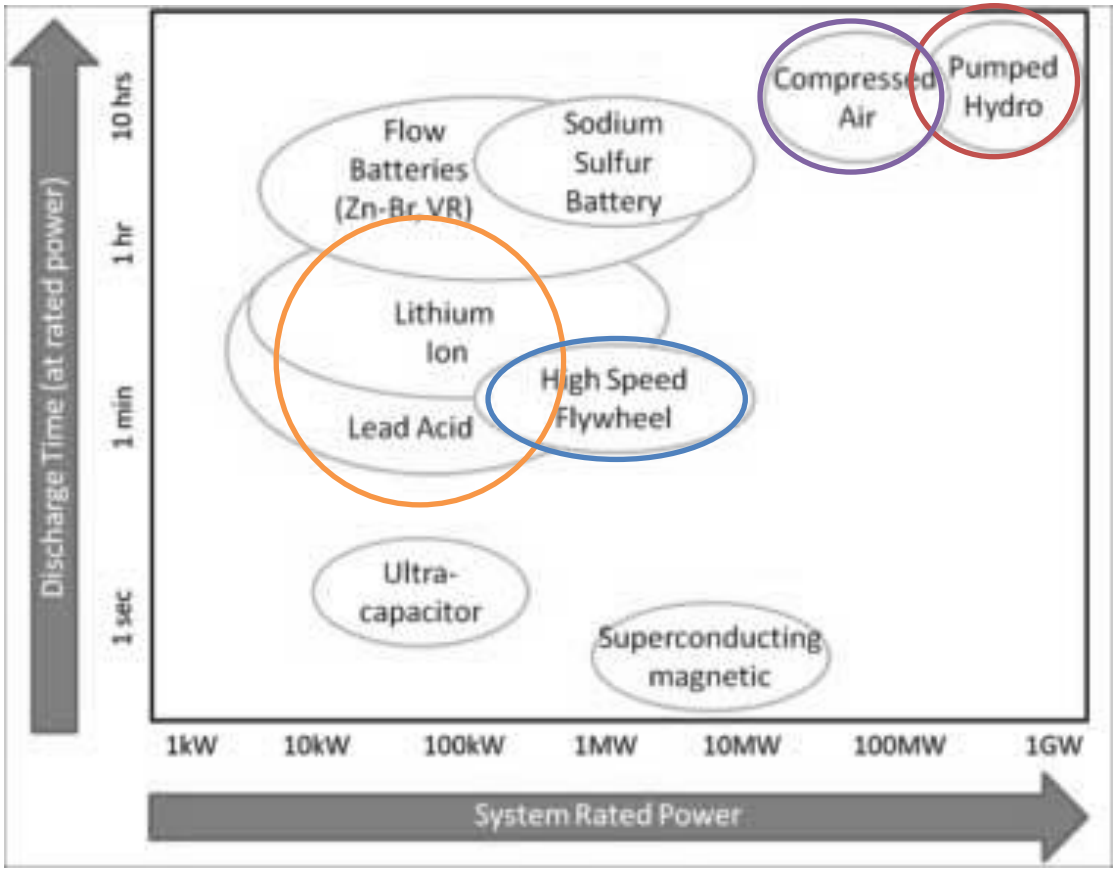


Miguel C Brito

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

Group	Application	Obser	Questions
1	Electricity	Batteries	kW kWh €/kWh Kg/kWh
2		H2	
3		Compressed air	
4		Pumped storage	
5		Transmission	€/kWh/km Losses
6	Heat	*District heating*	

Storage electricity



http://www.greentechmedia.com/research-blog/post/VCs-Energy-Storage-and-The-Smart-Grid-/

Storage electricity | parameters

- Capacity (kWh)
- Density energy/power(MW/kg; MWh/kg)
- Specific density (MWh/m^3)
- Efficiency (%)
- Charge/discharge time
- Operation cost(€/MWh)
- Investment cost (€/MWh)
- Lifetime (years/days)

Storage electricity

Examples:

Car battery capacity

Assuming traditional battery
40Ah x 12V = 480Wh
x number of cars
/ people
= [kWh/person]

Assuming EV battery
30kWh
x number of cars
/ people
= [kWh/person]

100 hp x 0.7 kW/hp = 70kW/car
x number of cars
/ people
= [kW/person]

Domestic battery capacity

Assume 1 battery per home /2 days autonomy
(discuss ownership)

Storage electricity

Examples:

Pumped storage

Available power

- assume max waterflow

Capacity

- dam size (500 x 500 x 18 m^3),
- conversion efficiency (75%)
- output in kWh/person.

and

Compressed air

(timescale, costs, capacity, etc)

Storage electricity

Hydrogen

- H2 production from electricity
- Conversion efficiency (overall)
- Heat?
- Domestic or mobility use
- Costs: actual, not foreseen

Transmission electricity

Grid caracterization

- Customers/line km

  (depends on geography and population density, e.g. Madeira = 3x continental Portugal)

- AC or DC?
- Underground or aerial lines? Health ipmacts,
- Losses (transport and distribution)
- Costs(ERSE)

Heat transmission

- Technolgy, range
- Cost €/kWh and losses
- Final discussion of heat system management.

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The role of district heating in future renewable energy systems

H. Lund [a,*], B. Möller [a], B.V. Mathiesen [a], A. Dyrelund [b]

[a] Department of Development and Planning, Aalborg University, Fibigerstraede 13, DK 9220 Aalborg, Denmark
[b] Ramboll Denmark Ltd., Teknikerbyen 31, DK 2830 Virum, Denmark