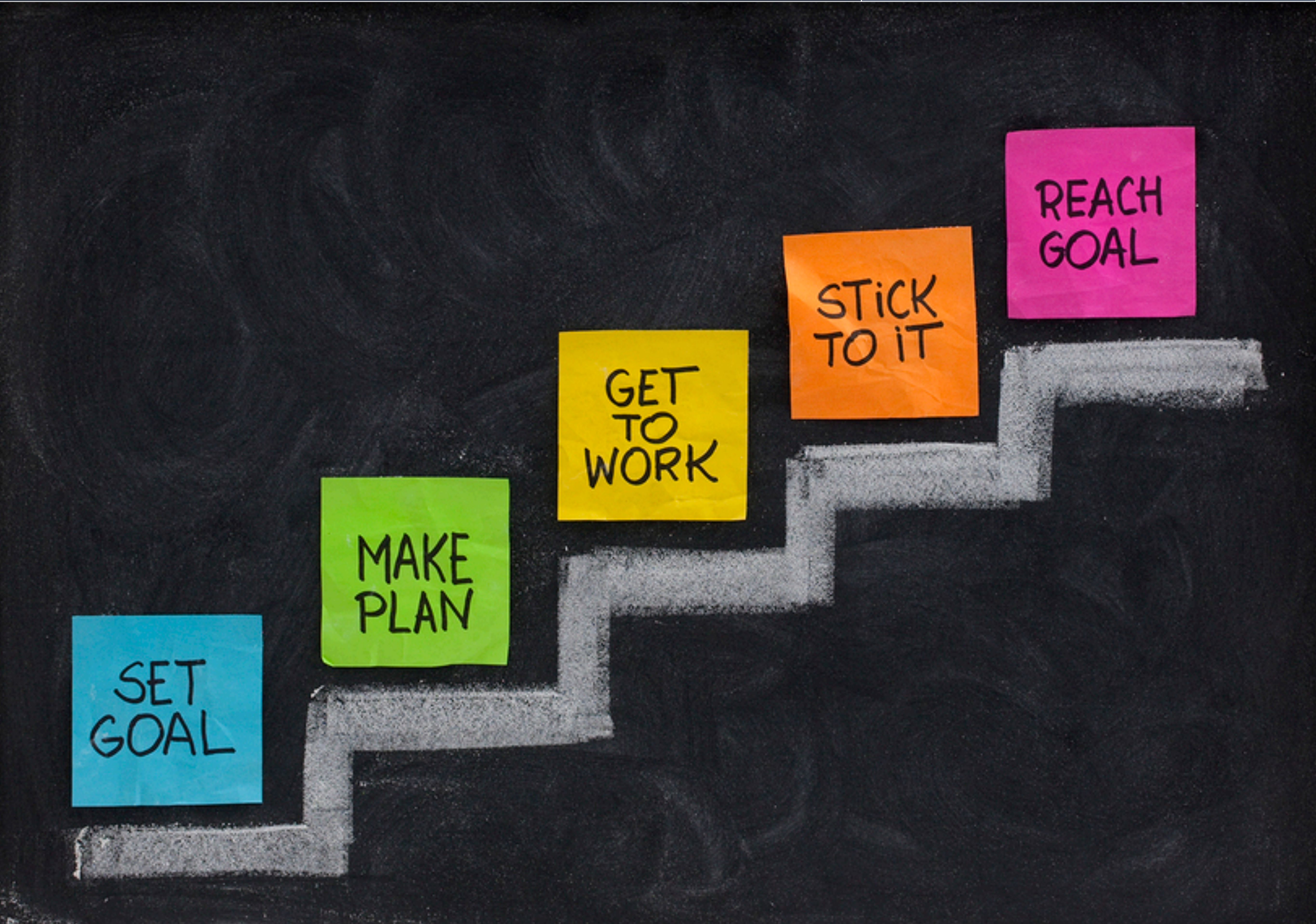
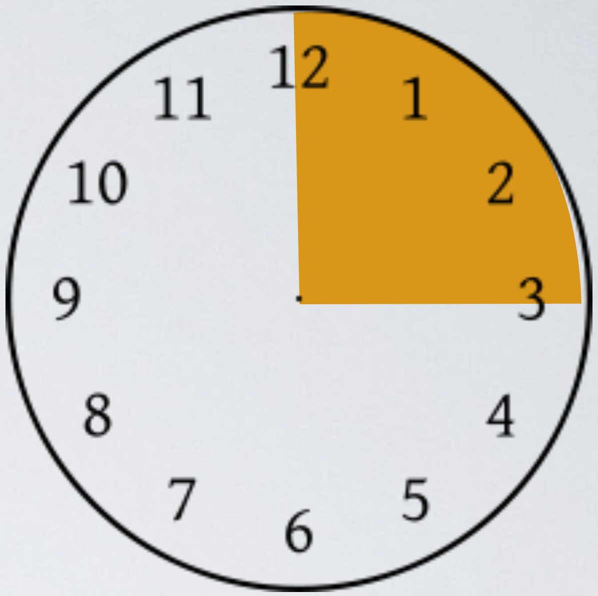
Marta Oliveira Panão

Energy systems in buildings


SET GOAL
MAKE PLAN
GET TO WORK
STICK TO IT
REACH GOAL

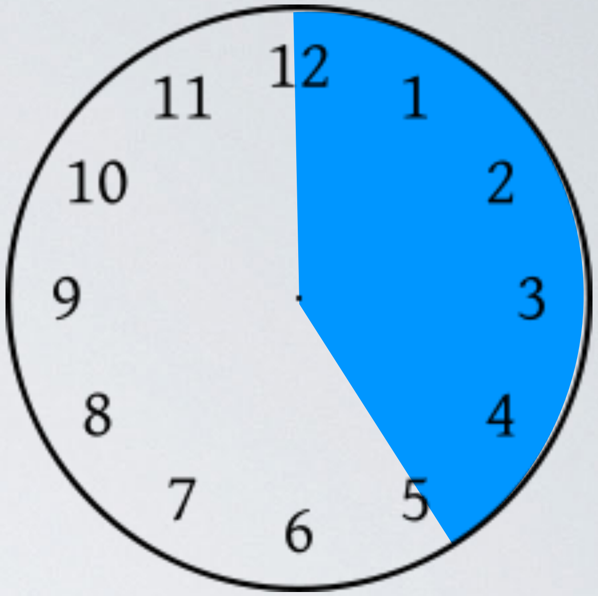


3 horas / semana

- **2 aulas de 1.5h**
- **Exposição dos conteúdos teóricos**
- **Resolução de alguns exercícios**

Ciências ULisboa

Trabalho semanal



3-5 horas / semana

- **Revisão dos conteúdos teóricos**
- **Resolução de outros exercícios**
- **Realização de um trabalho prático (aplicação do Regulamento)**

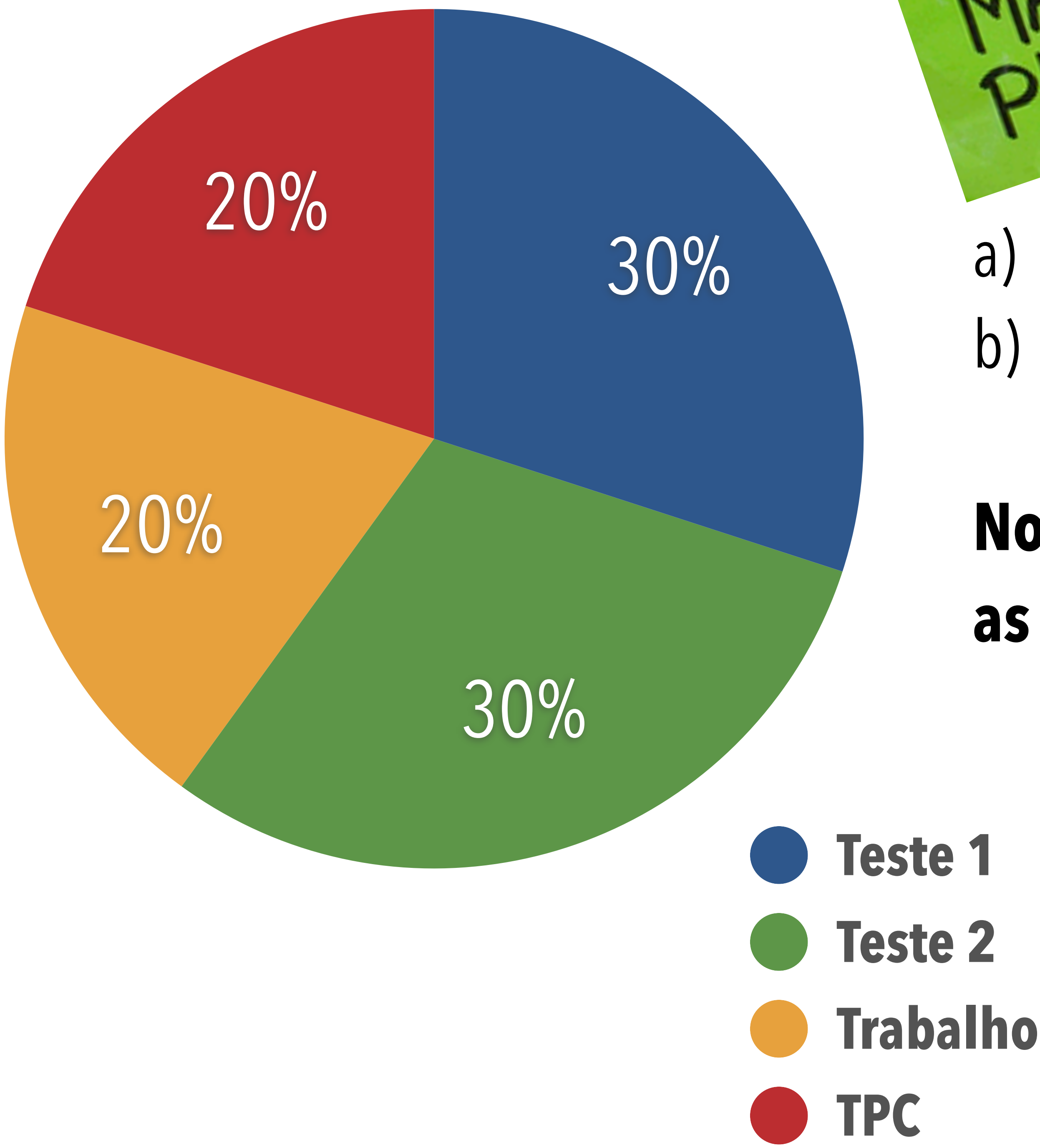
Ciências ULisboa

Horas	Segunda	Terça	Quarta
08:00 - 08:30			
08:30 - 09:00			
09:00 - 09:30			
09:30 - 10:00			
10:00 - 10:30			
10:30 - 11:00	[4MIEEA02; 5MIEEA01] [8 1 67] [PL] PL21		[4MIEEA02; 5MIEEA01] [8 2 15] [TP] TP21
11:00 - 11:30			
11:30 - 12:00			
12:00 - 12:30	[4MIEEA02; 5MIEEA01] [8 2 11] [T] T21		
12:30 - 13:00			
13:00 - 13:30			

	2ª feira	4ª feira
Aulas	**10:30-12:00 (8.2.11)**	**10:30-12:00 (8.2.15)**
Aulas com computador	**12:00-13:00 (8.2.11)**	

Ciências ULisboa

Avaliação periódica



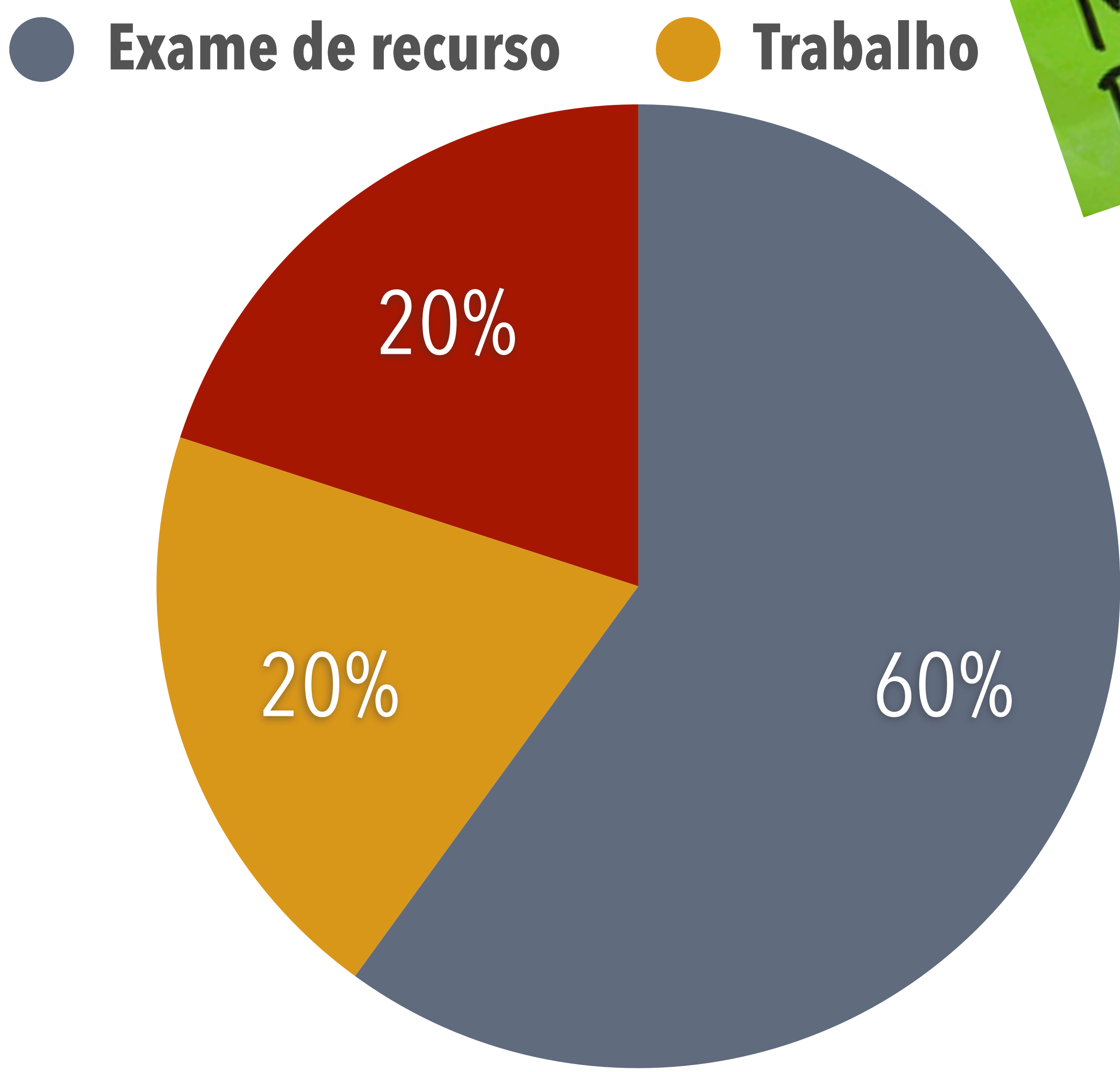
a) Teoria + aplicações práticas

b) com consulta **apenas** de formulário

Nota mínima em todas as componentes de avaliação: 9.5

Ciências ULisboa

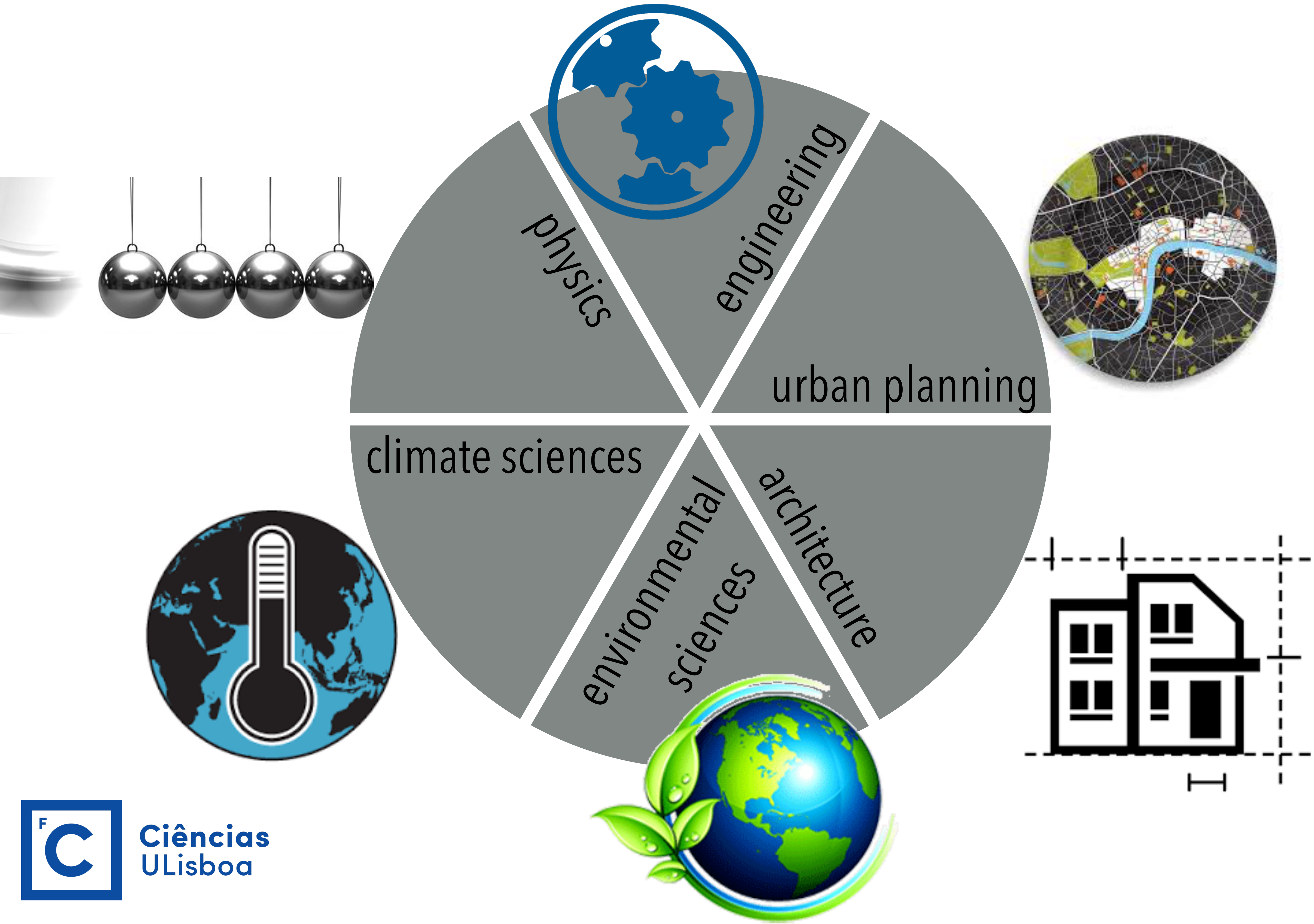
Avaliação exame (opção B)



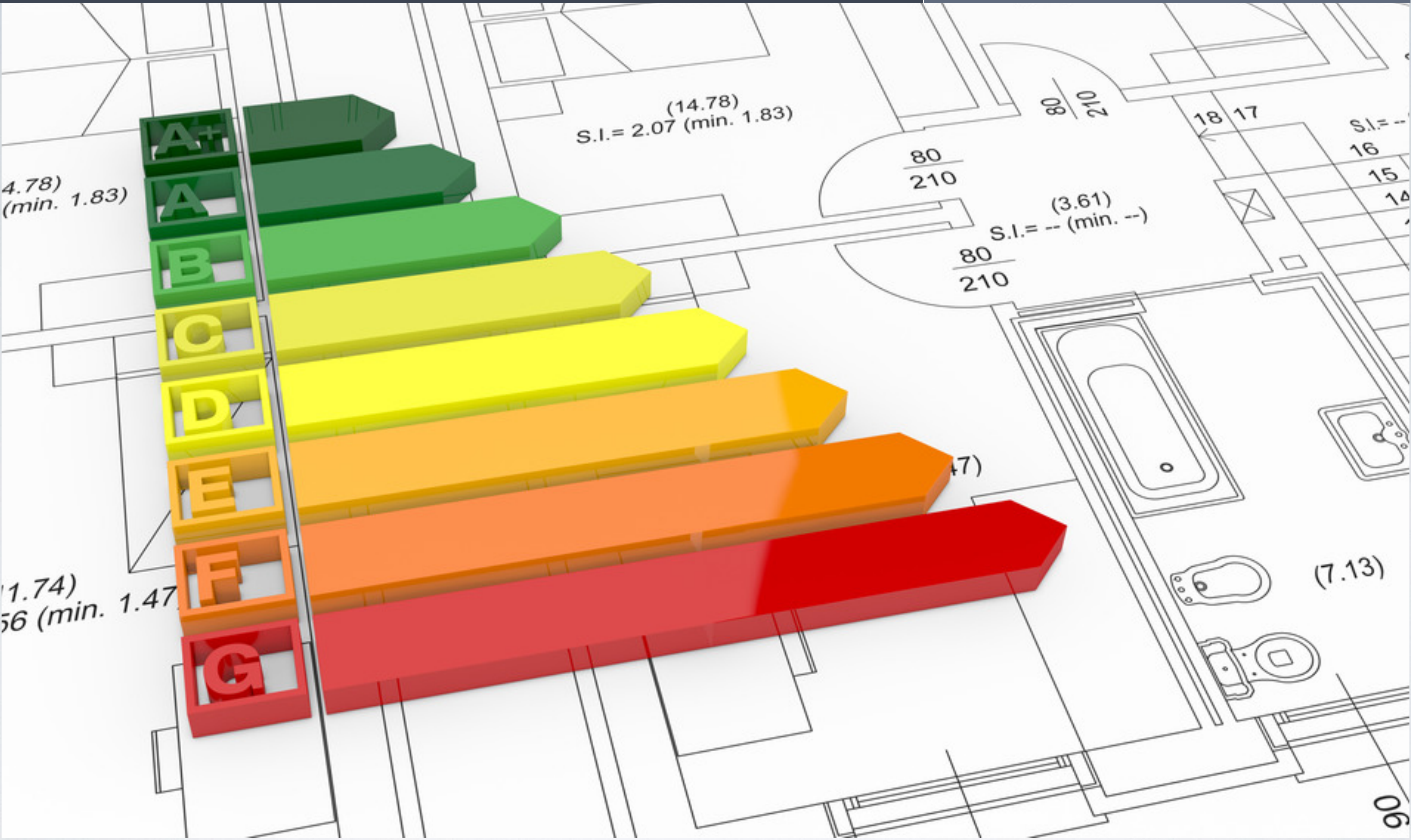
a) Teoria + aplicações práticas
b) com consulta **apenas** de formulário

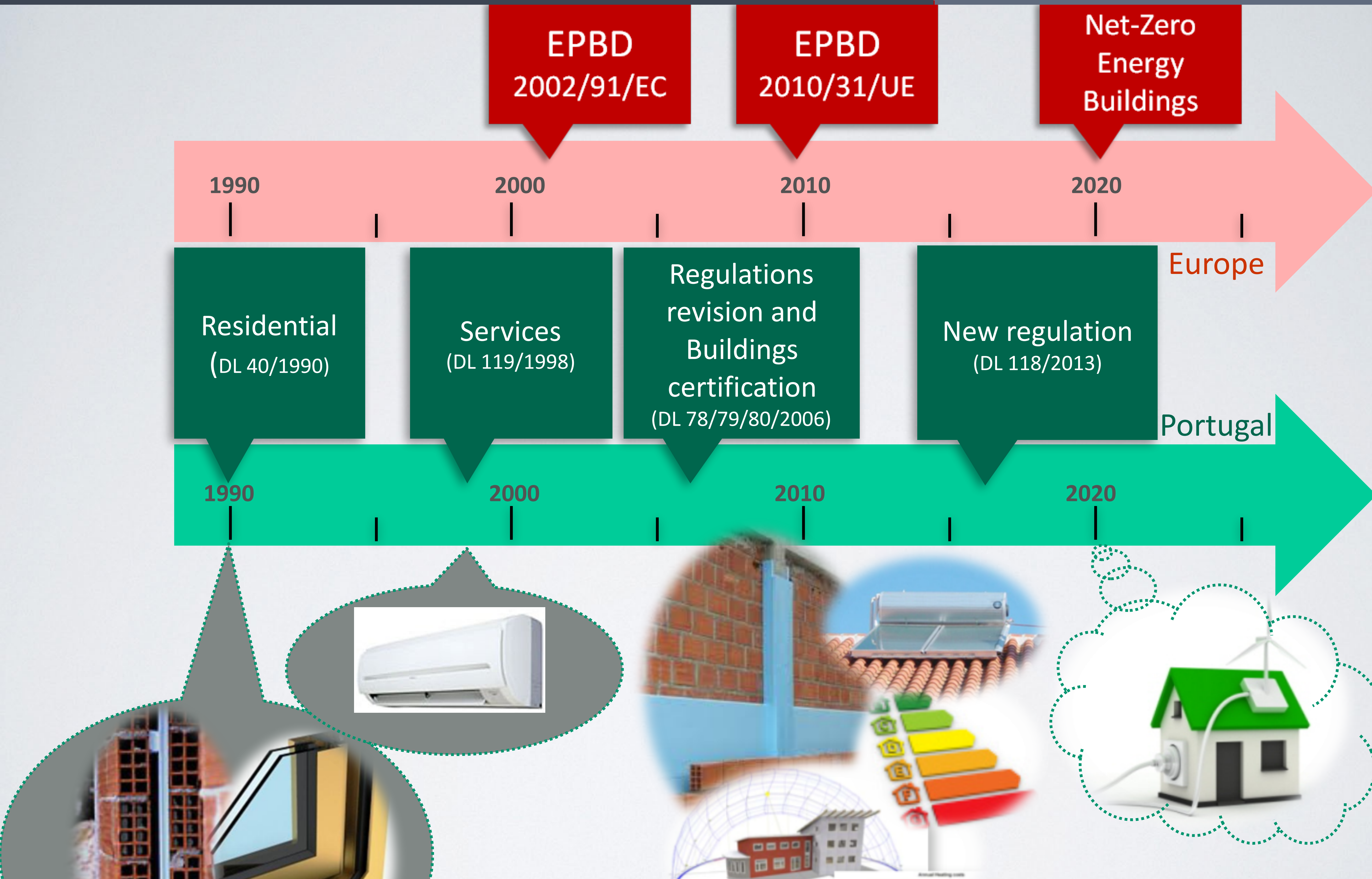
Nota mínima: 9.5

Semana		Contents - T&TP
1	**19 fevereiro**	Introdução
	Carnaval	
2	**2-4 março**	Regulamentos SCE, REH e RECS
3	**9-11 março**	Heat transfer + network analysis
4	**16-18 março**	Radiation: thermal radiation, solar geometry, radiative heat transfer
5	**23-25 março**	Balanço de energia numa zona térmica, regime permanente
6	**30 março - 1 abril**	Balanço de energia numa zona térmica, regime quase-estacionário (REH)
7	**6 abril**	Balanço de energia numa zona térmica, cálculo dinâmico simplificado (RECS-PES)
	Páscoa	
8	**15 abril**	**Teste 1**
9	**20-22 abril**	Psicrometria
10	**27-29 abril**	Conforto térmico / Qualidade do ar interior e ventilação
11	**4-6 maio**	Cargas térmicas de aquecimento e arrefecimento
12	**11-13 maio**	Sistemas de aquecimento e arrefecimento, ventiladores e bombas
13	**18-20 maio**	Iluminação
14	**25-27 maio**	**Teste 2**
Teste 1 (30%)	**15 abril**	
Teste 2 (30%)	**25 ou 27 de maio (a definir)**	



Ciências
ULisboa


A+
A
B
C
D
E
F
G
(14.78)
S.I.= 2.07 (min. 1.83)
80
210
(3.61)
S.I.= -- (min. --)
80
210
80
210
18 17
16
15
(7.13)



EPBD - Energy Performance of Buildings Directive
RCCTE - Regulamento das Características do Comportamento Térmico dos Edifícios
RSECE - Regulamento dos Sistemas Energéticos de Climatização em Edifícios
SCE - Sistema de Certificação de Edifícios

Is ZERO-ENERGY a new millenium concept?

ZERO-ENERGY HOUSE

Solar Energy, Vol. 19, pp. 195–199. Pergamon Press 1977. Printed in Great Britain

DIMENSIONING OF THE SOLAR HEATING SYSTEM IN THE ZERO ENERGY HOUSE IN DENMARK†

TORBEN V. ESBENSEN and VAGN KORSGAARD
Thermal Insulation Laboratory, Technical University of Denmark,
Building 118, DK-2800 Lyngby, Denmark

(*Received* 19 *April* 1976)

Abstract—The paper describes the project for a Zero Energy House constructed at the Technical University of Denmark. The house is designed and constructed in such a way that it can be heated all winter without any "artificial" energy supply, the main source being solar energy. With energy conservation arrangements, such as high-insulated constructions (30–40 cm mineral wool insulation), movable insulation of the windows and heat recovery in the ventilating system, the total heat requirement for space heating is calculated to 2300 kWh per year. For a typical, well insulated, one-storied, one-family house built in Denmark, the corresponding heat requirement is 20,000 kWh. The solar heating system is dimensioned to cover the heat requirements and the hot water supply for the Zero Energy House during the whole year on the basis of the weather data in the "Reference Year". The solar heating system consists of a 42 m^2 flat-plate solar collector, a 30 m^3 water storage tank (insulated with 60 cm of mineral wool), and a heat distribution system. A total heat balance is set up for the system and solved for each day of the "Reference Year". Collected and accumulated solar energy in the system is about 7300 kWh per yr; 30 per cent of the collected energy is used for space heating, 30 per cent for hot water supply, and 40 per cent is heat loss from the accumulator tank. For the operation of the solar heating system, the pumps and valves need a conventional electric energy supply of 230 kWh per year (corresponding to 5 per cent of the useful solar energy).

INTRODUCTION

During the spring of 1975, a one-family, one-storied, experimental house, the Zero Energy House, was constructed at the Technical University of Denmark.

an insulated storage tank of 30 m^3 buried in the just outside the atrium.

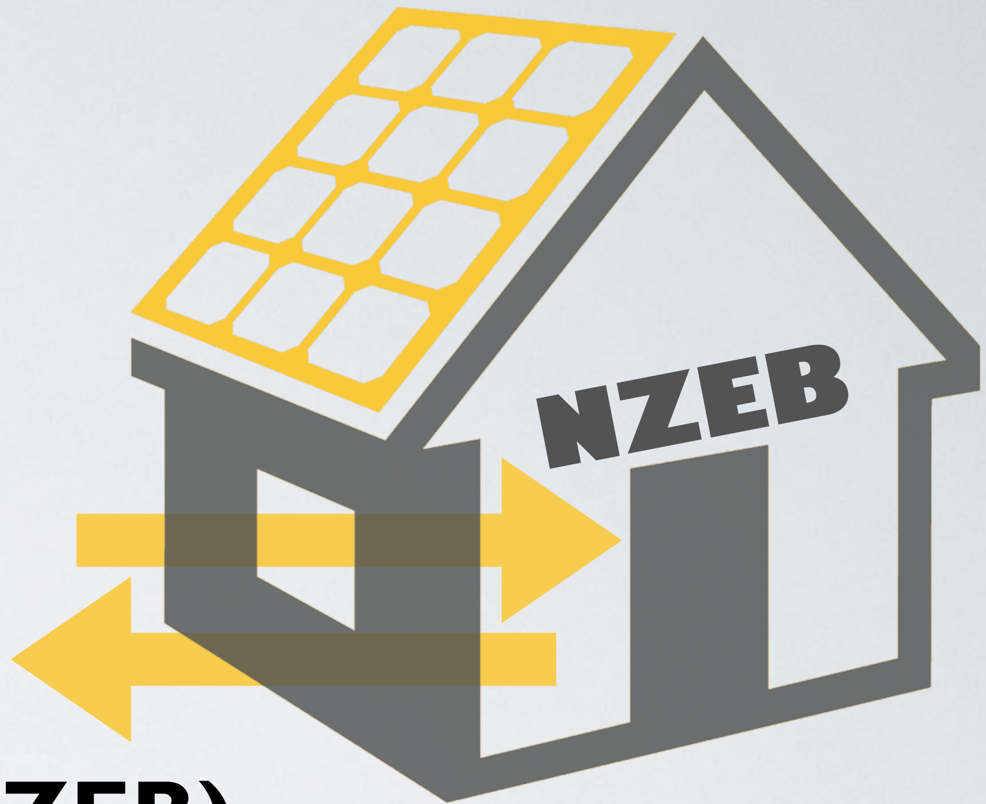
The measuring equipment was installed duri summer 1975, and a family occupied the house

ZERO-ENERGY BUILDING (ZEB) (strict concept) or off-grid ZEB*

"do not require connection to grid or only as a backup. Stand alone buildings can autonomously supply themselves with energy, as they have the capacity to store energy for night-time or wintertime use."

Laudsten, Energy Efficiency Requirements in Building Codes, in: Energy Efficiency Policies for New Buildings, OECD/IEA, Paris, 2008.

*self-sufficient, autonomous, stand alone



NET ZERO ENERGY BUILDING (NZEB)

or on-grid ZEB* *"are buildings that over a year are neutral, meaning that they deliver as much energy to the supply grids as they use from the grids."*

Laudsten, Energy Efficiency Requirements in Building Codes, in: Energy Efficiency Policies for New Buildings, OECD/IEA, Paris, 2008.

Ciências ULisboa

*grid connected, grid integrated