House Refuge

PCIF/AGT/a0109/2018

Atitudes e Comportamentos Face à Prevenção e Combate de Incêndios e a Gestão do Território, Incluindo a sua Vertente Colaborativa

www.adai.pt/houserefuge

House-Refuge

Miguel Almeida
miguelalmeida@adai.pt

MohammaReza (ADAI), Dulce Lopes (UC), Inês Martins (UC), Fernando Gomes (itecons), João Paulo Rodrigues (itecons)

Partners:

Associação para o Desenvolvimento da Aerodinâmica Industrial

1 2 9 0 UNIVERSIDADE D COIMBRA

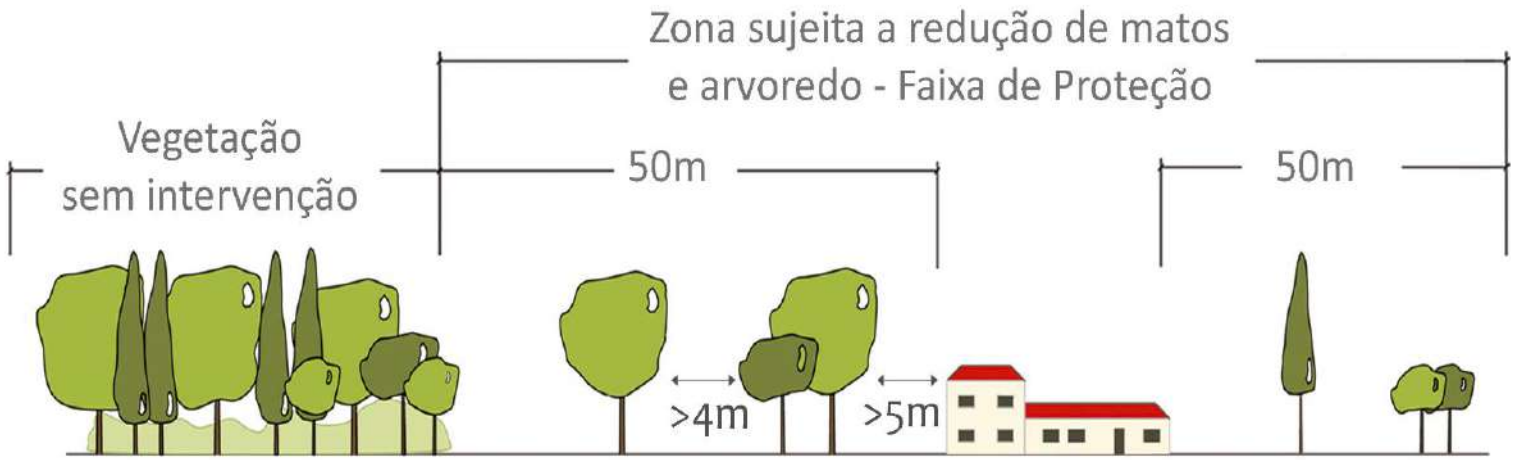
ITeCons Instituto de Investigação e Desenvolvimento Tecnológico em Ciências da Construção

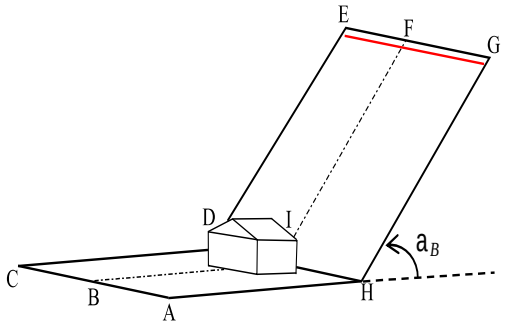
AVIPG

Project funded by:

FCT Fundação para a Ciência e a Tecnologia

Scope of the work





- Is 50m the best bandwidth for fuel management?
- Should there be a single width regardless of the characteristics of the deployment area?
- How do building materials and good building practices minimise risk?
- How do compensatory self-protection measures minimise the risk?

Structure of the project

Advisory Board
(J. Leonard, S. Manzello)

Books
Demonstration

Characteristics of the surroundings

Self-protection measures

Building materials and construction practices

Good practices
Models

Effective implementation

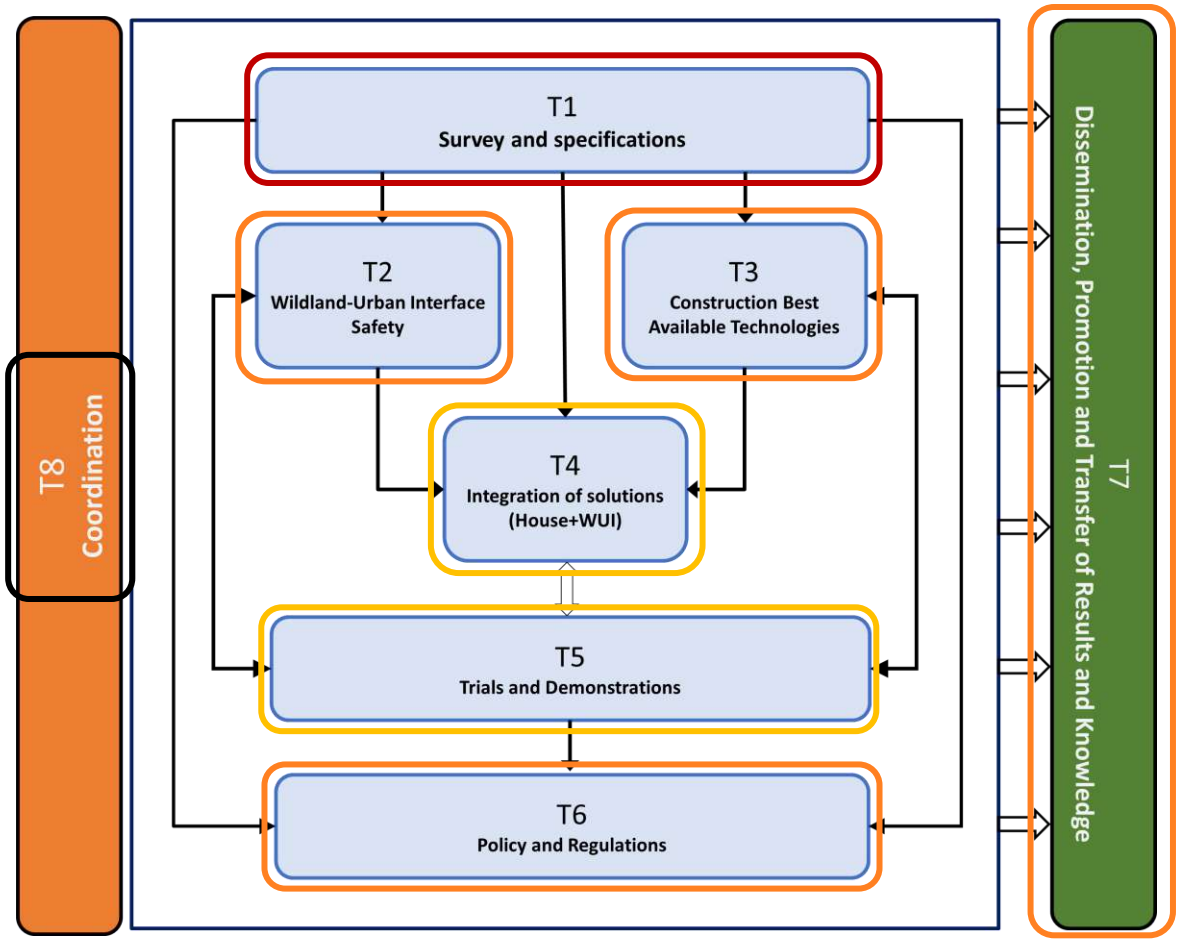
Awareness raising and training of population and professionals

Regulatory proposals

Proposals for insurance sector

Associated partners (e.g., APS)

State of progress



Task Nº	Task Denomination	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey and specifications																																				
2	Wildland-urban interface solutions for fire safety																																				
3	Fire wise technologies for buildings																																				
4	Integration of solutions (house+WUI)																																				
5	Trial and demonstrations																																				
6	Policy and regulations																																				
7	Dissemination, promotion and transfer of results and knowledge																																				
8	Coordination																																				

Developments T1- Survey and specifications

PROJETO HOUSE-REFUGE

Atitudes e Comportamentos Face à Prevenção e Combate de Incêndios e a Gestão do Território, Incluindo a sua Vertente Colaborativa

www.adai.pt/houserefuge

House Refuge

1º Relatório

LEGISLAÇÃO PORTUGUESA APLICADA À INTERFACE URBANO-FLORESTAL NA DUAL CASA/ENVOLVENTE
(Legislação Nacional com relevo no âmbito do Projeto House Refuge)

- Decree-Law 124/2006 (National System of Forest defence against rural fires):
  - **(inter)municipal plans for forest defence against rural fires**
  - **Fire Management Zones**
  - **Fuel management obligations** (50m around buildings)
  - **Construction prohibition** (in high and very high fire prone areas) **and limitations** (50 m to the limit of the property in forested areas; other limits possible depending on the occupation of the surroundings and the use of the construction).

Developments T1- Survey and specifications

PROJETO HOUSE-REFUGE

Atitudes e Comportamentos Face à Prevenção e Combate de Incêndios e a Gestão do Território, Incluindo a sua Vertente Colaborativa

www.adai.pt/houserefuge

House Refuge

Relatório Nr 2

Cenários Típicos de interface urbano-florestal na dual casa/envolvente

Typical buildings

- ***Number of floors:*** *building with one or two floors*;
- ***Structure:*** *building with reinforced concrete structure and brick masonry, or stone masonry and reinforced concrete floors*;
- ***Roof:*** *building with sloping roof covered with ceramic tiles*;
- ***Spans:*** *aluminium or wooden doors and windows*
- ***Ventilation:*** *PVC grids*;
- ***Insulation:*** *XPS thermal insulator and steel and PU sandwich panel.*

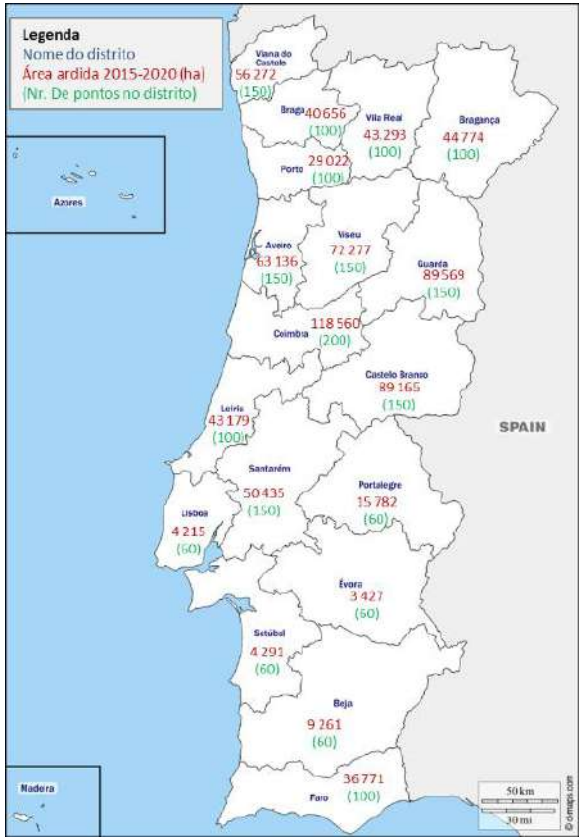
Developments T1- Survey and specifications

Relatório Nr 2

Cenários Típicos de interface urbano-florestal na dual casa/envolvente

Typical surrounding scenario

2000 isolated houses

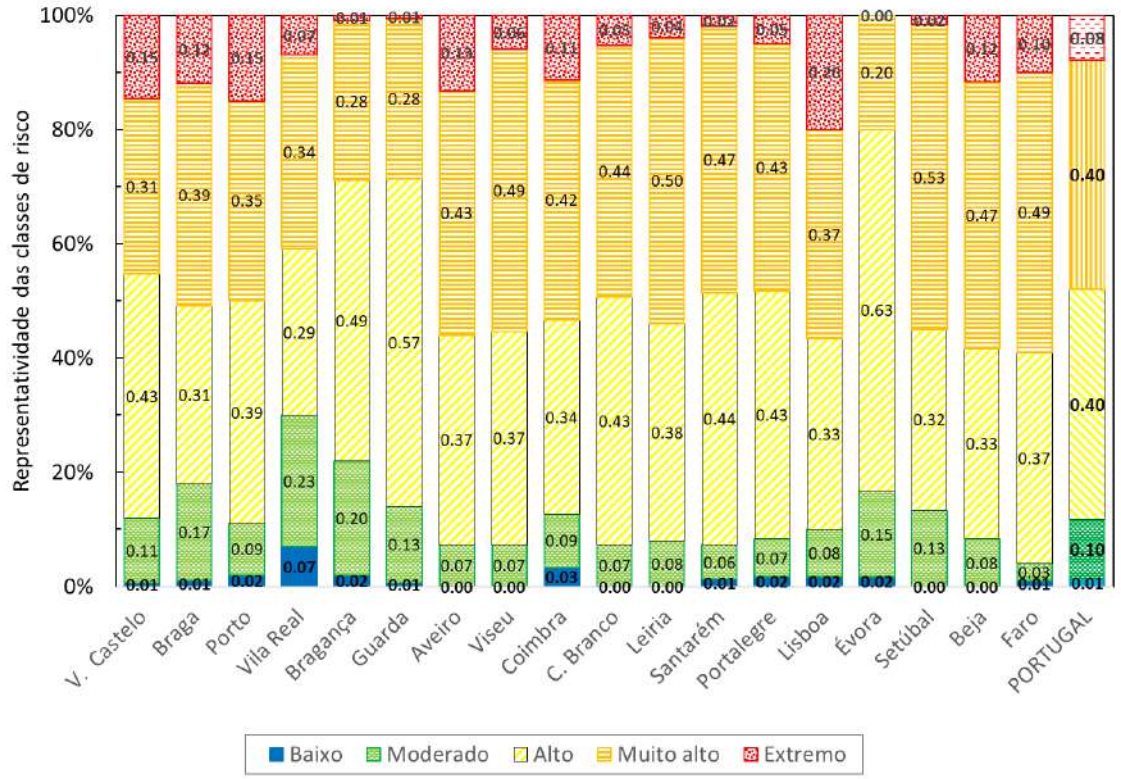


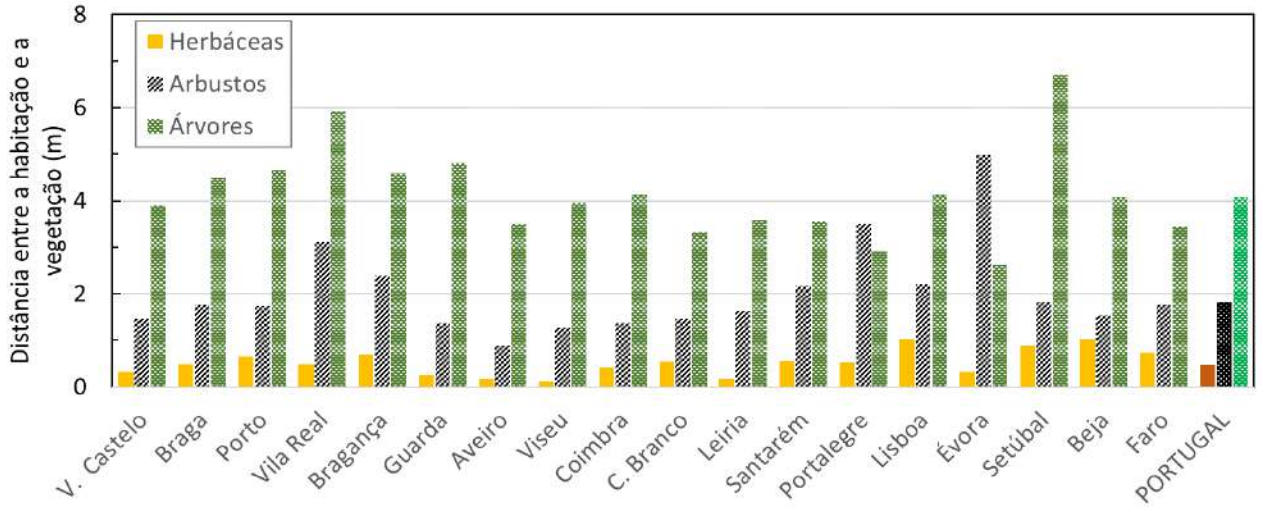
Developments T1- Survey and specifications

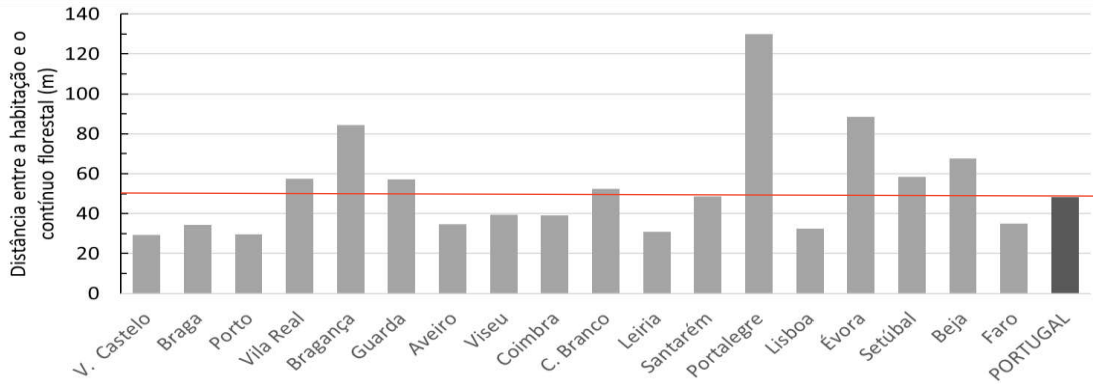
Relatório Nr 2

Cenários Típicos de interface urbano-florestal na dual casa/envolvente

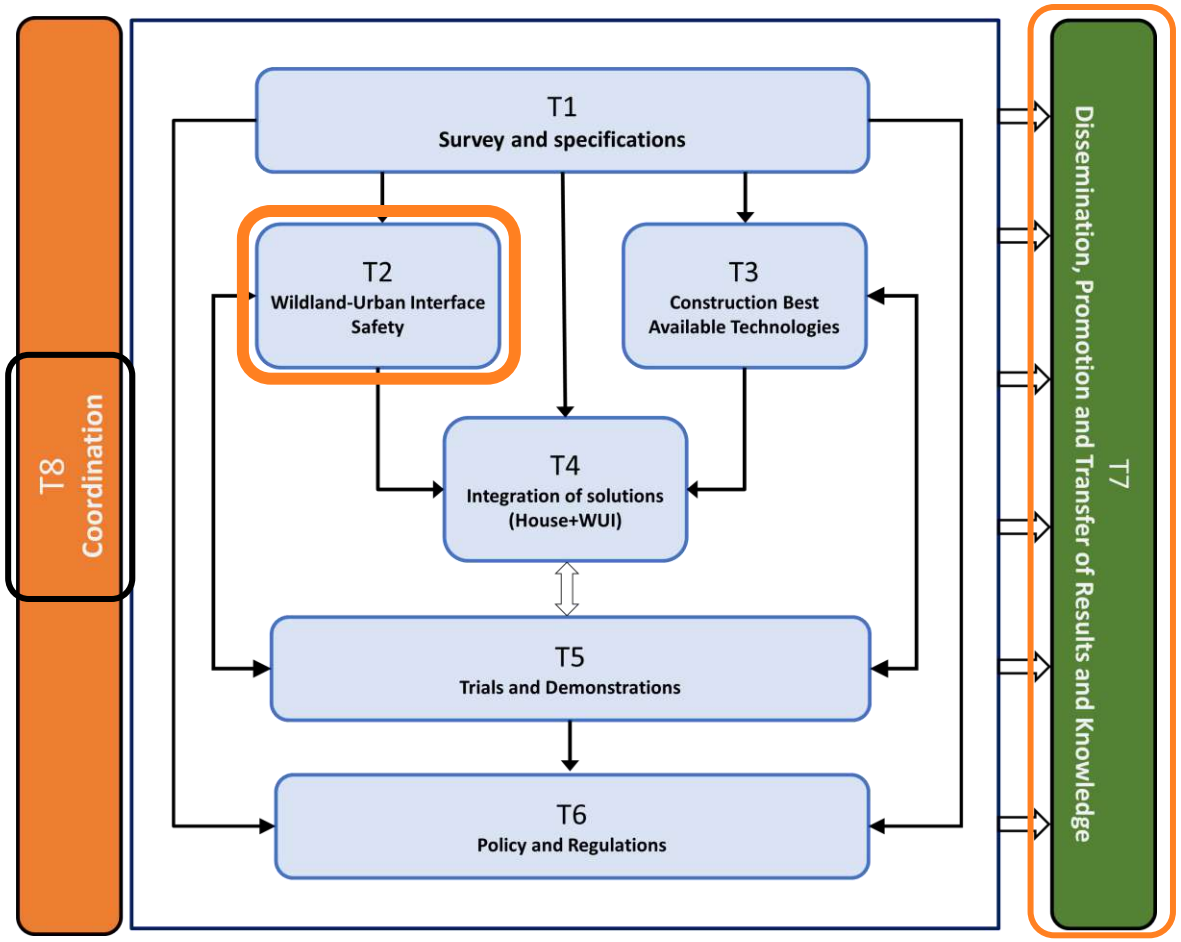
Typical surrounding scenario







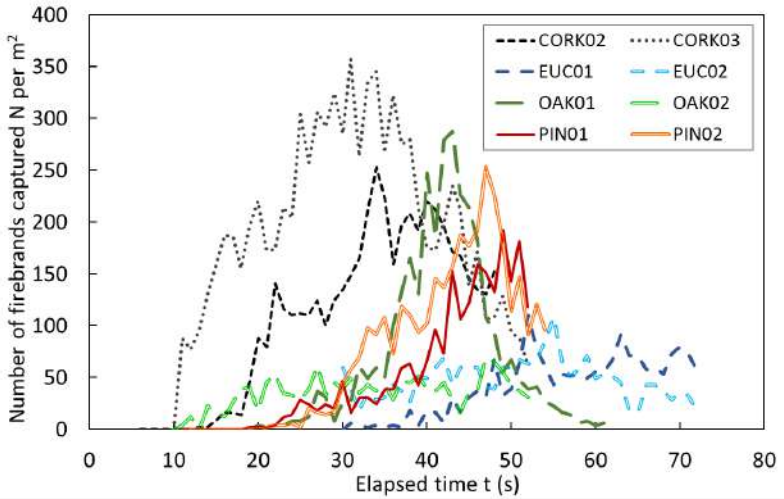
State of progress

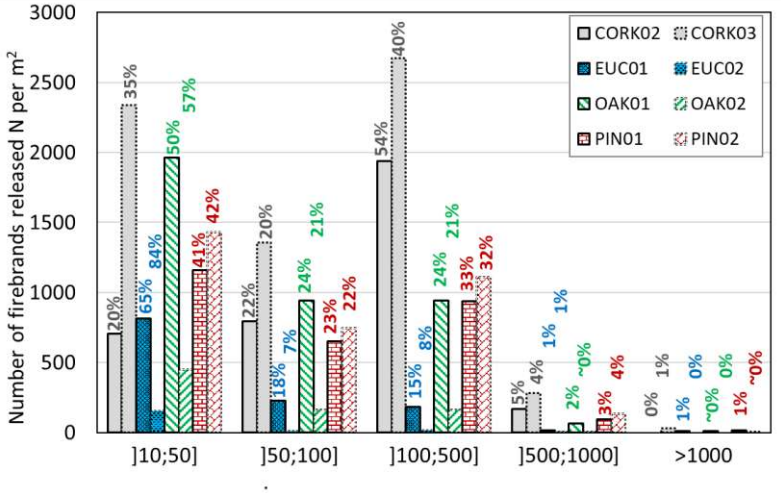


Task Nº	Task Denomination	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey and specifications																																				
2	Wildland-urban interface solutions for fire safety																																				
3	Fire wise technologies for buildings																																				
4	Integration of solutions (house+WUI)																																				
5	Trial and demonstrations																																				
6	Policy and regulations																																				
7	Dissemination, promotion and transfer of results and knowledge																																				
8	Coordination																																				

Developments T2- WUI safety (best practices)

Analysis of tree species with higher potential for producing firebrands





- Tests with airflow **V**
- Tests with hedges **V**
- Tests with garden trees (linden, weeping willow, orange tree / lemon tree, pear / apple tree, ...)

Modeling Approach

Computational Fluid Dynamics of fire

The Douglas-fir tree (equivalent hydrocarbon fuel: $C_{1.0}H_{1.6416}O_{0.7143}N_{1.4E-3}$) is used as a benchmark for the CFD modelling of the fire in this project:

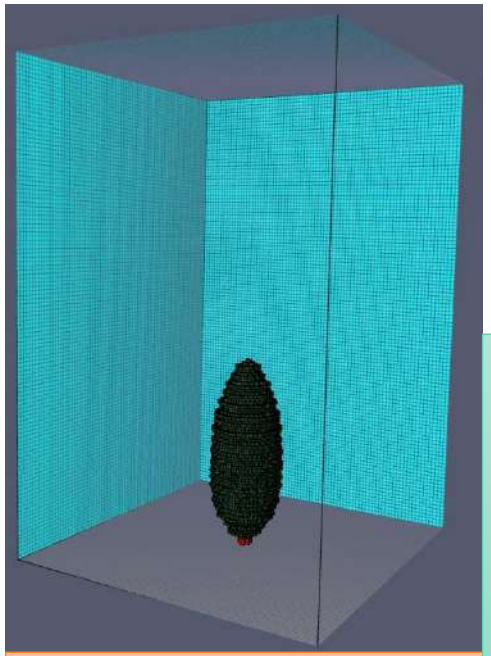


Fig.1. Douglas-fir tree, H = 1.2m

Domain Size: $2\times2\times3m^3$

Grid Size: 1.2E6 cells

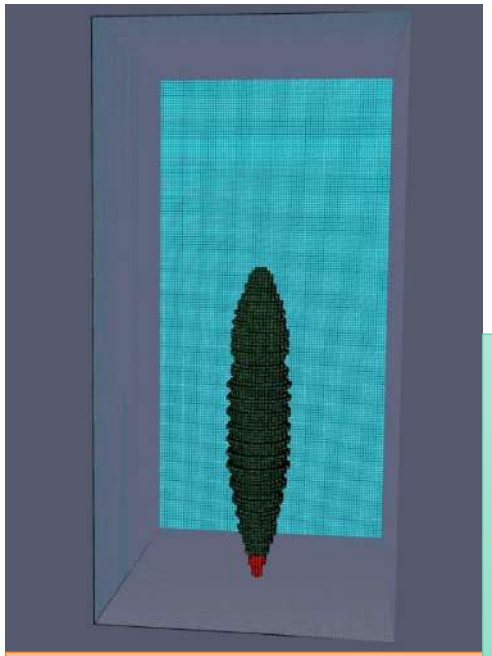


Fig.2. Douglas-fir tree, H = 2.4m

Domain Size: $2\times2\times4m^3$

Grid Size: 1.4E6 cells

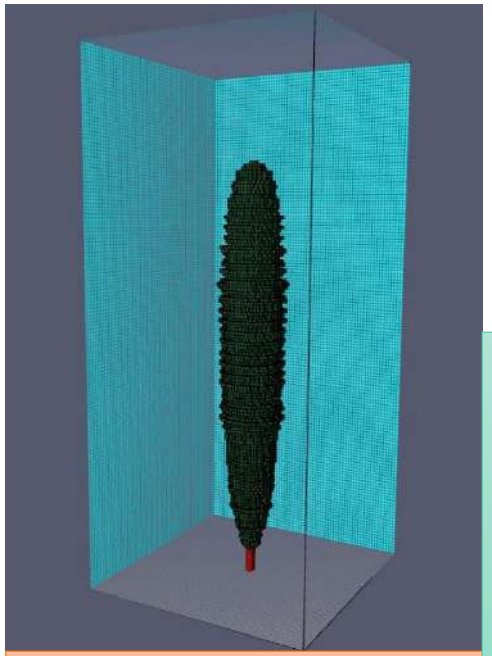
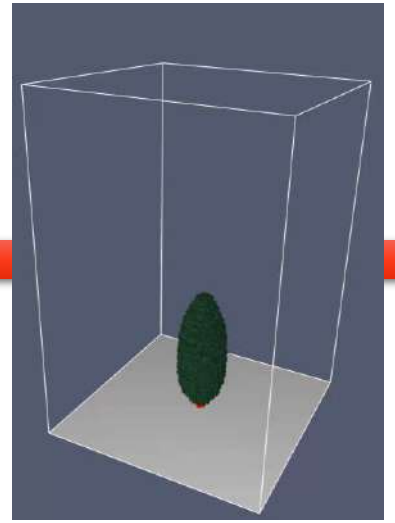


Fig.3. Douglas-fir tree, H = 3.6m

Domain Size: $2\times2\times4.5m^3$

Grid Size: 1.85E6 cells

Modeling Approach



Computational Fluid Dynamics of fire

The results of the fire dynamics simulation (FDS):

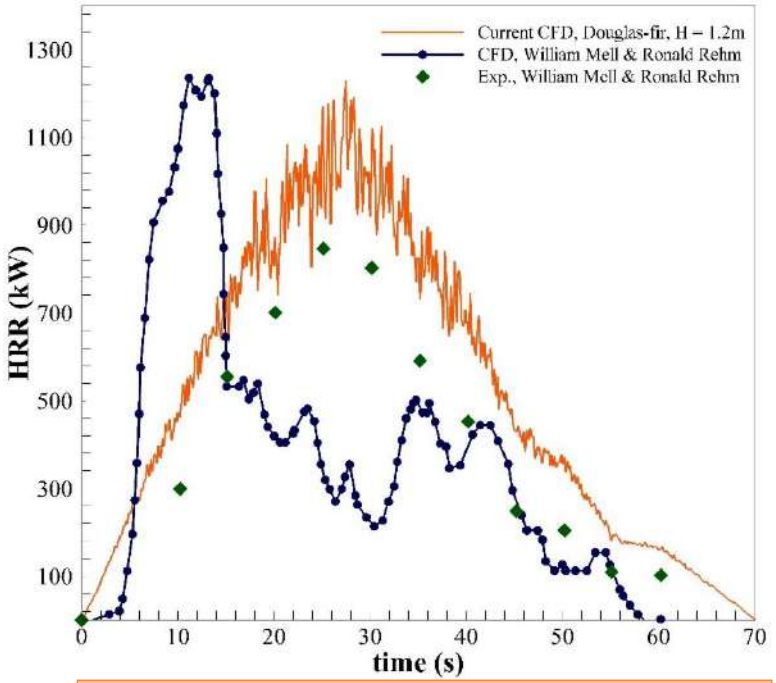


Fig.3. Comparison of Results for Heat Release Rate (HRR) in kWs, for Douglas-fir H = 1.2m. Moisture Content: 25%

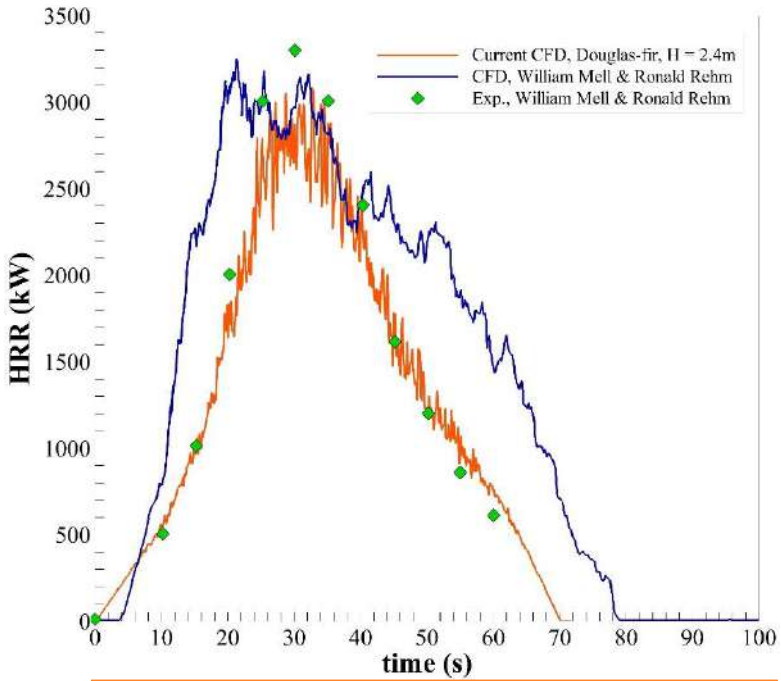


Fig.4. Comparison of Results for Heat Release Rate (HRR) in kWs, for Douglas-fir H = 2.4m. Moisture Content: 53%

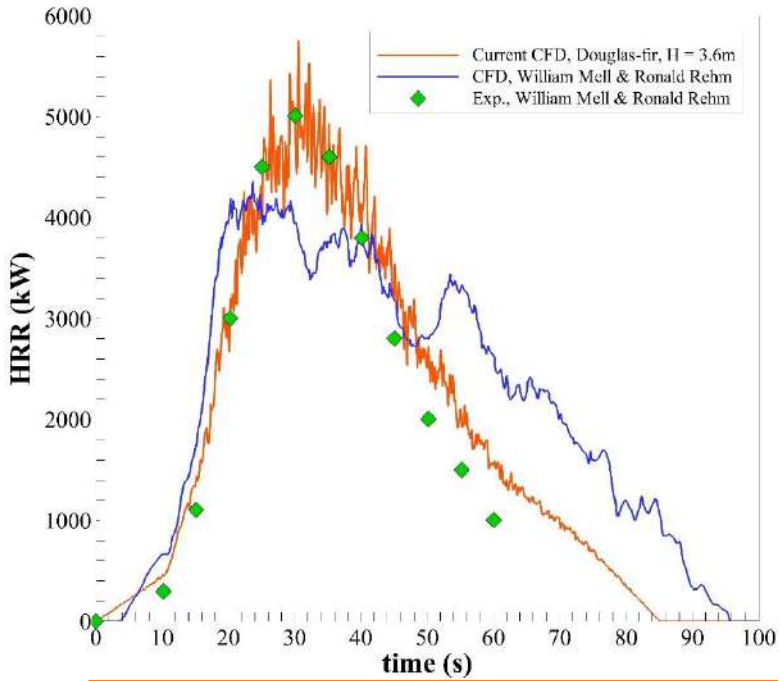
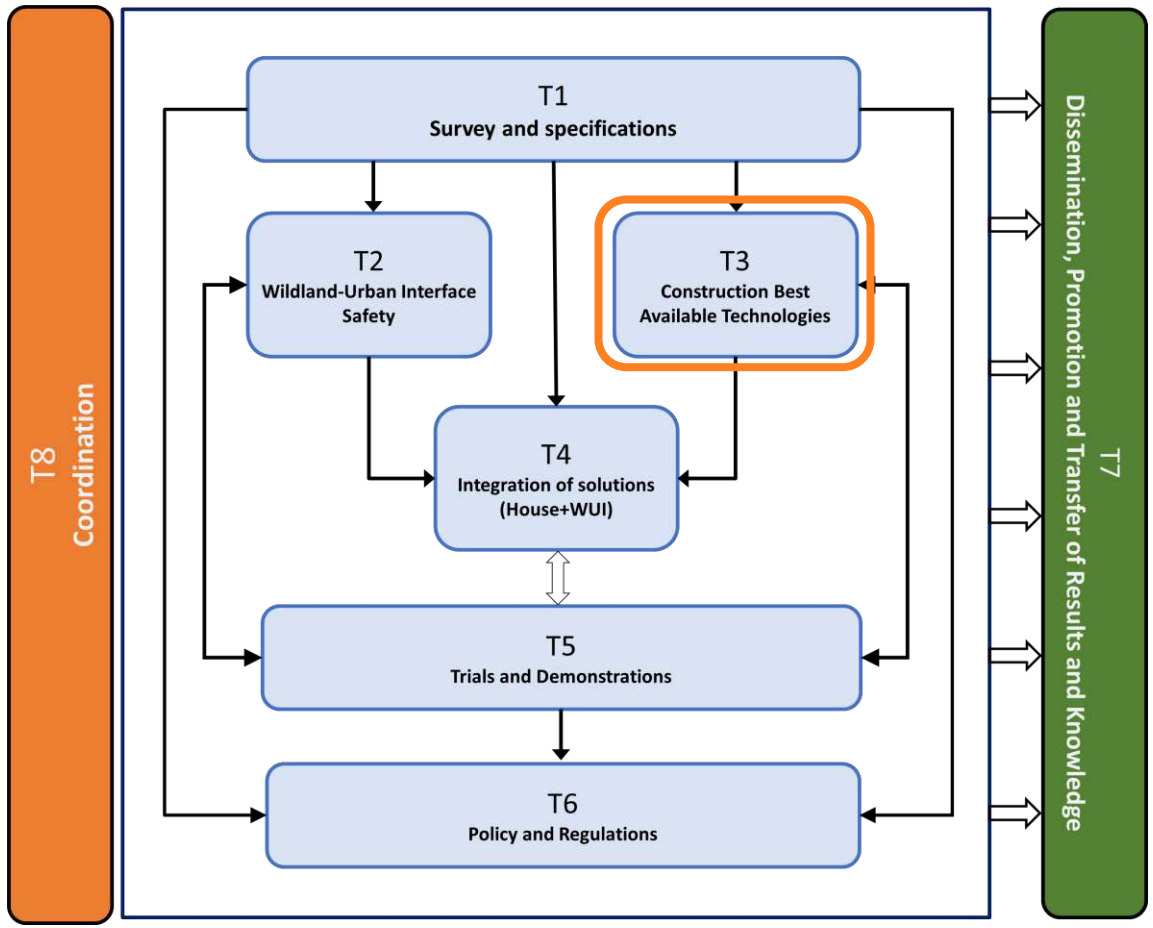


Fig.6. Comparison of Results for Heat Release Rate (HRR) in kWs, for Douglas-fir H = 3.6m. Moisture Content: 54%

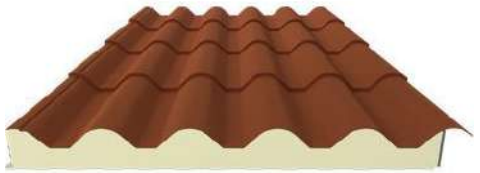
State of progress



Task Nº	Task Denomination	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey and specifications																																				
2	Wildland-urban interface solutions for fire safety																																				
3	Fire wise technologies for buildings																																				
4	Integration of solutions (house+WUI)																																				
5	Trial and demonstrations																																				
6	Policy and regulations																																				
7	Dissemination, promotion and transfer of results and knowledge																																				
8	Coordination																																				

Developments T3- Construction Best Available technologies

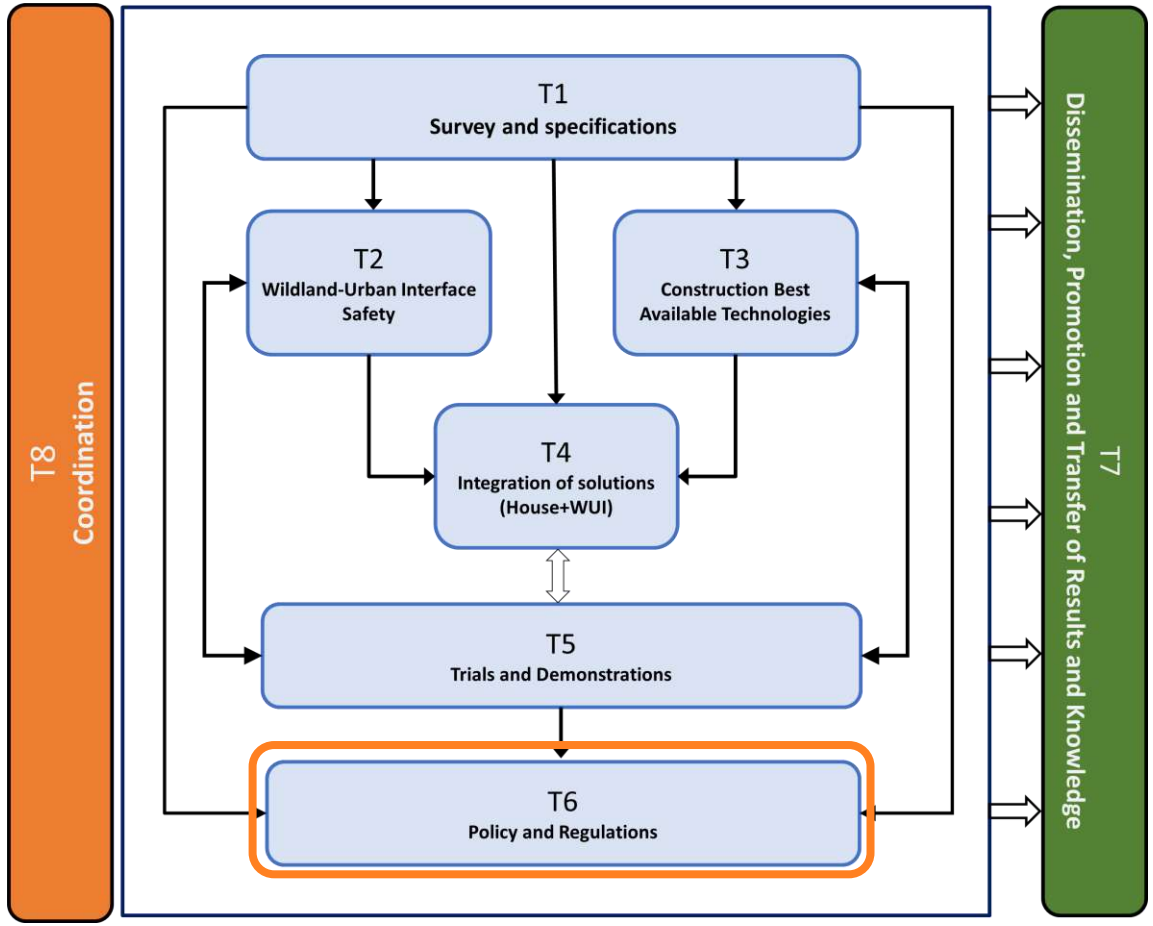
Aluminium window frames



Sandwich panel

- Buildings with reinforced concrete structure and brick masonry and buildings with stone masonry and reinforced concrete floors are the most resilient (most frequent) construction technologies.
- Wooden or metal frame buildings are more vulnerable (infrequent).
- Study of other vulnerable elements in buildings (doors, windows, grids, insulation) – the aim is to develop guidelines for good practice in construction.

State of progress



Task Nº	Task Denomination	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey and specifications																																				
2	Wildland-urban interface solutions for fire safety																																				
3	Fire wise technologies for buildings																																				
4	Integration of solutions (house+WUI)																																				
5	Trial and demonstrations																																				
6	Policy and regulations																																				
7	Dissemination, promotion and transfer of results and knowledge																																				
8	Coordination																																				

Developments T6- Policy and regulations

House Refuge
www.adai.pt/houserefuge

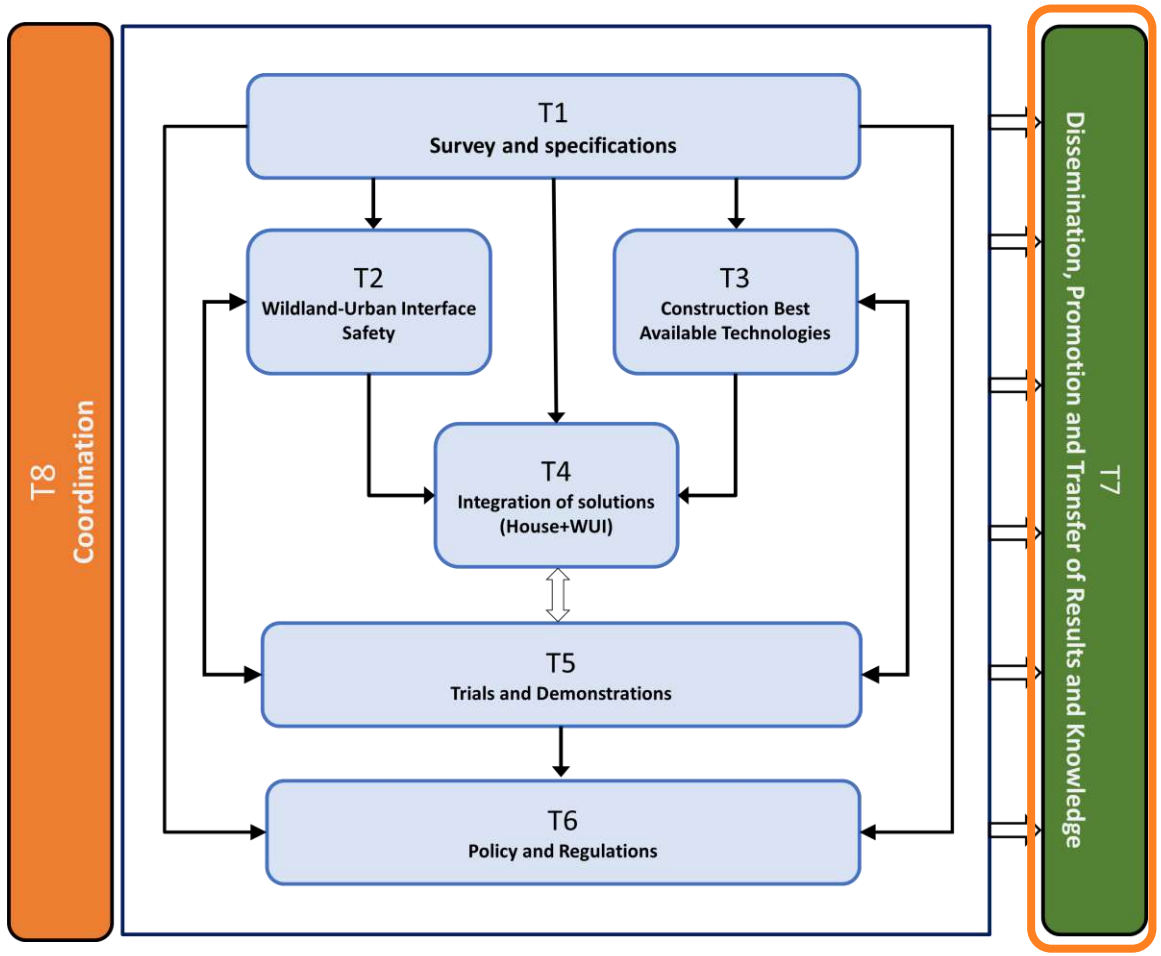
Ficha de simulação de seguro contra incêndios florestais

Caso Referência

- Establishment of contacts with the Portuguese Insurance Association (APS) in order to ascertain the level of consideration of wildfire risk in the WUI in Portugal
  - Conduction of questionnaires
  - Webinar on insurance law and policies

- International legislation and policies on WUI
  - Comparative report on legislation and insurance policies in several States

State of progress



Task Nº	Task Denomination	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Survey and specifications																																				
2	Wildland-urban interface solutions for fire safety																																				
3	Fire wise technologies for buildings																																				
4	Integration of solutions (house+WUI)																																				
5	Trial and demonstrations																																				
6	Policy and regulations																																				
7	Dissemination, promotion and transfer of results and knowledge																																				
8	Coordination																																				

Developments T7- Disseminationm promotion and transfer

www.adai.pt/houserefuge

- 3 reports
  - Portuguese legislation applied to the wildland-urban interface in the dual construction/surroundings (IJUC)
  - Typical scenarios of the wildland-urban interface in the dual construction/surroundings (itecons, ADAI)
  - Report of the visit to Quinta de Chãozinho: analysis of fire behaviour and its impact on the fire event in Alijó started on the 7th August 2020 (ADAI)
- 2 Scientific papers in international journals
  - Ribeiro, L.M.; Rodrigues, A.; Lucas, D.; Viegas, D.X. The Impact on Structures of the Pedrógão Grande Fire Complex in June 2017 (Portugal). Fire 2020, 3, 57. https://doi.org/10.3390/fire3040057
  - Almeida, M.; Porto, L; Viegas, D. X. (2021). Characterization of Firebrands Released from Different Burning Tree Species. Frontiers in Mechanical Engineering, section Thermal and Mass Transport – accepted for publication
- 4 book chapters

House Refuge

PCIF/AGT/a0109/2018

Atitudes e Comportamentos Face à Prevenção e Combate de Incêndios e a Gestão do Território, Incluindo a sua Vertente Colaborativa

www.adai.pt/houserefuge

House-Refuge

Miguel Almeida
miguelalmeida@adai.pt

MohammaReza (ADAI), Dulce Lopes (UC), Inês Martins (UC), Fernando Gomes (itecons), João Paulo Rodrigues (itecons)

Partners:

Associação para o Desenvolvimento da Aerodinâmica Industrial

1 2 9 0 UNIVERSIDADE D COIMBRA

ITeCons Instituto de Investigação e Desenvolvimento Tecnológico em Ciências da Construção

AVIPG

Project funded by:

FCT Fundação para a Ciência e a Tecnologia