

**Project title:** Renewable residential heating with fast pyrolysis bio-oil

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## Dissemination (Please cross-tick the correct type and level)

Type: R      R      - Report  
                      DEM    - Demonstrator, pilot, prototype  
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## Residue2Heat Overall Concept

Residue<sup>2</sup>Heat



### Renewable Residential Heating with Fast Pyrolysis Bio-Oil

A long-term objective of *Residue2Heat* is to use agricultural or forest residue streams that are unsuitable for food or feed production and have low ILUC values for residential heating. Within *Residue2Heat* a burner is modified to build up a reliable combustion system in which Fast Pyrolysis Bio-Oil (FPBO) can be used as single fuel. Up till now the utilization of FPBO in residential-scale systems has never been done.



**Step 1)** A wide variety of biomasses or biomass residue streams will be converted into a uniform 2<sup>nd</sup> generation liquid biofuel via the fast pyrolysis process. It's a process where organic material is rapidly heated to ~500°C in the absence of air leading to so-called fast pyrolysis bio-oil (FPBO).

**Step 2)** The properties of crude FPBO vary and are completely different compared to fossil fuel oils. In *Residue2Heat* the oil is conditioned and standardized for optimal market introduction. The produced FPBO in *Residue2Heat* will be ash free and of a standardized quality.



**Step 3)** The production of FPBO is decoupled from its use; time, scale and location. This is beneficial for the application and market introduction of FPBO in residential-scale heating system. The ambition in *Residue2Heat* is to clear the path for the implementation of handling and distribution of FPBO.

**Step 4)** Limited knowledge is available on physical and chemical properties of FPBO. One objective is to increase the knowledge of these properties in order to support the design process of highly efficient burners. The standardized FPBO is beneficial and increases the opportunities for market introduction of FPBO in residential heating systems.



**Step 5)** *Residue2Heat* aims not only to use the 2<sup>nd</sup> generation biofuel FPBO for residential heating but also to maximise the combustion efficiency. Currently, only 10% of the residential heating units are classified as high efficient condensing boilers (labelling A-class).

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**Project details:**

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Call: Competitive Low Carbon Energy  
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**Project partners.**



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## Residue2Heat Project Objectives



## Renewable Residential Heating with Fast Pyrolysis Bio-Oil

### -1- Introduction

A long-term objective of *Residue2Heat* is to use agricultural or forest residue streams that are unsuitable for food or feed production and have low ILUC values for residential heating.

### -2- Ambition

The intention of the *Residue2Heat* project is to clear the path for the implementation of FPBO in residential heating systems combined with maximum combustion efficiency.



The overall ambition is:

Address all technical challenges associated with the use of residual biomass for sustainable residential heat

### -3- Project Objectives

The overall objective of the project *Residue2Heat* is to enable the utilization of various biomass residue streams in residential heating applications in a sustainable manner. The overall project objectives are:

- Widening the feedstock base,
- Ash free FPBO,
- Improving efficiencies,
- Low-emissions.

### -4- Approach and Methodology

The different development steps in *Residue2Heat* for an efficient, low emission, biomass residential heating system based on FPBO are:

- FPBO is produced from different biomass residues;
- High ash content are recovered during FPBO production;
  - leading to low ash emissions at the end-user;
  - Assessment of mineral recycling;
- Standardisation of FPBO;
- Thermo-physical properties FPBO;
- Fundamental of FPBO spray and combustion;
- Optimization of the burner design;
  - Leading to low emissions.



### -5- Layout of the Work Packages

The overall project has been divided into 8 logical work packages each covering a specific aspect of the development of the whole development chain, as depicted schematically in the figure below. The project consists mainly of two pillars; the standardization of FPBO for residential heating and development of a residential heating system for this standardized FPBO.



### -6- Use FPBO in Residential Heating Systems

A liquid fuel burner is modified for the use of the standardised FPBO. The foreseen overall adaptations lead to a reliable system and the TRL is moved from 3 to 5 in this R&I project.



### -7- Expected Results

The overall objective of the project *Residue2Heat* is to enable the utilization of various biomass residue streams in residential heating applications in a sustainable manner. The produced Fast-Pyrolysis Bio-Oil (FPBO) will be:

- Produced from various high-ash biomass residues,
- High quality and standardised FPBO,
- Minimal one FPBO grade suitable for residential use
- Enhanced knowledge on atomisation and combustion of FPBO,
- Proof of concept of FPBO fuelled residential heater,
- Known socio-Economic and environmental impacts of FPBO,
- Market assessment of key countries for FPBO deployment,

### Project website:

<http://www.residue2heat.eu>



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