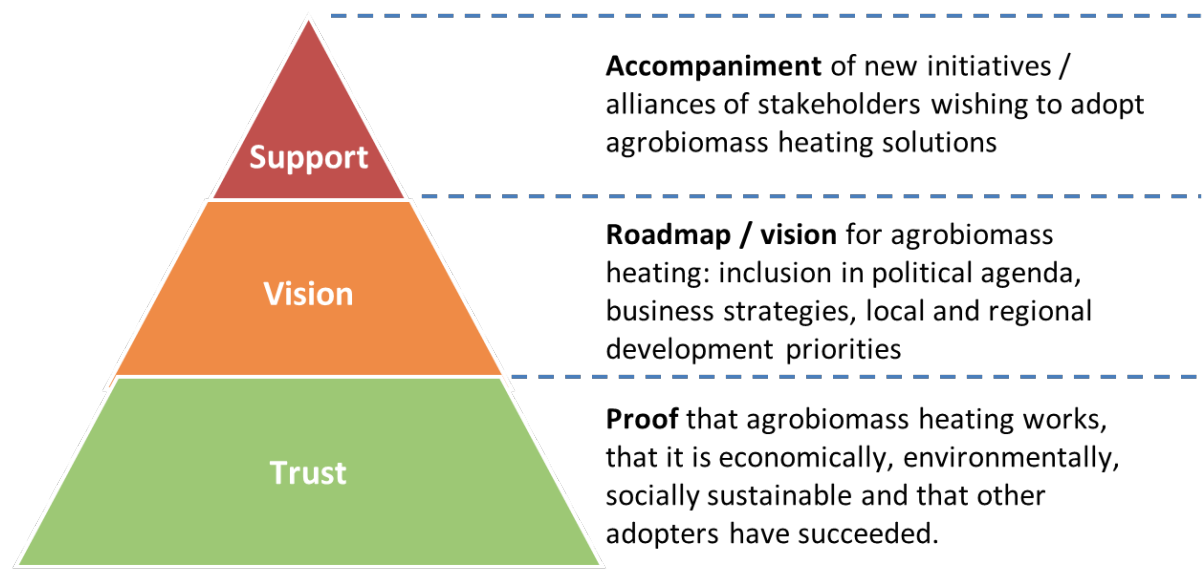


AgroBioHeat



Adopt modern solutions for **agrobiomass heating** and reap the **benefits**:

- ✓ **Reduce your heating costs!**
- ✓ **Support rural growth and circular economy!**
- ✓ **Reduce your carbon footprint and help fight climate change!**



Agrobiomass, a perfect heating fuel for:

- ✓ **Farms and rural households!**
- ✓ **Schools, municipal buildings and other community energy projects!**
- ✓ **Agro-industries, greenhouses and others!**



Consortium:



Project Acronym: **AgroBioHeat** Project Number: **818369** Call: **H2020-LC-SC3-2018-RES-SingleStage**

Topic: **LC-SC3-RES-28-2018-2019-2020 - Market Uptake support**

Project title: **Promoting the penetration of agrobiomass heating in European rural areas**



Main Category of the Project: Bioenergy

TRL: 7-9

Keywords: agrobiomass; Ecodesign regulation; rural areas; heating sector; agro-industries; straw; prunings; by-products; residues; agriculture

Technological approach of the Project: agrobiomass is an abundant, indigenous renewable energy resource in Europe that is currently underutilized. Technological developments can ensure that modern agrobiomass heating solutions are high-efficient and low-emission and a relevant option for the decarbonization of the heating sector, especially in rural areas. AgroBioHeat supports the market uptake of such technologies through a combined and coordinated set of actions.

Expected Impact of the Project: 1) increased mobilization of agrobiomass resources in Europe; 2) contribution to meeting the 2030 and 2050 energy and climate targets; 3) creation of new economic opportunities and job creation in agrobiomass value chains (e.g. logistics, manufacturing installation and operation of boilers); improvement of local air quality

Highlights (technological/non-technological): expected highlights include: 1) Intensive support of 8 new “flagship” initiatives on the multiplication counties / 80 agrobiomass heating initiatives triggered; 2) 6 national policy guidelines & 1 EU level roadmap; 3) suggestions for revision of Ecodesign regulation and inclusion of agrobiomass boilers; 4) 12 success cases monitored in detailed and disseminated; 5) social survey on EU and local level; 6) alignment and empowerment of stakeholders through capacity building and visibility actions (presence in fairs, trainings, site-visits)

What is needed in future: to be checked with stakeholders during project implementation. We expect that a stronger political vision for (agro)biomass heating will be required as well as some structured support for the adoption of (agro)biomass boilers, e.g. through subsidizing the capital investment of small-scale consumers. Support for the further technical development of agrobiomass boilers should also be expected.



This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 691763

Paving the way towards clean energy and fuels in Europe

Talks with research, industry and EU Member States on bioenergy, advanced biofuels and renewable fuels

Cost-effective transformation of a highly-efficient, advanced, thermal ultra-super-critical coal-fired power plant into a CHP by retrofitting and integrating an ARBAFLAME biomass upgrading process



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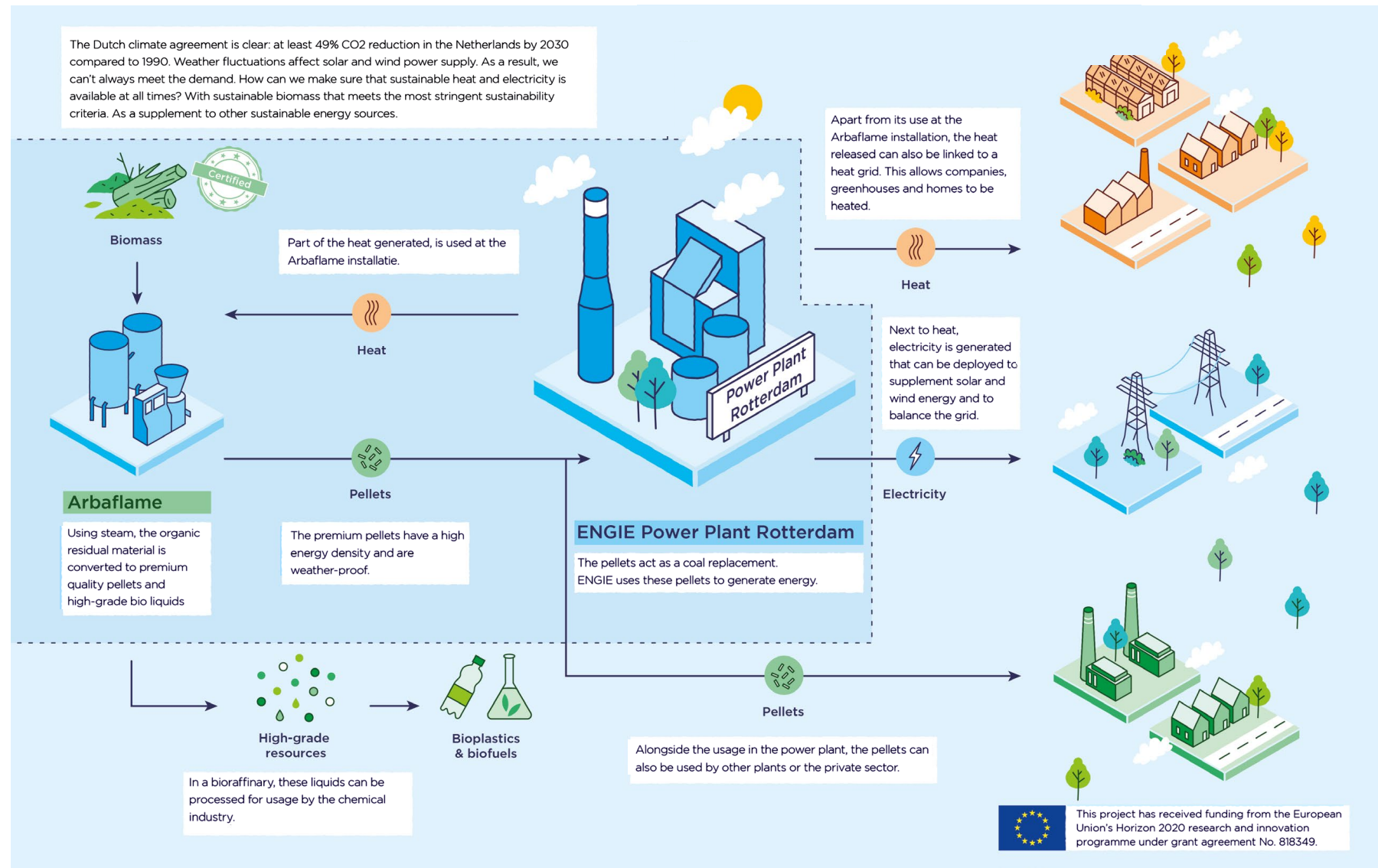
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 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818349.

Project Acronym: ARBAHEAT **Project Number:** 818349 **Call:** H2020-LC-SC3-2018

Topic: Demonstrate solutions that significantly reduce the cost of renewable power generation

Project title: Cost-effective transformation of a highly-efficient, advanced, thermal ultra-super-critical coal-fired power plant into a CHP by retrofitting and integrating an ARBAFLAME biomass upgrading process

Main Category of the Project: Bioenergy, CHP

TRL: TRL5 to TRL 7

Keywords: Renewable energy, Combined Heat and Power, Conversion, Demonstration, Steam explosion, Thermal treatment, Biomass

Technological approach of the Project: In the ARBAHEAT project an existing 731 MWe Ultra-SuperCritical coal-fired power plant of ENGIE will be transformed into a biomass-fired Combined Heat and Power plant by partially repowering with thermally-treated biomass produced on-site

Expected Impact of the Project: This demonstration of an integrated very low-costs concept in large-scale energy production will pave the way to subsequent multiplication in commercial industrial projects, thus increasing the EU capacity for renewable power and heat generation

Highlights (technological/non-technological): The thermal biomass upgrading process of ARBAFLAME will deliver biomass fuel with handling and milling characteristics approaching that of coal, allowing for retrofitting with minimal adaptations to the existing power plant

What is needed in future: Availability of local low grade feedstock that can provide the right handling and milling characteristics after thermal treatment and that allows for further cascading of all chemical components into green products in biorefineries



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 818349



Lowering Costs by Improving Efficiencies in Biomass Fueled Boilers: New Materials and Coatings to Reduce Corrosion



Project Acronym: **BELENUS** Project Number: 815147 Call: H2020-LC-SC3-2018-RES-TwoStages

Topic: LC-SC3-RES-11-2018

Project title: **Lowering costs by improving efficiencies in biomass fueled boilers: New materials and coatings to reduce corrosion**

Main Category of the Project: Renewable electricity, Bioenergy, CHP

TRL: TRL3 to TRL5

Keywords: Biomass corrosion, efficiency, lifetime, protective coating, corrosion monitoring

Technological approach of the Project: Preventing or mitigating corrosion through: a) biomass corrosion highly resistant coatings, b) new strategies of welding and bending for coated tubes and c) new online corrosion monitoring for biomass CHP plants.

Expected Impact of the Project: (1) To reduce the bioenergy CAPEX and OPEX. (2) Potentially reduce environmental impact. (3) Issues related to social acceptance of new energy technologies. (4) Related socioeconomic issues. (5) New market opportunities.

Highlights (technological/non-technological): To develop a solution for corrosion prevention that will allow plant operation at 580-625°C, reaching efficiencies of ~40-43% while increasing the lifetime of components and plants.

What is needed in future: Technological, economic, environmental and social challenges for next biomass CHP plants, focusing in achieving sustainable and efficient renewable energy and reducing CO₂ emissions.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [815147]



Highly-efficient biomass CHP plants by handling ash-related problems

Motivation:

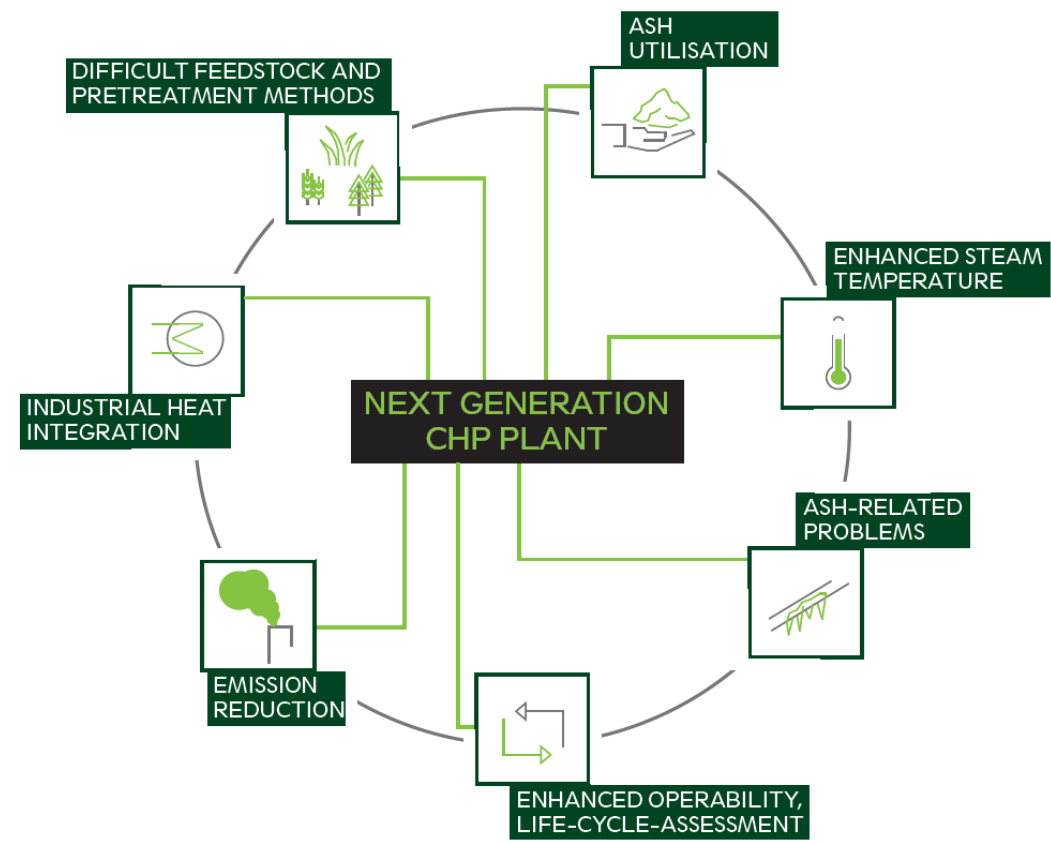
Development of next generation biomass-fired CHP plants with elevated steam temperatures

Research focus:

- Feedstock widening by pretreatment and use of additives
- Ash formation and fate of inorganic elements
- Experimental work on all scales
- Reduction of emissions and risk of deposit formation and corrosion
- New ash utilisation technologies for biomass ashes
- Concept development for next generation CHP plant

Project:

- EU Horizon 2020 program
- 11/2016 - 10/2019



Main Category of the Project: CHP

TRL: 5-6

Keywords: CHP, combustion, biomass ash utilisation, pre-treatment

Technological approach of the Project:

- Experimental investigation (emissions, deposit formation, fly ash formation etc.) of combustion of pre-treated biomass materials in FB and PF systems at different scales
- Investigation of pre-treatment technologies of different biomass materials with subsequent ash utilization options
- Life-cycle assessment and evaluation of design of next generation CHP power plant by state-of-the-art modelling tools

Expected Impact of the Project: Reduce the technological risks for the next development stages; Significantly increased technology performance; Reducing life-cycle environmental impact; Nurturing the development of the industrial capacity to produce components and systems and opening of new opportunities; Contributing to the strengthening the European industrial technology base, thereby creating growth and jobs in Europe; Reducing renewable energy technologies installation time and cost and/or operational costs, hence easing the deployment of renewable energy sources within the energy mix; Increasing the reliability and lifetime while decreasing operation and maintenance costs, hence creating new business opportunities; Contributing to solving the global climate and energy challenges.

Highlights (technological/non-technological):

- Holistic understanding of ash-related problems during biomass combustion
- Bring biomass pre-treatment technologies (torrefaction, steam explosion, hydrothermal carbonization) to commercial stage
- Improve ash utilization from biomass combustion and development of new utilization pathways
- Design of the next generation biomass fired CHP plant with increased efficiency & availability, reduced emissions and optimized resource utilization
- Lifecycle assessment along the whole value chain of bioenergy generation by combustion in order to assure sustainability

What is needed in future:

Fundamental research on biomass ash formation, Model development for better transferability of results, fuel blending and utilisation of difficult feedstock;





Biomass Low cost Advanced Zero Emission small-to-medium scale integrated gasifier - fuel cell CHP plant

H2020 RIA, 4 M€, 3/2019-2/2022, GA 815284

Enrico Bocci

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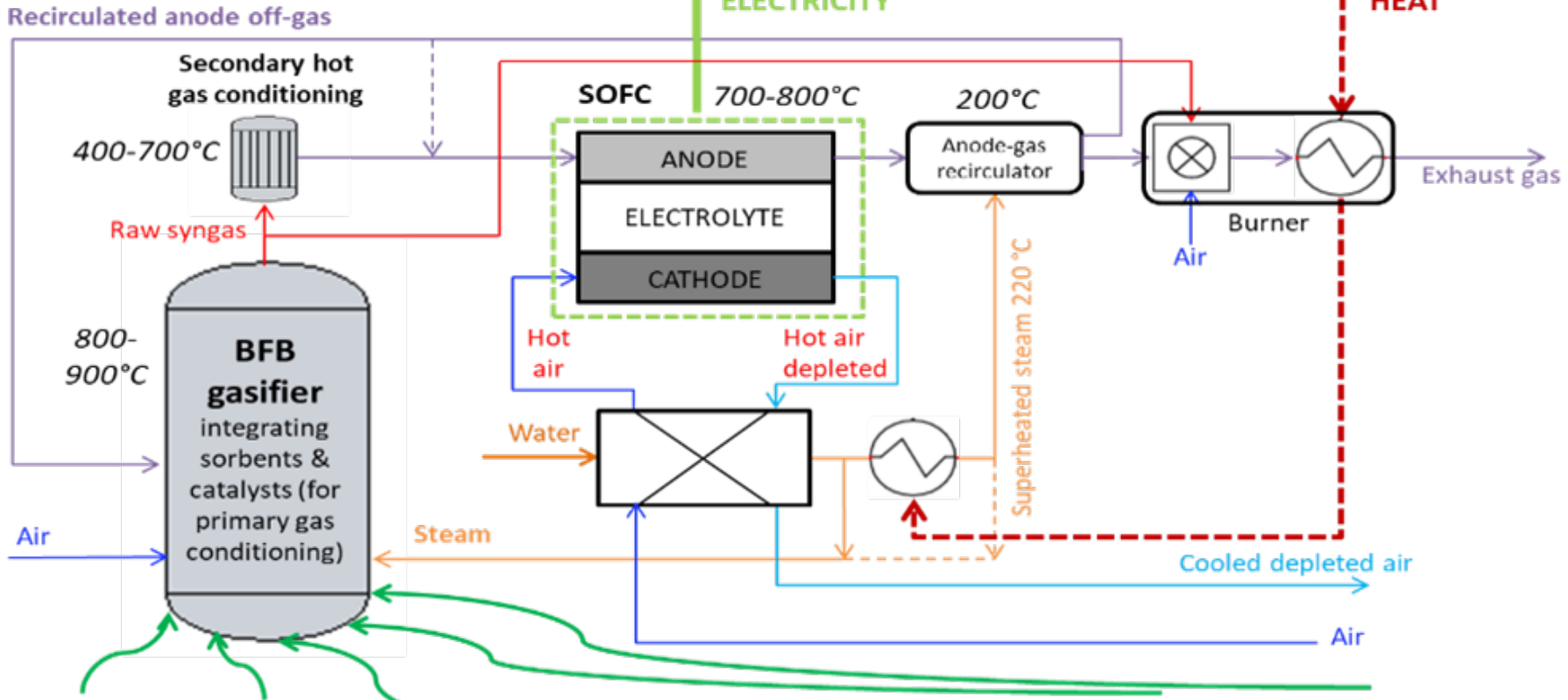
- overall 90% (versus 65%, target SET-PLAN 75%) and electrical 50% (versus 25%, target SET-PLAN >30%) CHP efficiencies for small and medium scale biomass CHP
- near-zero gaseous and PM emissions as well as CAPEX below 4,000 €/kWe (versus the actual 5,000-10,000 €/kWe), and OPEX of ≈ 0.05 €/kWe (using low cost biomass, i.e. < 80 €/t, respect to the actual greater than 0.10 €/kWe)
- electricity production cost below 0.10 €/kWh (versus the actual 0.22 €/kWh, SET-PLAN target of 20% cost reduction by 2020, and 50% by 2030).



BLAZE



Flexible electricity supply and heat integration with agro, industrial or buildings



Low cost woody e.g. pruning waste

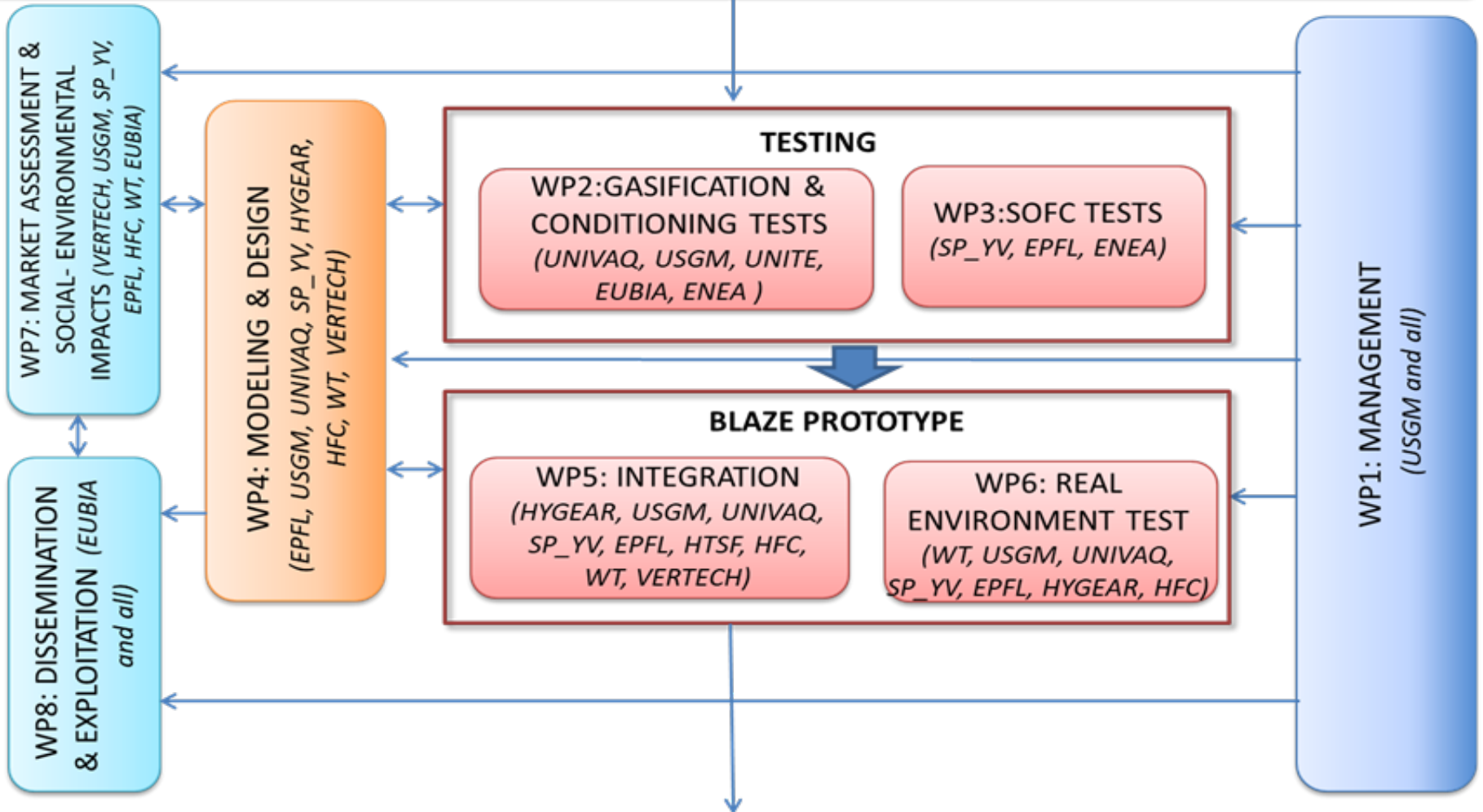
Industry waste (timber/food/distillation)

OFMSW

Digestate



Objectives: to develop Biomass, Low cost, Advanced and Zero Emission small-medium scale CHP plant «BLAZE»

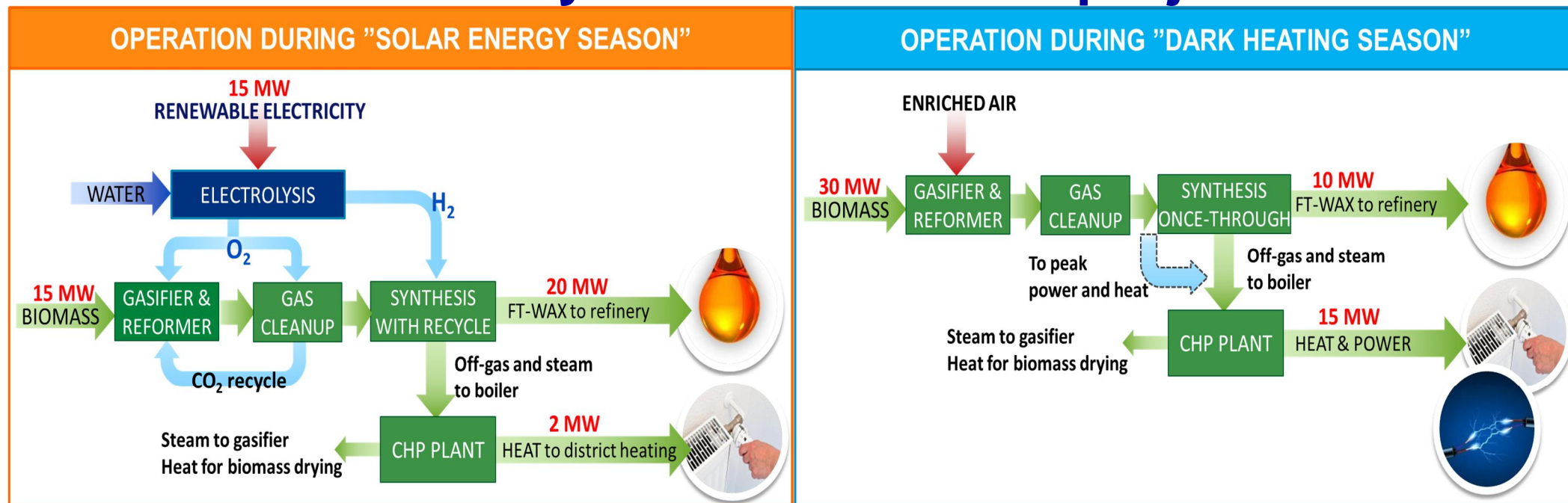


Results: Breakthrough in the cost reduction and performance increase of biomass small and medium CHP



FLEXCHX: Flexible combined production of power, heat and transport fuels from renewable energy sources

The key idea of FLEXCHX project



The **vision** is to realise a process for optimal use of the seasonal solar energy supply and available biomass resources to satisfy the seasonal demand for heat and power, and to simultaneously produce low-GHG fuels for the transport sector.

Project Acronym: FLEXCHX Project Number: 763919 Call: H2020-LCE-2017-RES-RIA
Topic: Developing the next generation technologies of renewable electricity heating/cooling
Project title: Flexible combined production of power, heat and transport fuels from renewable energy sources

Main Category of the Project: RIA project in the 'Biomass, Biofuels & Alternative Fuels' field

TRL: 3-4 to TLR 5

Keywords: Gasification, electrolysis, synthesis, transport fuels, heat and power

Technological approach of the Project: To develop a flexible and integrated hybrid process, which combines electrolysis of water with gasification of biomass and catalytic liquefaction. This process produces heat, power and an intermediate energy carrier (FT wax) which can be refined to transportation fuels using existing oil refining equipment.

Expected Impact of the Project: To develop a process concept that will enable flexible co-generation of heat, power and 2nd generation biofuels in the small-to-medium size range (5-50 MW biomass and 0-30 MW electricity input) using various low-cost feedstocks and also excess electricity during the sunny season

Highlights (technological/non-technological): An innovative staged fixed-bed gasifier followed by hot filtration and catalytic reforming is developed at 1 MW pilot plant at VTT. A slip stream of syngas is cleaned and utilized in the Fischer-Tropsch reactor of Ineratec. Integrated operation is validated with various biomass feedstocks. First gasification tests are being carried out in May-September 2019, while final validation test for the complete process are scheduled for 2020.

What is needed in future: The key enabling technologies will be developed and validated to TRL5 enabling follow-on demonstration activities, which are already preliminarily planned in the project.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 763919

Project objectives

- **Development of a new innovative, highly efficient and equal-zero-emission medium-scale biomass CHP technology (1 to 10 MW total output) based on**
 - a fixed-bed updraft gasifier with an integrated partial oxidation stage for tar reduction
 - a novel compact high temperature gas cleaning unit for S and Cl removal and tar reforming within one reactor and
 - a solid oxide fuel cell (SOFC)
- **Targeted efficiencies: gross electric efficiency >40% and overall efficiency >90%**

Project status

- **System design and development/design of the single components finalized**
- **Construction of a first testing plant completed (based on a gasifier with 400 kW_{NCV} fuel power)**
- **Preliminary market studies, techno-economic analyses, risk and impact assessments, which shall support the further technology development, completed**

Project Acronym: **HiEff-BioPower**

Project Number: **727330**

Call: H2020-LCE-2016-2017

Topic: LCE-07-2016-2017

Project title: **Development of a new highly efficient and fuel flexible CHP technology based on fixed-bed updraft biomass gasification and a SOFC**

Main Category of the Project: CHP

TRL: 5 (at project end)

Keywords: Biomass, SOFC, CHP, fuel flexibility

Technological approach of the Project: Development of a new highly efficient biomass CHP technology consisting of a gasifier, a newly developed tar reforming unit, a novel compact gas cleaning system and a solid oxide fuel cell (SOFC) for a capacity range of 1-10 MW (total energy output). Within the project a testing plant consisting of a gasifier (400 kW fuel power), a gas cleaning unit and a side stream 6 kW_{el} SOFC system is developed, tested and stepwisely improved. The R&D work covers modelling as well as experiments.

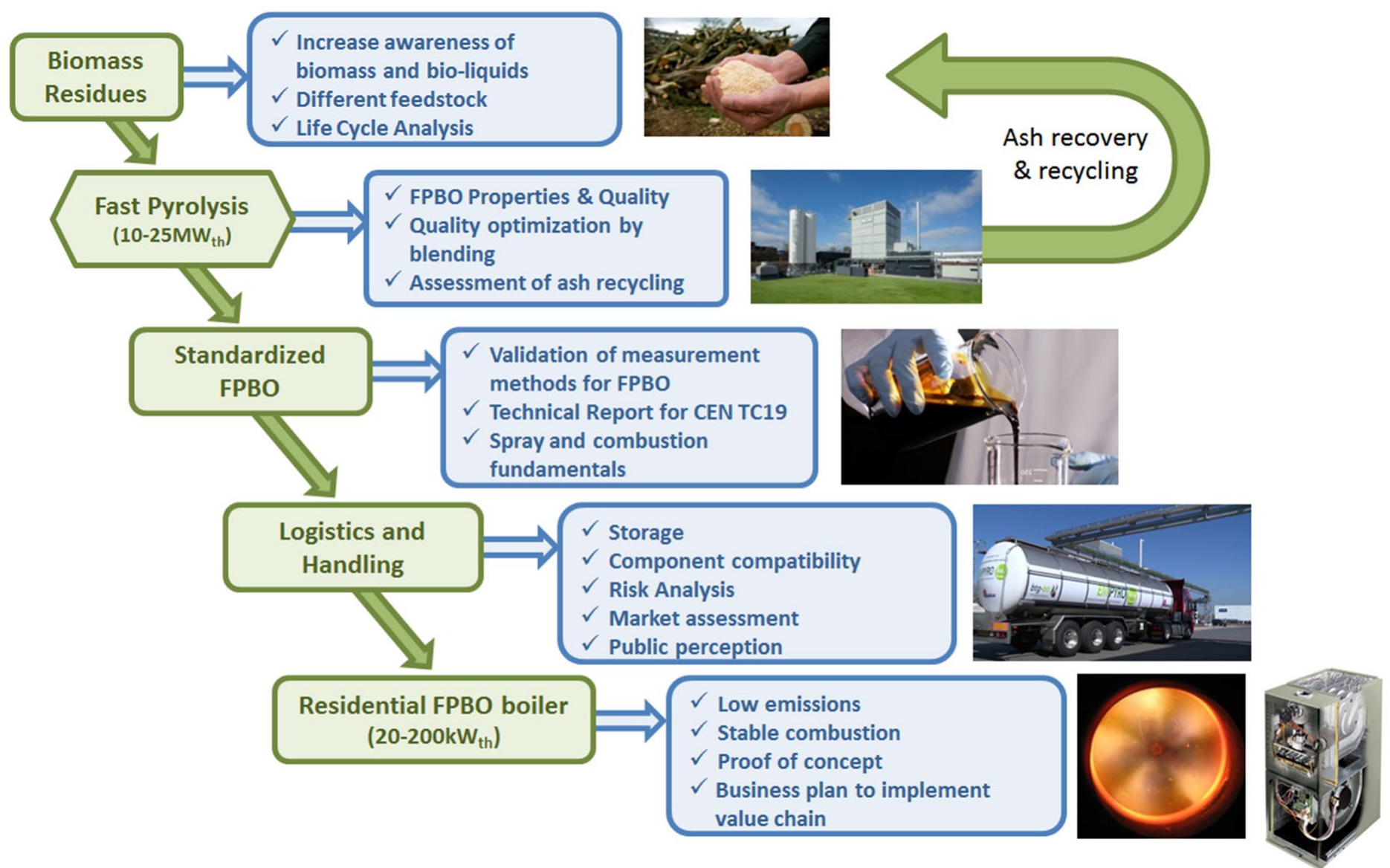
Expected Impact of the Project: Significantly increased technology performance and reduced life-cycle environmental impact; extended technology leadership of European companies and R&D institutions; contribution to strengthening the European industrial technology base; contribution to solving the global climate and energy challenges.

Highlights (technological/non-technological): Presently the first testing plant of the new CHP technology is in the start-up phase

What is needed in future: Appropriate support schemes to support the further technology development of the technology from TRL 5 at project end towards market implementation; policies which promote the application of renewable energy based CHP technologies



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No **727330**



Project partners:



Project Acronym: **Residue2Heat** Project Number: **654650** Call: **LCE-2-2015**
Topic: **Developing the next generation technologies of renewable electricity and heating/cooling**

Project title: **Renewable Residential Heating with Fast Pyrolysis Bio-Oil**

Main Category of the Project: Heating and Cooling

TRL: TRL3 -> TRL5

Keywords: Pyrolysis oil, Residential Heating, Ash recovery and recycling, Standardization

Technological approach of the Project: FPBO will be produced from biomass feedstocks. For each supply chain, a sustainability analysis has been carried out. The development of an efficient small scale FPBO residential heating boiler requires a better fundamental understanding of FPBO combustion. High efficiencies (class A) will be achieved with a full condensing boiler.

Expected Impact of the Project: The Residue2Heat project includes the Integration of new knowledge on the combustion of FPBO in residential scale heaters between research institutes and manufacturing industry. With this new knowledge, innovative heating systems are developed. This will enhance innovation capacity, thus strengthening the competitiveness and growth of the European industry.

Highlights (technological/non-technological): Stable combustion of FPBO in a residential heating system without pilot flame. Technical report for standardization ready for publication. Potential for ash recycling and recovery has been shown

What is needed in future: Uniform fuel definition across Europe, clear pathway for industry wrt new fuels



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654650