

DELIVERABLE REPORT



FLEXCHX

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

Call: H2020-LCE-2017-RES-RIA- TwoStage
Topic: Developing the next generation technologies of renewable electricity heating/cooling
Grant agreement No: 763919
Start date: 01.03.2018 Duration: 36 Months
Project Coordinator: VTT Technical Research Centre of Finland Ltd

WP No: 9
Task No: 9.1
Deliverable No: D9.4
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Lead beneficiary: VTT
Dissemination level: Public

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Acceptance

Name, Company	DD/MM/2018
Esa Kurkela, VTT (Coordinator)	26/04/2018

History of changes

1.0	26/04/2018
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Distribution

26/04/2018	FLEXCHX Share Point workplace
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Table of acronyms

WP	Work package
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Table of Contents

1	Short summary.....	4
2	Introduction	5
3	FLEXCHX website.....	5
3.1	Domain and technical specification	5
3.2	Website structure	5
4	Conclusions.....	12



1 Short summary

This document provides a summary of the structure and functionalities of the website developed for the FLEXCHX project. The details of the website management system and tools are provided. The website will be continuously updated with project news, events and publications and it will be one important channel for communications and disseminations.



2 Introduction

As a part of one important channel for communications and dissemination activities a website for the FLEXCHX project is established. The FLEXCHX website gives information about the project to the public quickly and easily. The content will expand as the project develops and the website will be continuously updated with project news and events.

3 FLEXCHX website

3.1 Domain and technical specification

The website is available at www.flexchx.eu. The Basic structure of the site is designed in collaboration with VTT Communications. The website will be in operation from month 2 and VTT, with the help of all participants, will be responsible for establishing the website.

All public information about FLEXCHX project will be published in the website. The site will not include a private section since the project participants will use FLEXCHX SharePoint workplace to collaborate and disseminate confidential materials and information.

3.2 Website structure

The FLEXCHX website is structured into seven main sections:

- Home
- About
- Work Plan
- Consortium
- News & Events
- Downloads
- Contact

Home page includes brief description of the project: the vision and the project summary are both included.

About section contains project objectives. The right column is occupied by short key information about the project including e.g. acronym, coordinator, duration, EU contribution and type of action.

The Work Plan section gives a brief description of each work packages including the names of WP leaders.

The Consortium section provides information of the participants involved in the project as well as links to their websites.

News & Events section includes all events and meeting which will take place within the lifetime of FLEXCHX project.

Downloads section contains publishable materials such as public Deliverables, Newsletters, Publications and Posters & Brochures.

Contact information, the project coordinator, is presented in the Contact section.

Figures 1-7 show the screenshots of all main pages of the FLEXCHX website.



HOME ABOUT WORK PLAN CONSORTIUM NEWS & EVENTS DOWNLOADS CONTACT

FLEXCHX

FLEXIBLE COMBINED PRODUCTION OF POWER, HEAT AND TRANSPORT FUELS FROM RENEWABLE ENERGY SOURCES

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.

The project summary

Seasonal solar energy potential and the need for heat and power do not match in Northern and Central European conditions. Consequently, large investments are needed for storing solar energy from summer season to dark winter time. The widely available combined heat and power plants and heating networks should be utilized effectively also in the future energy system. In addition to these challenges, decarbonization of the transport sector requires massive production of renewable fuels especially for the heavy duty sector.

FLEXCHX project is aiming to present a cost-effective solution to tackle these challenges of the new European energy mix. Principal ideas are:

- A hybrid process that integrates electrolysis to biomass gasification and synthesis is developed and the key enabling technologies of this process are validated to reach TRL5.
- In summer season renewable fuel intermediate (FT-wax) is produced from biomass carbon boosted with solar energy driven electrolysis. A small amount of by-product heat is also produced to cover the summer-time demand for district heating. Biomass consumption is halved compared to the wintertime operation and 50% of the input energy comes from low-cost excess electricity.
- In winter season the plant is operated without the electrolyzer in a way that biomass conversion to liquid fuel intermediate, heat and electricity is maximized.
- Most of the invested plant components are in full use throughout the year, only the electrolysis unit is operated seasonally.

Behind FLEXCHX there is a multi-national consortium composed of RTD organizations, industry and SMEs representing the entire value chain. The RTD partners have excellent synergistic competences, while the industrial partners represent lead industries covering the complete value chain from biomass gasification, gas cleaning and fuel synthesis component and plant manufacturers to service providers and end-users.

OPERATION DURING "SOLAR ENERGY SEASON"

OPERATION DURING "DARK HEATING SEASON"

Figure 1. HOME page of FLEXCHX website.



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FLEXCHX

About project

Objectives

- To develop an integrated production concept for heat, power and transport fuels utilizing biomass/waste and excess renewable electricity to meet the following performance and production cost targets:
 - In dark winter season, over 85 % thermal conversion efficiency to fuel intermediates, heat and power is achieved using biomass as the only energy source for the process.
 - In solar energy season, the fuel production is doubled (and biomass consumption halved) by using a maximum amount of electrolytic hydrogen. The energy conversion efficiency is > 85 % (biomass + electricity to FT products).
 - In addition to balancing out the seasonal variation in energy supply and demand, the process is capable of managing the energy system fluctuations on an hourly and daily basis.
 - The distributed co-production of heat and FT wax will more than double the revenues of the local producer and introduce a renewable intermediate feedstock to centralized refining plant at a cost of < 80 €/MWh.
- To develop and validate (to TRL5) the key enabling technologies required for realizing the FLEXCHX process:
 - A novel two-stage fixed-bed gasifier will be developed and tested at the 1 MW scale with the most potential biomass residues and waste-derived feedstocks.
 - Robust and reliable hot gas filtration and catalytic tar removal will be developed and validated with the full gas flow of the 1 MW pilot. This will be demonstrated both under steam reforming and dry reforming conditions, which simulate the two basic (summer/winter) operation modes of the process.
 - A cost-effective and robust final gas cleaning process will be designed to ensure that the final gas meets the purity requirements set by the FT synthesis.
 - FT synthesis operation will be demonstrated under both operation modes (once-through vs. with recycle).
 - The key elements of operational flexibility will be validated: 1) process operated with and without additional feeding of H₂ and gas composition in the gasifier is adjusted by CO₂ feeding, 2) gasifier/reformer operated with different levels of oxygen purity, 3) synthesis gas boosting with additional H₂ and recycling of synthesis off-gases back to the reformer simulated.
- To design and evaluate an optimal introduction of the intermediate hydrocarbon feed (FT wax) from several distributed biomass gasification/electrolysis units to a centralized large-scale refinery in order to meet the target production cost of renewable transport fuels 80-100 €/MWh or drop-in liquid fuel.
- To produce a techno-economic map of Europe for the specific CHP applications with respect to location, scale and total volume, where implementation of the FLEXCHX technology gives the best economic along the value chain of renewable heating and cooling, taking into account also the social and environmental aspects from a full life cycle analysis (LCA) perspective.
- To present a road map for follow-on demonstration and industrial deployment taking into consideration regional socio-economic-political landscapes.

FLEXCHX-project is organized in nine work packages. [Read more here >](#)

FLEXCHX - the conceptual idea of distributed production of heat, power and bio-FT products combined with centralized refining to high-quality transportation fuels.

Project acronym: FLEXCHX
Coordinator: Esa Karkiela, VTT Technical Research Centre of Finland Ltd
EU contribution: 4 489 545 €
Duration: March 2018 - February 2021, 3 years
Type of action: Research and innovation
Topic: Developing the next generation technologies renewable electricity and heating/cooling
FLEXCHX-project is organized in nine work packages. [Read more here >](#)

Horizon 2020
This project has received funding from the European Union's Horizon 2020 research and innovation Programme under Grant Agreement No 769939.

Figure 2. ABOUT page of FLEXCHX website.



HOME ABOUT WORK PLAN CONSORTIUM NEWS & EVENTS DOWNLOADS CONTACT

FLEXCHX

Work plan

FLEXCHX-project is organized in nine work packages:

- WP1 Coordination and Management (lead VTT, Etsä Kurkela)
- WP2 Concept development (lead ENG, Raifed Lukosevicius)
- WP3 Gasification and raw gas cleaning (lead VTT, Sanna Tuomi)
- WP4 Reforming and final syngas cleaning (lead JMI, Andrew Steele)
- WP5 Flexible FT synthesis (lead IT, Tim Boettler)
- WP6 Validation of the key enabling technologies (lead VTT, Ilkka Hiltunen)
- WP7 Integration of FT products to refineries (lead NES, Outi Ervasti)
- WP8 Techno-economic & environmental assessment of the process concepts (lead DLR, Ralph-Uwe Dietrich)
- WP9 Dissemination and Exploitation (lead VTT, Minne Kurkela)

WP1 is focused on the management and coordination actions and to ensure realization of the FLEXCHX project goals with the technical and financial quality level and timing.

In WP2, the available feedstock sources will be evaluated, the feasibility of different electrolytic technologies are assessed and the CHP markets are analysed in order to define the surrounding conditions and requirements for the FLEXCHX technology.

WPs 3, 4 and 5 are technical development work packages, where the new key enabling technologies are developed by carrying out experimental R&D at laboratory, bench-scale and pilot-scale test facilities.

In WP6, the key front-end technologies, gasifier, filtration unit and the catalytic reformer are validated in full gas flow of the 1 MW pilot gasifier. The simplified final gas cleaning process and the compact FT process are connected to a pilotstream of this gasifier to carry out validation tests also for these process stages.

WP7 is focused on the back-end of the process and the aim is to define optimal ways for using the FT products in final refineries creating a maximal value for this renewable intermediate product.

In WP8, the technical, economic and environmental feasibility of the systems will be evaluated, which also includes sustainability studies.

Health, safety and environmental issues and technical risks related to follow-on industrial plants are evaluated in the process validation WP6, while the business risks are assessed in WP7 and WP8.

WP9 is the project Dissemination and Exploitation work package.

FLEXCHX overall approach and activities:

Click to image to enlarge.

FLEXCHX - work packages and their interdependencies.

Figure 3. WORK PLAN page of FLEXCHX website.



HOME ABOUT WORK PLAN CONSORTIUM NEWS & EVENTS DOWNLOADS CONTACT

FLEXCHX

Consortium

The consortium consists of 10 partners, three of which are major research institutes (VTT, LEI and DLR), 5 large enterprises (ENS, HELEN, KE, NES and JM) and 2 SMEs (GRM, IT).

VTT

VTT Technical Research Centre of Finland Ltd, Finland [VTT] Finland

VTT is the largest internationally networked R&D Centre for applied research in Northern Europe, harnessing high technology to develop scientific solutions for sustainable development and creating new business opportunities. In the research areas of sustainable energy and chemical technologies, VTT is supporting the development of the business sector in a time of structural change towards circular economies. VTT provides customers with research, development and piloting services. VTT has experience in coordinating and participating in numerous national and EU funded projects in the field of gasification, pyrolysis and catalytic processes.

Role in FLEXCHX: VTT will hold the position of Project Coordinator and is responsible for the WP3, WP6 and WP9.

Visit Website:
VTT Biofuel Pilot Centre www.vttresearch.com/biofuel-pilot-centre
VTT Research www.vttresearch.com

ENERSTENA

UAB Enerstena, Lithuania (ENS)

Enerstena is one of the largest energy companies in the Baltic region and is well-known as a developer, manufacturer and installer of biomass combustion technologies. The company has been operating in the energy market since 2002. Enerstena is the main enterprise of Enerstena Group, which nowadays comprises six engineering, manufacturing, sales and project management companies and four representatives in foreign countries. Enerstena Group has activities covering the path from idea to the key turn – research, development, design, automation, manufacturing, sales, project management, maintenance and operation. The mission is to develop and produce effective, reliable, sustainable green thermal and power energy systems.

Role in FLEXCHX: Enerstena will lead the activities of WP2 and participate in the work of WP3, WP4, WP5 and WP9.

Visit Website: www.enerstena.eu

INERATEC

INERATEC, Germany (IT)

INERATEC integrates compact chemical plants in containers. Fischer-Tropsch fuels and chemical materials are produced efficiently from various gases. INERATEC offers compact chemical systems for Gas-to-Liquid, Power-to-Liquid and Power-to-Gas processes. Innovative chemical reactor technology converts gases into liquid Fischer-Tropsch (FT) fuels or valuable chemical products. With innovative manufacturing methods and intelligent design, INERATEC has developed a technology platform based on compact microstructured chemical reactors. The compact reactors enable the integration of the entire chemical plant in transportable containers. The compact reactor technology allows dynamic, safe and efficient operation of highly exothermic and endothermic chemical reactions, such as Fischer-Tropsch synthesis. Significant competitive advantages arise on a decentralized scale. INERATEC's services range from engineering, construction, commissioning and maintenance of the units.

Role in FLEXCHX: INERATEC is the leader of WP3 and participate activities of WP2, WP6, WP7 and WP9.

Visit Website: www.inerotec.de

DLR Aerospace Center

Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany (DLR)

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. Research efforts of the Institute of Engineering Thermodynamics (DLR-IT) are focused on efficient energy conversion and storage with low environmental impact, and on the improvement and acceleration of the use of renewable energy sources. The scientific spectrum includes electrochemical, thermochemical and thermal energy technologies covering the full range from functional materials, development and design of components to system integration. These activities are accompanied by systems analysis to evaluate the associated technological, environmental and economic potential in a larger context of future energy systems.

Role in FLEXCHX: DLR is the leader of WP8 and participates in WP2 and WP9.

Visit Website: www.dlr.de









	<p>HELEN, Finland (HELEN)</p> <p>HELEN Limited operates as an energy company, owned by the City of Helsinki. The Company produces electric energy through natural gas, coal, nuclear power and renewable energy sources, as well as transmits and distributes to customers in the city of Helsinki. Energy is produced in the power and heating plants located in Helsinki. HELEN's goal is to develop renewable energy production and customer-oriented services and to secure competitiveness of operations in a challenging market situation. The most significant strategic policy with respect to the development of Helen's energy production structure is to produce energy in a carbon-neutral way by the year 2030. Helen aims to make progressive investments in reducing emissions and increasing renewable energy, and to make use of all the opportunities offered by new technologies.</p> <p>Role in FLEXCHX: HELEN participates in WP2, WP8 and WP9.</p> <p>Visit Website: www.helen.fi</p>
	<p>Lithuanian Energy Institute, Lithuania (LEI)</p> <p>Lithuanian Energy Institute is a state scientific research organization with about 300 employees. The strategic mission of LEI is to plan and carry out long-term fundamental and applied research activities, as well as experimental and development tasks, mainly through international cooperation projects devoted to energy and environmental issues that could represent a major advance for the nation, its society and its industrial and service system.</p> <p>Role in FLEXCHX: LEI participates activities in WP2, WP3, WP8 and WP9.</p> <p>Visit Website: www.lei.lt</p>
	<p>Kauno Energija AB, Lithuania (KE)</p> <p>The main activities of AB Kauno energija is heat and hot water supply, heat generation and distribution, maintenance of manifolds. The Company covers a major part of heat production and supply market in the cities of Kaunas and Jurbarkas and Kaunas district (Lithuania). Total installed heat generation capacity is 587 MW.</p> <p>Role in FLEXCHX: KE participates in WP2, WP8 and WP9.</p> <p>Visit Website: www.kaunoenergija.lt</p>
	<p>Neste Engineering Solutions, Finland (NES)</p> <p>Neste is a preferred solution provider of high-quality technology, engineering and project services for a wide range of industries in the fields of oil and gas, petrochemicals, chemicals, biorefining, biochemicals, biopharma and industrial infrastructure. The company has 60 years of experience in technology development and industrial investment projects as well as maintenance and performance improvement in Europe, North and South America, Asia and the Middle East. Neste is among the world's leading biorefining engineering and consulting company. The company has had a key role in the design and execution of Neste biorefinery projects in Finland, the Netherlands and Singapore.</p> <p>Role in FLEXCHX: NESTE will lead WP7 and participates in WP2, WP4, WP8 and WP9.</p> <p>Visit Website: www.neste.com</p>
	<p>Johnson Matthey, UK (JM)</p> <p>Johnson Matthey is a UK based speciality chemicals company focused on its core skills in catalysis, precious metals, fine chemicals and process technology. The company employs around 13000 people worldwide located in over 30 countries; around 10% of those work in an R&D function.</p> <p>Johnson Matthey's principal activities are the manufacture of autocatalysts, heavy duty diesel catalysts and pollution control systems, catalysts and components for fuel cells, catalysts and technologies for chemical processes, fine chemicals, chemical catalysts and active pharmaceutical ingredients and the marketing, refining, and fabrication of precious metals. Developing products that have a direct environmental benefit is a key part of the company's growth strategy. The main emerging environmental opportunities are seen to be in clean air, efficient natural resources and health.</p> <p>Role in FLEXCHX: JM will lead WP4 and participates in WP2, WP6, and WP9.</p> <p>Visit Website: www.matthey.com</p>
	<p>Oy Brynolf Grönmark AB, Finland (GRM)</p> <p>Grönmark is a private owned SME company, established in 1914. Grönmark is a strategic partner and a solution provider connecting world-class manufacturers and Finnish industry. Grönmark engages in active product development together with appliance and material manufacturers and customers. As a traditional Finnish family business, Grönmark takes a long-term view on issues and is aware of responsibility towards the environment and society. Grönmark is representing BKN Sinter Metals GmbH from Germany. BKN has developed a new type of filter media for high temperature applications.</p> <p>Role in FLEXCHX: GRM participates in WP3, WP6 and WP9.</p> <p>Visit Website: www.gronmark.fi</p>

Figure 4. CONSORTIUM page of FLEXCHX website.

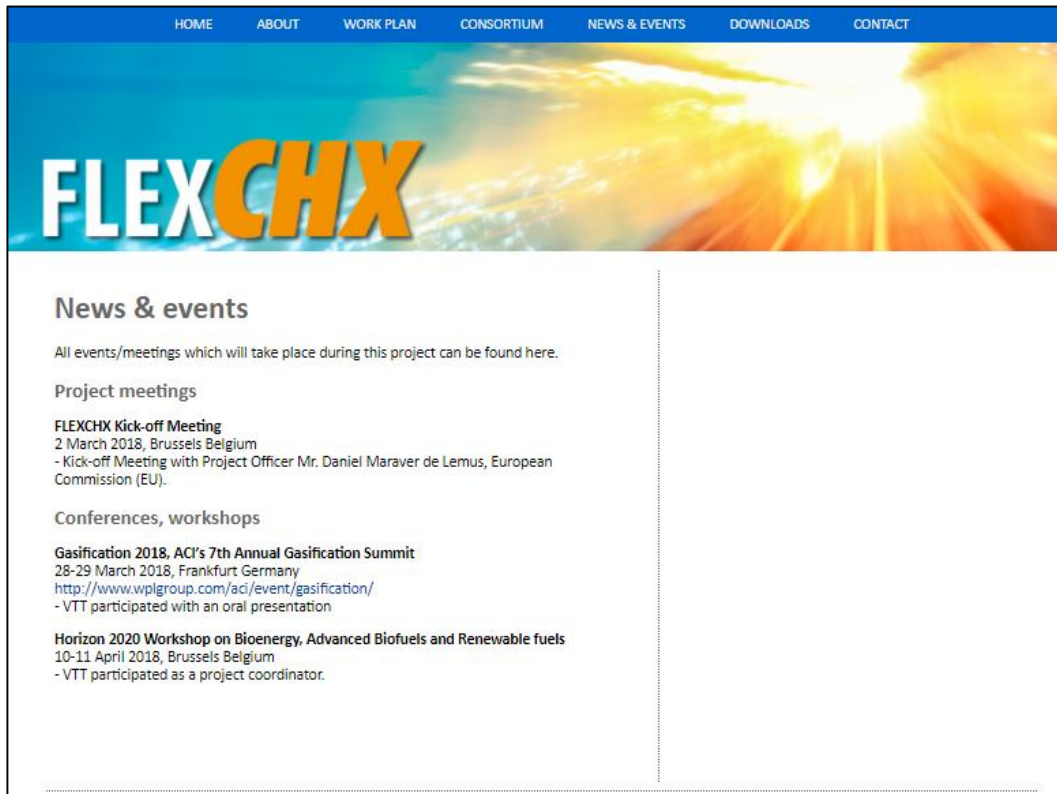


Figure 5. NEWS & EVENST page of FLEXCHX website.



Figure 6. DOWNLOADS page of FLEXCHX website.

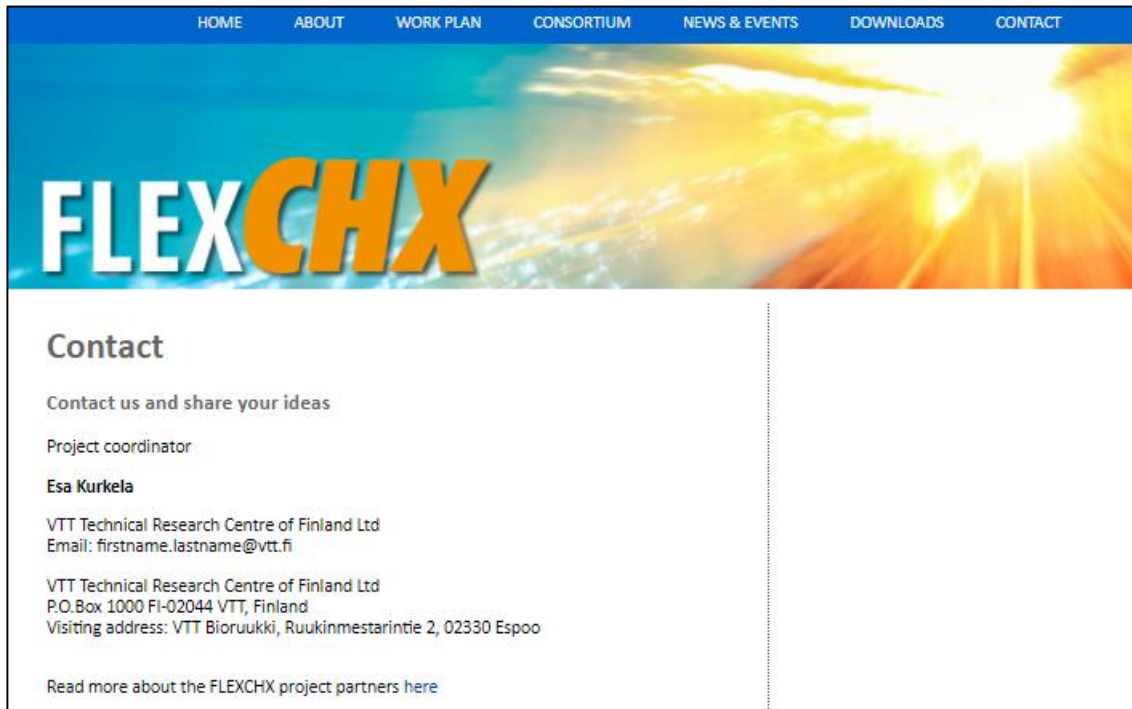


Figure 7. CONTACT page of FLEXCHX website.

4 Conclusions

The website of the FLEXCHX project has been created and it is accessible at www.flexchx.eu. It contains public section which will be continuously updated as the project advances.