FINLAND BEST PRACTICES

of industries with RES

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Low-carbon economy

RESINDUSTRY
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1. CONCEPT FOR A CARBON NEUTRAL GROCERY STORE

1. General information	
Title of the practice	**Concept for a carbon-neutral grocery store**
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	LAB University of Applied Sciences	
Geographical scope of the practice	*Select National/Regional/Local* regional	
Location of the practice	Country	*Drop-down list* Finland
	Region	*Drop-down list* Päijät-Häme
	City	*Drop-down list* Lahti
Keywords related to your practice	climate change, carbon emissions, renewable energy, solar energy	
Upload image		

2. Author contact information	
[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard] [Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organizational profile in the Interreg Europe community will be linked to it.]	
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Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	*[160 characters]* Since the beginning of 2017, all electricity purchased by Kesko group in Finland is renewable. Part of the energy is produced by the solar energy built into K-Group's properties.

Detailed information on the practice	*[1500 characters] Please provide information on the practice itself. In particular:* 1. *What is the problem addressed and the context which triggered the introduction of the practice?* 2. *Please briefly technically describe the practice. Also state the motivation of the owner for the installation and the decision process.* 3. *How does the practice reach its objectives and how it is implemented?* 4. *Who are the main stakeholders and beneficiaries of the practice?* 1. Objective: carbon-neutral food store. Food stores and food warehouses consume a lot of electricity in refrigeration. K-Group accounts for approximately 1% of all electricity consumed in Finland. Transfer to renewable electricity supports the K-Group's commitment to the Paris Climate Agreement's targets and the UN Sustainable Development Goal 'Affordable and clean energy' and Goal 'Climate action'. K-Group with Granlund has developed an energy recycling model that can reduce heat consumption by as much as 95%, turning a property almost carbon-neutral in terms of energy. The energy recycling system combines a very low-emission refrigeration system that uses natural refrigerants, a heat pump and recovery systems for energy recycling. It utilizes the condensation heat of cooling in heating the property. The innovation can reduce a property's heat consumption by 90%, making a store almost carbon-neutral. 2. From 2016. K-Group has significantly increased its production and use of solar power. In 2016, Finland's biggest rooftop solar power plant was completed on the rooftop of K-Citymarket Tammisto, Helsinki. By summer 2017, K-Group had four even bigger solar power plants than Tammisto and there will be as many as 16 solar power plants operating on the rooftops of stores. The investments make K-Group Finland's biggest producer and user of solar power. Currently, K-Group in Finland has 34 solar power plants totalling 12 MW. 3. For the fifth year in a row, Kesko ranks as the most sustainable trading sector company in the world on the Global 100 list. Kesko has committed to goals of international climate summits and set ambitious emission targets for its operations and supply chain. All electricity bought by Kesko in Finland for Kesko properties is from renewable sources, and K-Group is the biggest producer and user of solar power in Finland. 4. Stakeholders include the stores, manufacturers and the electric grid as there is potential to sell electricity into the grid as well.
Resources needed	*Estimated 20 % of project costs covered by Business Finland energy aid. Systems require some maintenance staff.*
Resources used	Business Finland energiatuki (Energy aid). Energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions. Aid is paid as a percentage of project costs depending on the type of system. For solar power, aid is usually 20 %.
Policy instrument used	
Total project costs (EUR)	NA (Estimated 10 Million Euros total based on public funding)
Net present value of the investment (EUR)	NA

Internal rate of return on investment (%)	NA
Payback period (y)	NA
Lending rate (%)	NA
Timescale (start/end date)	2016 – 2025 (Fully carbon-neutral goal)
Installed capacity (kW)	12 000
Fraction of renewable energy consumed (%)	100
Investment costs per installed kW (EUR/kW)	*NA*
RES type used	Purchased electricity is produced via the bioenergy, solar and wind. The renewable energy produced in stores is produced via solar panel solutions.
Evidence of success (results achieved)	*[500 characters] Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results).* Combined with energy savings from Granlund´s heat recovery system, a store can be turned fully carbon-neutral in practice.
Challenges encountered (optional)	*The ability of roofs to be able to hold up the weight of solar panels varies due to old preexisting buildings not having been designed with solar panels in mind. The strength of roofs has to be considered when building rooftop solar.*
Potential for learning or transfer	*[1000 characters] Please explain why you consider this practice (or some aspects of this practice) as being potentially interesting for other regions to learn from. This can be done e.g. through information on key success factors for a transfer or on, factors that can hamper a transfer. Information on transfer(s) that already took place can also be provided (if possible, specify the country, the region – NUTS 2 – and organization to which the practice was transferred)* *[Technical: A good practice be edited throughout a project life time (e.g. to add information on the transfers that have occurred)]* The potential to use practice like this is even greater the further south one goes as the usefulness of solar panels increases in warmer countries.
Further information	*https://www.kesko.fi/media/uutiset-ja-tiedotteet/porssitiedotteet/2020/keskon-vuosiraportti-2019-on-julkaistu/*

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*3*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*3*
Replication possibility	*Please clarify how can this practice be replicated.*	*2*

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2. BIOFUEL PRODUCTION FROM FOOD INDUSTRY RESIDUES

1. General information	
Title of the practice	**Biofuel production from food industry residues**
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Select National/Regional/Local* regional	
Location of the practice	Country	*Drop-down list* Finland
	Region	*Drop-down list* Päijät-Häme
	City	*Drop-down list* Lahti
Keywords related to your practice	biofuel, bioethanol, renewable energy sources, food industry, resource efficiency	
Upload image		

2. Author contact information	
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Email	*paavo.lahteenaro@lab.fi*
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Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	Biofuel produced from food industry process residues producing renewable energy

Detailed information on the practice	*Please provide information on the practice itself. In particular:* 5. *What is the problem addressed and the context which triggered the introduction of the practice?* 6. *Please briefly technically describe the practice. Also state the motivation of the owner for the installation and the decision process.* 7. *How does the practice reach its objectives and how it is implemented?* 8. *Who are the main stakeholders and beneficiaries of the practice?* The plant is a symbiosis of energy company St1 and beverage company Hartwall where residues from Hartwell's drinks manufacturing are used as material for bioethanol production. By locating the plants next to each other, the leftover yeast and other liquid waste containing sugar and alcohols can be directly pumped to the bioethanol plant, accounting for up to 40 % of the raw material required by the ethanol plant, with rest shipped from other locations. As part of the European Union's RES-directive, in Finland, fuel sold for transport must contain an aggregate percentage of biofuels, the obligation in 2020 being 20 %. This has led to the creation of various novel bioethanol production efforts in Finland, including many by St1. The plant's fermentation system uses a variety of waste biomass from failed beverage batches, yeast, leftover bread from stores and other waste from bakeries and biowaste from stores. Etanolix plants as a concept were born out of a desire to make bioethanol production more local moving it out of the third world and into Europe and not being dependent on food crops by using waste instead. The produced fuel is mixed into transport fuel and sold, making the stakeholders of the practice the transport sector as well as commuters. From the supply side, drinks manufacturers, bakeries and stores are all beneficiaries. The yeast leftover is also further processed into feed for pigs, making farmers another stakeholder group. Heat for the process is supplied from gas boilers of the Hartwall plant, which uses mixture of natural and biogas in the form of landfill gas which fills approximately 10 % of the energy demand of the brewery, biorefinery and district heating production of the total of 24 MW boiler capacity.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The plant in Lahti employs only 2 full-time operators and additionally a few other employees on an hourly basis. St1 shares its maintenance and laboratory functions between all seven of its bioethanol plants in Finland. The plant is operated remotely during nights and weekends as, during normal operation, no on-site crew is required at all.
Resources used	*Institutional / Structural EU funds (describe the program used) / Other* None
Policy instrument used	*State the name of the policy instrument and briefly sum up its specifications.*
Total project costs (EUR)	NA (Multiple million Euros)
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	NA
Payback period (y)	NA
Lending rate (%)	-
Timescale (start/end date)	1/2009-11/2009
Installed capacity (kW)	*Hard to quantify, energy for the refining is produced in boilers of the adjacent brewery.*
Fraction of renewable energy consumed (%)	10 % (biogas portion of the brewery energy use)

Investment costs per installed kW (EUR/kW)	*Review the total investment costs per installed kW of renewable energy source in euros per kW.*
RES type used	*biomass energy*
Evidence of success (results achieved)	*[500 characters] Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results).* The St1's Etanolix plant in Lahti is able to produce 1,3 million litres of bioethanol in a year. The cooperation of St1 and local food industries is a successful example of turning waste into valuable material. The Etanolix plant treats bio-based by-products of nearby industries, and thus reduces the amount of produced waste. Emissions of the fuel are reduced by 70 % compared to equivalent fossil fuels.
Challenges encountered (optional)	*The wide variety of raw material used by the plant creates challenges for production. The amount of quality of waste the plant receives varies temporarily which complicates optimization of the production process. On the other, this had led to a fast ability to react to changes in production. The plant has over the years proven to be small, with newer plants built currently being several times larger in production capacity offering better economy of scale. More biowaste is available than the plant is able to take.*
Potential for learning or transfer	*[1000 characters] Please explain why you consider this practice (or some aspects of this practice) as being potentially interesting for other regions to learn from. This can be done e.g. through information on key success factors for a transfer or on, factors that can hamper a transfer. Information on transfer(s) that already took place can also be provided (if possible, specify the country, the region – NUTS 2 – and organization to which the practice was transferred)* *[Technical: A good practice be edited throughout a project life time (e.g. to add information on the transfers that have occurred)]* A similar system could be implemented in other places with breweries and so it has much potential. The EU member states also must require fuel suppliers to supply a minimum of 14% energy consumed in road and rail transport by 2030 as renewables. the share of biogas and advanced biofuels, such as the bioethanol produced by St1 Etanolix plant, must increase to 1% by 2025 and 3.5% by 2030. Therefore, we can foresee potential for similar plants across Europe in order to fulfil this goal.
Further information	https://www.st1.com/about-st1/company-information/areas-operations/advanced-fuels-waste

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*2*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*3*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*2*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

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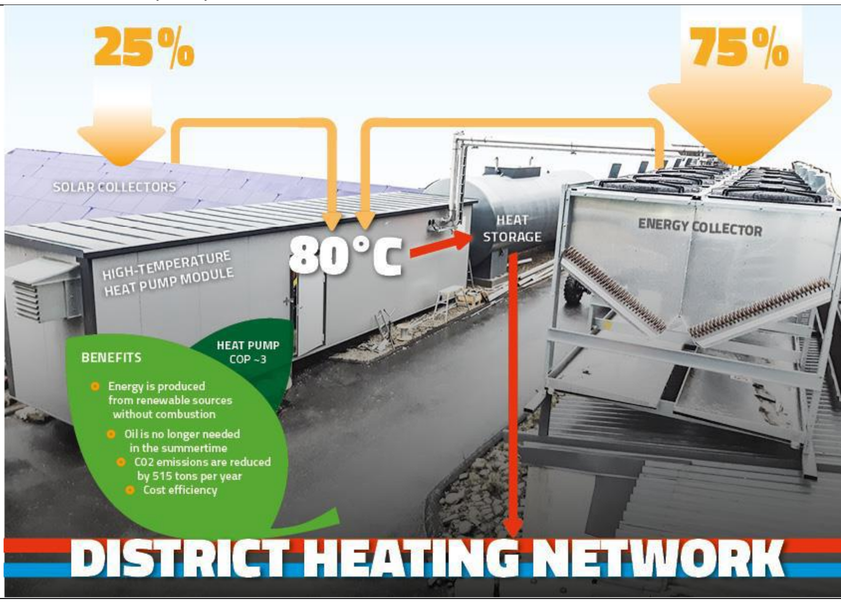
3. HYBRID SOLAR THERMAL AND AIR HEAT PUMP SYSTEM FOR DISTRICT HEATING

1. General information	
Title of the practice	Hybrid solar thermal and air heat pump system for district heating
Does this practice come from an Interreg Europe Project	**no**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Local*	
Location of the practice	Country	*Finland*
	Region	*Etelä-Karjala*
	City	*Puumala*
Keywords related to your practice	*Select existing keywords or add Solar power, renewable energy, heating, solar thermal, heat pump, low-carbon*	

Upload image



2. Author contact information	
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Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	A hybrid solar thermal and air heat pump system replaces oil fired boiler for producing district heating during low summer month loads.

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Detailed information on the practice	Suur-Savon Sähkö, a local energy company, had a problem with their biomass heating plant. The plant was covering the local district heating need in winter but the heating load in summer was so low that the large plant could not be run at such a low partial load. Therefore, in the summertime, the small heating load had to be covered by an older oil-fired boiler. To cover the small summertime load, a new hybrid solar thermal system was devised by Calefa Oy, a Päijät-Häme based energy efficiency systems provider, which uses panels that gather solar heat which is then used as a heat source for a heat pump. The heat pump is devised so that it can also use ambient air as a heat source and is fitted with a heat storage tank so that it continues to function with high efficiency even in the night-time when temperatures cool down and sun no longer shines. The main stakeholders of the project are the energy company, its customers and the municipality of Puumala, as well as, the local parish that donated the land on which the solar collectors are placed.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The system runs itself almost maintenance-free. Design and delivery by an external energy efficiency system turnkey solutions provider Calefa.
Resources used	Business Finland energy aid for novel energy systems totalling 170 000 €
Policy instrument used	Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions. The aid is paid as a percentage of project costs depending on the type of system. For new technology, the aid can be 30-40 %.
Total project costs (EUR)	650 000
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	7 %
Payback period (y)	Estimated originally 15 years but has proven in use to be less
Lending rate (%)	NA
Timescale (start/end date)	6/2019 – 11/2019
Installed capacity (kW)	500
Fraction of renewable energy consumed (%)	79%
Investment costs per installed kW (EUR/kW)	1300
RES type used	Solar power
Evidence of success (results achieved)	Oil use has reduced by 30 000 litres a year and CO2 emissions by 515 tons per year. The system has proven to work even in the wintertime if the weather is sunny.
Challenges encountered (optional)	*[300 characters] Please specify any challenges encountered/lessons learned during the implementation of the practice.* Placement of the solar collector field, due to lack of space around the previous heating plant. Eventually, the land was acquired for rent from cooperation with the local church. Having both design and delivery supplied by a single company, Calefa Oy, was proven vital for success in integrating machinery designed by multiple manufacturers.
Potential for learning or transfer	A system like this has the potential to work even better in countries with longer summers than in Finland. Addition of a heat pump makes solar

	thermal heating much more efficient and allows for higher temperatures to be achieved while still being very energy efficient. However, countries with better solar thermal potential also have less demand for heating. However, the company points out that the system would be even more efficient if coupled with a demand for cooling, which the heat pumps could supply simultaneously with heating. Also as the heat pumps benefit from cheap electricity, the system is well suited to exploit power-to-X, producing heat during periods of cheap electricity, which can also be stored in the heat storage, making it cheaper to run and increasing return on investment. Similar systems could be used for heating industrial processes by combining solar thermal collectors with heat pumps. New high-temperature heat pumps such as the one used in this plant open up much new potential for heat pump applications.
Further information	https://vuosikertomus.sssoy.fi/2019/liiketoiminta/energian-tuotanto

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*2*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*3*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*1*
Social influence	*Is there any social influence on the industry or the local municipality?*	*1*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

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4. BIOMASS HEATING PRODUCTION IN FOOD INDUSTRY

1. General information	
Title of the practice	**Biomass Heating Production in Food Industry**
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Select National/Regional/Local* regional	
Location of the practice	Country	*Drop-down list* Finland
	Region	*Drop-down list* Päijät-Häme
	City	*Drop-down list* Lahti
Keywords related to your practice	biomass, low-carbon, bioenergy	
Upload image		

2. Author contact information	
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Email	*paavo.lahteenaro@lab.fi*
Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	*[160 characters]* The biomass-fired heating facility from factory's own oat hull side streams.

Detailed information on the practice	Reducing emissions is a direct means of reducing the climate impacts of food production, and renewable energy plays an important role in cutting emissions. The Finnish bakery and confectionery Karl Fazer Oy (Fazer) are participating actively in the work to curb climate change and is investing in sustainable food production. Fazer's sustainability approach consists of four ambitious core goals by 2030: 50 % fewer emissions, 50 % less food waste, to be 100 % sustainably sourced and more plant based. Fazer together with Lahti Energia Oy (the regional energy company) is building a biomass-fired heating facility located directly in Fazer's factory area in Lahti. The facility will replace the previous natural gas-based heating, which has been getting increasingly expensive as taxes are raised on fossil fuels. The facility is expected to be ready in autumn 2020. Produced bioenergy (heat and process steam) will be used by the Fazer mill, bakery and rye crisp production lines as well as the new xylitol production facility, for heating the facilities and can also be used for heating the rest of the city by feeding heat into the district heating network. The fuel for the new heating facility will be derived from the production sidestreams in the factory area, mainly from the oat hulls which will be leftover following the Xylitol production process. Stakeholders for such project are the energy company, the factory, district heating customers and grain markets.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* Xylitol factory in total creates 30 new jobs.
Resources used	*Institutional / Structural EU funds (describe the program used) / Other* - *none*
Policy instrument used	*State the name of the policy instrument and briefly sum up its specifications.* - none
Total project costs (EUR)	8 000 000
Net present value of the investment (EUR)	Na
Internal rate of return on investment (%)	Na
Payback period (y)	NA
Lending rate (%)	NA
Timescale (start/end date)	February 2019 – expected to be ready in autumn 2020
Installed capacity (kW)	8000 kW
Fraction of renewable energy consumed (%)	The biomass boiler will produce all the heating of the facility and is 100 % renewable.
Investment costs per installed kW (EUR/kW)	1000
RES type used	biomass energy
Evidence of success (results achieved)	*Fazer's bioenergy-producing method supports the concept of a modern circular economy. Both the Xylitol and bio heating production processes are uniquely combined to use the raw material which, until now, has not been commercially utilised.*
Challenges encountered (optional)	Equipment deliveries were delayed due to quarantines imposed by COVID-19

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Potential for learning or transfer	Similar industrial synergies could be utilized in other places with the grain-based food industry and a district heating network. The energy produced is not only renewable but also material that would otherwise go to waste.
Further information	https://www.lahtienergia.fi/fi/ajankohtaista/tiedotteet/lahti-energia-toimittaa-fazerille-uuden-energiantuotantolaitoksen

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*3*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*2*
Social influence	*Is there any social influence on the industry or the local municipality?*	*1*
Replication possibility	*Please clarify how can this practice be replicated.*	*2*

For more information, please contact:
Taina Lampela-Helin, Manager, Communications, Fazer Group, taina.lampela-helin@fazer.com

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5. GEOTHERMAL HEATING OF FACTORY USING HEAT PUMPS

1. General information	
Title of the practice	*Geothermal heating of factory using heat pumps*
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	LAB University of Applied Sciences	
Geographical scope of the practice	*Local*	
Location of the practice	Country	*Drop-down list Finland*
	Region	*Drop-down list Päijät-Häme*
	City	*Drop-down list Lahti*
Keywords related to your practice	*Select existing keywords or add* *Heat pump, energy efficiency, low-carbon*	
Upload image		

2. Author contact information	
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Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	*[160 characters]* The ground heat pump is used for heating the factory buildings.

Detailed information on the practice	Halton Marine wants to stand at the forefront of combating climate change and the company had a goal that all its operations around the world will be carbon neutral by 2025. In Haltons factory in Lahti, heat pumps are used replaced the previous natural gas heating. Changing to heat pumps will save money as the price of natural gas keeps rising and also replace the aged cooling system at the same time. The geothermal heat pump system consists of 22 heat wells, 310 to 330 meters deep, drilled into the land surrounding the plant. The ground stays at a steady temperature all year round allowing for heat to be captured in winter and transferred by the heat pump into the heating system of the factory. During summertime, the same heat pumps are used for cooling. With the new heat pumps, the cooling capacity is increased enough that it can replace both the old process cooling and also cool the factory halls, thus improving working conditions. In addition to the new system, Halton Lahti has invested in other energy-saving measures and signed a contract to only buy renewable electricity.
Resources needed	The system is delivered by external turnkey solutions provider and requires no extra workforce for the company. System was paid directly by the company with no loans involved. Land needed for wells to be dug in.
Resources used	Business Finland energy aid program covered 15 % of the investment costs.
Policy instrument used	Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions.
Total project costs (EUR)	607 000
Net present value of the investment (EUR)	-
Internal rate of return on investment (%)	10-13 %
Payback period (y)	8-10 years
Lending rate (%)	- (0%)
Timescale (start/end date)	1/2020-11/2020
Installed capacity (kW)	. 345
Fraction of renewable energy consumed (%)	100 %
Investment costs per installed kW (EUR/kW)	1759,42 €/kW
RES type used	Ground heat
Evidence of success (results achieved)	1.8 – 2.5 M€ Lifetime savings estimated for the system by saving money on gas. 90% reduction in emissions from heating adding to 103 tons/CO2 per year. 35 % savings on heating energy Money saved on buying a new separate cooling system. Cooling workspaces improves productivity in summer.
Challenges encountered (optional)	A similar system was planned for another Halton factory in Kausala but wells could not be dug because of the risk of groundwater contamination. Must be built in the area with no groundwater.
Potential for learning or transfer	Heat pumps are good option for any country with low electricity prices and need for heating. However, they are not profitable if electricity is too expensive.
Further information	https://www.halton.com/fi_FI/marine/news/-/asset_publisher/0MPAlnpYu8cu/content/halton-plant-introduces-geothermal-solution-in-lahti?redirect=https%3A%2F%2Fwww.halton.com%2Ffi_FI%2Fmarine%2Fnews%3Fp_p_id%3D101_INSTANCE_0MPAlnpYu8cu%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_count%3D2

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*2*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*3*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*3*
Replication possibility	*Please clarify how can this practice be replicated.* *Can be installed anywhere with heating demand and bedrock to drill into if there is no risk of ground water contamination.*	*5*

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6. SOLAR POWER PLANTS INTEGRATED EFFICIENTLY WITH COMMERCIAL REAL ESTATE

1. General information	
Title of the practice	*Solar powerplants integrated efficiently with commercial real estate*
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Regional*	
Location of the practice	Country	*Drop-down list Finland*
	Region	*Drop-down list Päijät-Häme*
	City	*Drop-down list*
Keywords related to your practice	*Select existing keywords or add solar energy, renewable energy, low carbon*	
Upload image		

2. Author contact information *[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard]* *[Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organisational profile in the Interreg Europe community will be linked to it.]*	
Name	*Paavo Lähteenaro*
Email	*paavo.lahteenaro@lab.fi*
Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	*[160 characters]* Solar power production integrated into various commercial properties.

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Detailed information on the practice	Systems were contracted from Lahti Energia, a local power company. The motivation for adopting solar power was the desire to take part in the common good and appeal to customers as well as financial as the company estimated they would gain significant savings. The panels directly feed into the power system of the store which uses nearly all of the energy consumed with only small amounts sold into the grid, allowing for higher efficiency as grid losses are negated. For grocery stores, solar power is advantageous as the peak production and peak load are at the same time. Power production peaks are midday in summer when the weather is hottest which is simultaneously the peak load for grocery stores as hot weather drives up cooling demand. Also, unlike residential buildings which consume more energy in the evening as people come home from work, grocery stores mostly consume energy during the day thus getting maximum use out of solar energy. Additionally, the same corporate group that runs the properties owns a share of wind farms, which supply 65 % of the electricity purchased from the grid giving an even higher fraction of renewables used.
Resources needed	The system was delivered by an external energy company that also is contracted for monitoring and upkeep. The instalments only took few weeks per building and required approximately 5 people. The system is almost maintenance-free and doesn't employ any people full time to run it.
Resources used	Business Finland energy investment aid covered 20 % of project costs as a part of a commercial energy efficiency agreement.
Policy instrument used	Business Finland energiatuki - Energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions.
Total project costs (EUR)	5 000 000
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	12,5
Payback period (y)	8
Lending rate (%)	NA
Timescale (start/end date)	5/2016- On going
Installed capacity (kW)	6,2 MW
Fraction of renewable energy consumed (%)	70,25 %
Investment costs per installed kW (EUR/kW)	800
RES type used	solar power
Evidence of success (results achieved)	CO2 emissions reduced by 540 tons- New panels cover 15 % of the energy consumed by the stores. 3780 MWh of production per year.
Challenges encountered (optional)	Hämeenmaan Kiinteistöt is starting to run out of roof space to put the panels in at the current time. Experiments with using solar thermal failed as the time when heating is required is also the time when solar heating is least effective and vice versa, leading to the use of solar power instead. Recommendation for systems to be as simplified as possible after a redundant loose switch caused a fire at one store.
Potential for learning or transfer	Installation of a system like this is very fast only 1-3 weeks and should be very easy to copy. As the energy is mostly used up in cooling and the usefulness of solar panels goes up in warmer countries, the potential to use practice like this is even greater the further south one goes.
Further information	https://www.sttinfo.fi/tiedote/hameenmaalle-13-aurinkovoimalaa-yhteistyossa-lahti-energian-kanssa?publisherId=68574224&releaseId=69859702

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Low-carbon economy

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*2*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

Low-carbon economy

7. UTILIZATION OF BIOWASTE STREAMS - BIO-BASED INDUSTRIAL SYMBIOSIS AS RES

1. General information	
Title of the practice	**Utilization of biowaste streams - bio-based industrial symbiosis as RES**
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Select National/Regional/Local* regional	
Location of the practice	Country	*Drop-down list* Finland
	Region	*Drop-down list* Päijät-Häme
	City	*Drop-down list* Lahti
Keywords related to your practice	*Select existing keywords or add* climate change, roadmap, greenhouse gas emissions, strategy, heat pump	
Upload image		

2. Author contact information	
[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard] [Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organizational profile in the Interreg Europe community will be linked to it.]	
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Telephone	*+358 469 232 738*
Your organisation	
Country	Finland
Region	Päijät-Häme

3. Detailed description	
Short summary of the practice	Heating the production of biogas and fertilizer from biowaste streams and wastewater sludge with heat pumps and composting waste heat.

Detailed information on the practice	*[1500 characters] Please provide information on the practice itself. In particular:* *1. What is the problem addressed and the context which triggered the introduction of the practice?* *2. Please briefly technically describe the practice. Also, state the motivation of the owner for the installation and the decision process.* *3. How does the practice reach its objectives and how it is implemented?* *4. Who are the main stakeholders and beneficiaries of the practice?* The amount of biowaste is growing. Previously it was landfilled causing difficulties with methane gas creation under anaerobic conditions, odour and most of all, landfilling contributed to a valuable resource and energy loss. LABIO Ltd biogas and the composting plant is a joint venture owned by Päijät-Häme Waste Management Ltd and the public water service provider Lahti Aqua Ltd. It produces biogas and fertilizer from industrial and municipal biowaste, wastewater sludge and biodegradable material from farming, forestry and fisheries. LABIO Ltd, the largest biogas production and refining plant in Finland is part of the industrial symbiosis in Kujala Waste Treatment Centre in Lahti. Biogas generated in the dry digesters is transported through the pipes to the nearby operator for upgrading and distribution in the gas grid. The digestate is processed with other biowaste in the composting facility to produce compost, soil and other growing solutions used in agriculture, cultivation and gardening. Heat energy from the composting process is captured from outgoing hot air using three 750 kW heat pumps and used to heat the biogas facility and the biogas reactors by means of heating water pipes. Stakeholders: Facilities and industry producing organic waste, biogas traffic, renewable fertilizer users and citizens are all stakeholders.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The plant was financed through public companies Päijät-Häme Waste Management Ltd, Gasum and Lahti Aqua Ltd with total investments of 17 M€. The investment in the plant was made based on the owners' waste treatment needs and to follow public strategy. The number of employees in the year 2020 was 14.
Resources used	*Institutional / Structural EU funds (describe the program used) / Other* Business Finland energy aid was given to the project covering 28 % of investment costs.
Policy instrument used	*State the name of the policy instrument and briefly sum up its specifications.* Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions.
Total project costs (EUR)	17 000 000
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	4
Payback period (y)	25
Lending rate (%)	NA
Timescale (start/end date)	1/2010 – 10/2014
Installed capacity (kW)	7875
Fraction of renewable energy consumed (%)	*NA*
Investment costs per installed kW (EUR/kW)	*Review the total investment costs per installed kW of renewable energy source in euros per kW.*

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	2158,73
RES type used	biomass energy
Evidence of success (results achieved)	*[500 characters] Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results).* LABIO Ltd is an independent company financing all costs through selling waste treatment services and biogas. The turnover in 2017 was 5,8 M€ consisting of gate fees 4,8 M€ and biogas income 1 M€. The operating profit was 0,6 M€. Landfilling of biowaste has finished and combustion decreased significantly. Odour emissions and greenhouse gas emissions are considerably lower. At the same time, renewable energy is produced the nutrients utilized. Also, the plant has not had a single day out of operation in 15 years.
Challenges encountered (optional)	*[300 characters] Please specify any challenges encountered/lessons learned during the implementation of the practice.* The plant was not delivered as a turnkey solution but rather as a constant negotiation between the manufacturer and the company, allowing problems to be solved as it was implemented. This they consider the only reasonable way to make such a plant. The construction process involved 10 different nationalities causing communication issues.
Potential for learning or transfer	*Biogas production helps to decrease the greenhouse gas emissions, and it does not cause any fine particulate emissions. The odour emissions are <500 ou/m3. The carbon footprint of the production chain is 11 000 tons CO2e/a negative (biogas compensation and nitrogen and phosphoric compensation taken into account). The carbon footprint of the nitrogen fertilizer is 300-500% lower than of mineral fertilizers.* *The plant is almost exactly the same as another plant built in Austria by the same manufacturer showing the potential to copy such system across borders.* *An advantage worth pointing out is the 4 separate reactors for biogas making, while 3 are usually enough to cover production. This allows for nonstop operation as one can always be worked on without interrupting production.* *Originally, LABIO Ltd served only to the needs of the Päijät-Häme region, but now it is also offering services for the whole Southern Finland due to increased competition between the growing number of biogas facilities. Too much subsidization of biogas can lead to competition for resources which can lead to a skewed market.*
Further information	*http://www.labio.fi/en/*

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*3*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*1*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

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8. DISTRICT HEATING PRODUCTION FROM RENEWABLE SOURCES

1. General information	
Title of the practice	**District heating production from renewable sources**
Does this practice come from an Interreg Europe Project	**No**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	LAB University of Applied Sciences	
Geographical scope of the practice	*Select National/Regional/Local* regional	
Location of the practice	Country	*Drop-down list* Finland
	Region	*Drop-down list* Päijät-Häme
	City	*Drop-down list* Lahti
Keywords related to your practice	*Select existing keywords or add* climate change, bioenergy, carbon neutrality, heat production	
Upload image		

2. Author contact information	
[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard] [Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organizational profile in the Interreg Europe community will be linked to it.]	
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Email	*paavo.lahteenaro@lab.fi*
Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	*[160 characters* Lahti Energia replaces its old coal power plant with a new biomass burning heat plant freeing the company entirely from coal use.

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Detailed information on the practice	*[1500 characters] Please provide information on the practice itself. In particular:* 9. *What is the problem addressed and the context which triggered the introduction of the practice?* 10. *Please briefly technically describe the practice. Also state the motivation of the owner for the installation and the decision process.* 11. *How does the practice reach its objectives and how it is implemented?* 12. *Who are the main stakeholders and beneficiaries of the practice?* The motivation for the plant was the plan of the city of Lahti to reduce its carbon emission and to abandon coal for energy production. The price of coal has continued to rise due to the rise of taxes on fossil fuels and the cost of emissions allowances too. New bio-heating plant with the main fuel of certified PEFC or FSC-certified, wood-based biofuel meaning the wood used is lumber industry waste consisting of forestry residues and waste from sawmills. The plant will be built as a high-pressure steam boiler with the possibility of adding a turbine for electricity production if the price of electricity rises. The power plant is also equipped with a heat recovery system, which increases the efficiency of the plant. The system can recover about 30-45 megawatts of thermal energy from the flue gases. The resulting condensates are also highly purified and used in the boiler and as district heating water making the plant water independent and fly ash captured by the scrubber is recycled back into the forests as fertilizer. Stakeholders for such plant are biomass producers, renewable fertilizer users, district heat users.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The total investment of renewable energy plant is 180 million EUR. The employment effect of the project is approximately 1,000 man-years and the plant's domesticity is approximately 40%. The institution employs around 100 people directly or indirectly.
Resources used	*Institutional / Structural EU funds (describe the program used) / Other* The flue gas scrubber condensate purification process has been selected as one of the supported energy spearhead projects by the Finnish Ministry of Employment and the Economy. The scrubber has received energy aid money from Business Finland, a government funding agency.
Policy instrument used	Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions.
Total project costs (EUR)	The total investment of renewable energy plant is 180 million EUR
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	NA
Payback period (y)	NA
Lending rate (%)	NA
Timescale (start/end date)	01/2018 – 1/2020
Installed capacity (kW)	190 000 kW
Fraction of renewable energy consumed (%)	New facility. The energy produced is 100 % renewable.
Investment costs per installed kW (EUR/kW)	947,37

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RES type used	biomass energy
Evidence of success (results achieved)	Kymijärvi III will allow total replacement of coal in energy use in the city of Lahti while at the same time fulfilling the City of Lahti goals for reduction of greenhouse gas emissions. CO_2 emissions reduced by 600 tons/year.
Challenges encountered (optional)	No problems with the technology used came up as it is mostly conventional and well tested in other similar plants. Only regular project management issues of large building projects were encountered.
Potential for learning or transfer	Kymijärvi III is evidence of how coal can be replaced by biomass in large plants. Any country with forest industry will have forest biomass that is unsuitable for lumber or pulp production, but which can be utilized as energy biomass. As such, Kymijärvi III is an example of what can be done with what could otherwise go to waste.
Further information	https://www.lahtienergia.fi/fi/lahti-energia/energian-tuotanto/kymijarvi-iii

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*2*
Social influence	*Is there any social influence on the industry or the local municipality?*	*1*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

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9. BIOGAS FROM WASTEWATER SLUDGE AS REPLACEMENT FOR FOSSIL SUPPORT FUELS IN BIOMASS BURNING

1. General information		
Title of the practice	*Biogas from wastewater treatment as replacement for fossil support fuels in biomass burning*	
Does this practice come from an Interreg Europe Project	**no**	

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Local*	
Location of the practice	Country	*Finland*
	Region	*Päijät-Häme*
	City	*Heinola*
Keywords related to your practice	*Renewable energy, biogas, waste water treatment, COD, paper, pulp*	
Upload image		

2. Author contact information	
[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard] *[Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organisational profile in the Interreg Europe community will be linked to it.]*	
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Email	*paavo.lahteenaro@lab.fi*
Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	

	Biogas is produced from wastewater sludge and is burned in the pulp mills waste biomass boiler to power the plant. Biogas as support fuel replaces fossil fuels. COD (chemical oxygen demand, mainly carbon) of wastewater can be seen as a resource for biogas production. If anaerobic reactor is installed in front of traditional activated sludge process, up to 80% of the COD can be turned to biomethane. That also generates huge savings when treating the rest 20 % in the aerobic process. Chemicals and aeration energy will be saved.
Detailed information on the practice	*What is the problem addressed and the context which triggered the introduction of the practice?* Wastewater treatment process (WWTP) is very expensive (chemicals and energy), and it also finally generates wet bio sludge that is a new problem. COD (carbon) of the wastewater is lost. Normally, WWTP only generates costs. Also, pulp mills burn their waste biomass, such as bark in bark boilers to produce electricity and heat for the plant's own use. To burn low quality biomass like bark, high-quality support fuel is needed which is usually fossil fuel. Producing biogas from wastewater sludge reduces the need for expensive wastewater processing and the resulting gas can be burned immediately in the bark boiler where it can replace fossil fuels. *Please briefly technically describe the practice. Also state the motivation of the owner for the installation and the decision process.* There is an anaerobic bacterial granular based process that is capable of generating biomethane directly from wastewater. Wastewaters can be characterized to evaluate which streams can be collected to such reactor. The reactor and granules inside can cut up to 80 % COD and turn that to biomethane. Granular bacteria are valuable and have a positive value (compared to wet bio sludge waste from the aerobic process). Idea is to put the anaerobic process in front of regular wastewater treatment, leaving less COD to treat, that means less chemical, energy and sludge treatment cost. *How does the practice reach its objectives and how it is implemented?* The process has worked well and is easy to operate. There are no rotating parts inside the reactor, so the maintenance costs are low. Biogas can be used as biofuel. Chemical and especially energy savings from aerobic activated sludge has been bigger than estimated. *Who are the main stakeholders and beneficiaries of the practice?* Company / City / State responsible for wastewater treatment.
Resources needed	Cost of the reactor, of course, depends the size needed, so the amount of wastewater treated. The total cost of the project consisting

	25 000 kg COD/d capacity reactor was roughly 5 M€. The system is largely maintenance-free requiring some monitoring.
Resources used	*Institutional / Structural EU funds (describe the program used) / Other* Aid from the Ministry of Industry providing 30 % of project costs, totalling 647 550 €. ENERGIATUKI INVESTOINTIHANKKEESEEN Työ- ja elinkeinoministeriö myöntää Teille energiatuen myöntämisen yleisistä ehdoista annetun valtioneuvoston asetuksen (1063/2012) nojalla energiatukea seuraavasti: Tuettava hanke: Biokaasun tuottaminen Investoinnin tarkoituksena on uusiutuvan energian tuotanto. Hanke sisältää uutta teknologiaa, minkä johdosta energiatuki on myönnetty valtioneuvoston asetuksen 1063/2012 7 § 2 mom perusteella (maksimituki 40 %). Tuen piiriin hyväksyttävät kustannukset (ilman arvonlisäveroa): Rakennukset 524 000 € Koneet ja laitteet 3 479 000 € Muut kustannukset 314 000 € Yhteensä 4 317 000 € Myönnetty energiatuki 647 550 €
Policy instrument used	Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions.
Total project costs (EUR)	4,5 M€
Net present value of the investment (EUR)	6,2 M€
Internal rate of return on investment (%)	30,5
Payback period (y)	5,8
Lending rate (%)	NA
Timescale (start/end date)	April 2015 – June 2016
Installed capacity (kW)	The capacity of the reactor is 25 000 kg COD/d (that much has not yet been available). Biogas produced: 2017 4387 MWh, 2018, 5289 MWh, 2019 4840 MWh. with typical pulp mill annual run time of 8000 h/a that gives average thermal power of 600 kW.
Fraction of renewable energy consumed (%)	*Solar fraction or amount of renewable energy used within the facility over the total energy consumption before the installation of the renewable energy source during the year in percentage. The denominator consists of actual energy consumption plus amount of renewable energy used.* $FR_{RES} = \frac{E_{RES\,USED}}{E_{CONS} + E_{RES_{USED}}}$ NA
Investment costs per installed kW (EUR/kW)	*Review the total investment costs per installed kW of renewable energy source in euros per kW.* 8333 €/kW (however, the system also grants energy and other savings for wastewater treatment)
RES type used	Biomass energy

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Evidence of success (results achieved)	[500 characters] Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results). Biogas produced: 2017 4387 MWh, 2018, 5289 MWh, 2019 4840 MWh Wastewater treatment energy use is reduced by 35 % and the total use of fossil fuels by the plant is reduced by 5 %.
Challenges encountered (optional)	*[300 characters] Please specify any challenges encountered/lessons learned during the implementation of the practice.* *NA*
Potential for learning or transfer	The system can be used in any pulp mill or pulp and paper to increase the use of renewables and replace fossil fuels. The system is considered novel in Finland, so there is much potential to apply the same system to other plants. A similar system has already been implemented in some other Stora Enso's plants in Central Europe. COD from wastewater is a resource we should not forget. It has been seen only as a cost before. Biogas is a renewable fuel. By traditional activated sludge process, a lot of chemicals is needed, also electricity and especially wet wastewater sludge problem are globally getting bad. This can be one part of the solution.
Further information	Reactor suppliers, like Paques, Econvert, Veolia etc. https://www.econvert.nl/econvert-products

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*1*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*1*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*2*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

10. BIOMASS BOILER FOR EFFICIENT DRYING PROCESS

1. General information	
Title of the practice	*Biomass boiler for efficient drying process*
Does this practice come from an Interreg Europe Project	**no**

Please select the project acronym	**RESINDUSTRY**

Specific objective	**Renewable energy sources used for industry**	
Main institution involved	*Technical: The name of the institution and location of the practice are per default those of the practice author. They remain editable.]* LAB University of Applied Sciences	
Geographical scope of the practice	*Local*	
Location of the practice	Country	*Drop-down list Finland*
	Region	*Drop-down list Päijät-Häme*
	City	*Drop-down list Lahti*
Keywords related to your practice	*Select existing keywords or add* *Biomass, food production, renewable energy, climate change*	
Upload image		

2. Author contact information	
[Technical: Contact information comes from your community profile. You can edit it by visiting your user dashboard] [Ideally, the owner of the good practice should fill in the form. Indeed, if you submit a good practice, your personal and organisational profile in the Interreg Europe community will be linked to it.]	
Name	*Paavo Lähteenaro*
Email	*paavo.lahteenaro@lab.fi*
Telephone	*+358 469 232 738*
Your organisation	
Country	*Finland*
Region	*Päijät-Häme*

3. Detailed description	
Short summary of the practice	Biomass boiler provides heat and steam for malt making

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Detailed information on the practice	Increasing costs of natural gas lead to a need for replacing the older heating system. The natural gas heating system was replaced with a biomass burning steam boiler capable of burning wood chips and agro biomass. The boiler is fitted with a flue gas scrubber with heat recovery. Recovered heat from flue gas scrubber is used to preheat local district heating systems water. The heating plant was built by Lahti Energia, a local energy company, which provides the plant as a paid service type contract. The boiler provides heating and steam for the malt making process as well as heating the buildings of the factory and can also be used to heat district heating water in times of high heat demand such as very cold winter days.
Resources needed	*[300 characters] Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* Running the heating boiler is done remotely and doesn't employ any workers full-time.
Resources used	Business Finland energy aid was given to the project covering 15 % of project costs.
Policy instrument used	Business Finland energiatuki - energy aid that can be granted to energy efficiency, renewable energy or any other project that reduces carbon emissions. Money is granted a percentage of project costs depending on a project type and novelty of the technology.
Total project costs (EUR)	9 000 000
Net present value of the investment (EUR)	NA
Internal rate of return on investment (%)	NA
Payback period (y)	NA
Lending rate (%)	NA
Timescale (start/end date)	11/2014-2/2016
Installed capacity (kW)	12 000
Fraction of renewable energy consumed (%)	Biomass boiler covers 90 – 95 % of the heat demand of the Malt factory with a backup natural gas boiler covering for maintenance and other downtime.
Investment costs per installed kW (EUR/kW)	750
RES type used	biomass energy
Evidence of success (results achieved)	+90% reduction in fossil fuel use.
Challenges encountered (optional)	The technology used is very conventional, so no new challenges were encountered.
Potential for learning or transfer	This technology could be used for process heat in most food industry facilities if a supply of biomass is available. It is a fine example of easily replacing natural gas burning with renewable energy.
Further information	*Link to where further information on the good practice can be found*

Please enter the value scaled from 1 – best, 2 – good, 3 – neutral, 4 – bad, 5 – worst:

Criteria	Description	Value
Energy efficiency	*Please rate the energy efficiency of the practice on the scale of 1 to 5.*	*2*
Financial efficiency	*Please rate the financial efficiency on the scale of 1 to 5.*	*2*
Environmental impact	*Were there any challenges connected to the e.g. visual impact of the practice?*	*1*
Political influence	*Does the project in any way influence the political situation in the surroundings of the installation?*	*3*
Social influence	*Is there any social influence on the industry or the local municipality?*	*3*
Replication possibility	*Please clarify how can this practice be replicated.*	*1*

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11. GOOD PRACTICE FROM POLICY LEARNING PLATFORM KUITTILA FARM

Good practice:
Energy self-sufficient Kuittila farm

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Kuittila farm has been almost energy self-sufficient since 2012 when the farm invested in a small CHP plant that generates electricity and heat from wood.

The farmer was interested in decreasing energy costs and producing own energy for the farm and a repair workshop located on the site. The farm has a dairy herd of 150 cows. The annual electricity consumption of the cow shed, repair shop, grain dryer, main building and wood chip dryer is c. 340,000 kWh and heat consumption c. 700,000 kWh.

In 2012, the farmer invested in a CHP (combined heat and power) system manufactured by Finnish Volter Ltd. The solution is unique because it produces electricity and heat by gasification of wood. The 140 kW CHP plant generates c.150 MWh of electricity and 375 MWh of heat a year. It consumes 700 m3 (loose volume) of wood chips per year. The farm has a 1,000 m3 storage facility and the wood chips are mechanically dried by using the waste heat of the plant. Wood chips with a moisture content of less than 18% are burned to process gas and converted into electricity and heat in an internal combustion engine. Wood chips are preheated before gasification in pyrolysis area.

Gasification temperature is 900-1,200 C. Gas is cooled from 550 to 200 C filter temperature. Fine soot is filtered, after which gas is cooled to 50 C, and ready for combustion. Combustion engine runs the generator, producing high-quality electricity for the farm. Excess electricity is sold to the national grid. Th e heat from the gas and engine cooling is utilised in the farm's micro-scale heating network.

Project	AgroRES
Main institution	Kuittila farm
Location	Pohjois- ja Itä-Suomi, Finland (Suomi)
Start Date	October 2012
End Date	Ongoing

Further information

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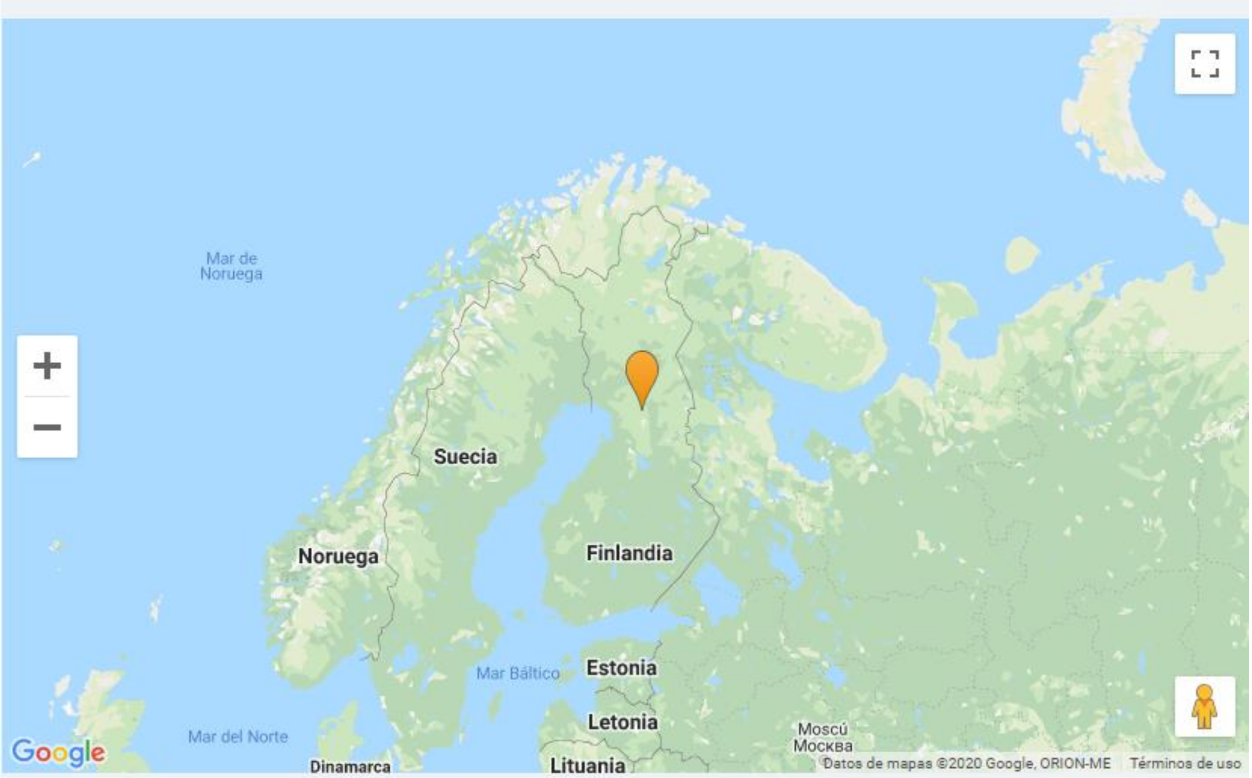

Resources needed

The total cost of the plant was c. 350,000 €: CHP unit and buildings cost around 220,000 €. The estimated payback period is 10 years. The farm received support for planning and implementation of the investment from an EAFRD project and 35% of investment support from ELY centre.

Evidence of success

The plant has been operating for several years and it has attained significant status as a small-scale CHP demonstration site in the region, both nationally and internationally. The small-scale CHP technology is innovative as it uses wood chips to generate heat and electricity.

Thanks to the investment, the farm is now almost energy self-sufficient. They need to buy fuels for machines.

Difficulties encountered

Fuel quality was a challenge at the beginning, but it was improved and controlled with the supplier of the CHP system.

Cost efficiency of the system depends much on the heat demand, and thus on the weather conditions.

Potential for learning or transfer

The energy system improves security of energy supply in farms and reduces the risks associated with climatic and weather conditions. In addition, the investment leads to significant carbon emission reductions and creates a positive image for the entrepreneur.

The practice would be potentially interesting for regions that have good forest resources. The Kuittila farm harvests its biomass mainly from local forests (thinning). The harvesting of small-sized wood improves the forest growth and provides high-quality fuel. The high quality pre-dried fuel, together with advanced combustion technology ensure low emissions and reduces harmful environmental and health impacts. The resulting ash can be used as forest fertiliser.

The CHP plant has opened additional business opportunities for the farm. The excess heat can be utilised in drying of forest fuel, in other farming activities or, for example, in hydronic underfloor heating, preheating of air-conditioning or domestic water.

Expert opinion

Simon Hunkin

Bioenergy is a truly local energy resource, with technologies able to make use of locally available resources, including wastes. This practice is especially promising because of its use of a CHP plant, where many single farms instead install heat only systems – especially those of small scale – as boilers are cheaper than CHP plants, and as there is also a need to find a use for the electricity which brings some additional complexity and costs. Transferability will depend on regional factors (biomass availability, regulatory framework, availability of financial support), but should certainly be encouraged. An excellent example of decentralised energy production.

Tags: Agriculture, Energy, Forest, Renewables

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12. GOOD PRACTICE FROM POLICY LEARNING PLATFORM ALAVA FARM

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Alava dairy farm is among the first farms in North Karelia, Finland, to generate electricity for the farm's needs by photovoltaic solar panels. Alava farm in the municipality of Kitee, North Karelia, Finland, is a dairy farm that was established in 1675. The farm milks around 60 cows and requires a lot of electricity for its daily activities. The annual electricity consumption of the farm is about 120,000 kWh. The largest share of electricity is needed for ventilation fans, milk machines and cooling of milk.

To decrease electricity bills, the owner invested in a solar photovoltaic (PV) system that covers one fourth of the farm's electricity needs (30,000 kWh). The investment was made in 2014 and the farm opted for a 33 kW photovoltaic system that, at the time, was the largest photovoltaic power plant in North Karelia. Photovoltaic panels were installed on a roof of a south-facing cowshed. The building was ideal for this purpose as it is surrounded by open fields and there are no trees around it to shade the PV panels.

The farm received renewable energy investment aid (EAFRD) for the investment through the Rural Development Programme for Mainland Finland 2014-2020.

The farm has also installed a geothermal heating system to replace oil heating and LED lighting solutions to further decrease its energy bills. The profitability of the farm has increased due to these investments. Moreover, the PV system and other measures have reduced the CO_2 emissions produced by the farm.

Project	AgroRES
Main institution	Alava dairy farm
Location	Pohjois- ja Itä-Suomi, Finland (Suomi)
Start Date	January 2014
End Date	Ongoing

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Low-carbon economy

Resources needed

The solar panel investment cost around 45,000 €. The farm received investment support from the Rural Development Programme for Mainland Finland 2014-2020. The support rate was 30 %.

Evidence of success

The solar PV system has decreased the farm's electricity bills by one-fourth. This has affected the farm's profitability. At the same time, the investment has reduced the farm's CO_2 emissions by approximately 4,750 kg per year.

The farm owner has been very pleased with the solar panel system. It is easy to maintain and use, it did not require building permits, the investment cost was fairly low and the estimated payback period is around 9 years.

Difficulties encountered

If the system momentarily produces more electricity than is needed on the farm, the surplus can be fed into the national electricity grid. However, the compensation paid for the surplus electricity is very low.

Potential for learning or transfer

PV systems are suitable for farms due to their long lifespan. In addition, they do not cause emissions or noise, they are easy to use and the need for maintenance is very low.

Solar electricity systems can be applied to a wide range of applications on farms, such as irrigation, cooling, air conditioning, water heating or generating electricity for farm buildings. And as this example shows, the technology is suitable even for farms located in the northern part of Europe.

The costs of PV systems have declined over time, making them even more attractive and accessible options for farms that have high energy needs.

Expert opinion

Simon Hunkin

More and more farms are recognising that they can make use of their lands and buildings for renewable energy generation, bringing down farm operational costs. This is a good example of using European Funds to support uptake of decentralised energy generation, in this case, the European Agricultural Fund for Rural Development (EAFRD) which can fund farm diversification activities and uptake of renewables. Even a relatively low rate of 30% coverage can trigger significant uptake.

Tags: Agriculture, Energy, Farming, Good practice, Renewables