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D5.3 Report on national particularities for the adaptation of iESA to Finland and Switzerland

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IMPAWATT

IMPlementAtion Work and Actions To change the energy culTure

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Contents

1 Introduction

1.1 Abstract and purpose of the report

In order to adapt the interactive Energy Savings Account (iESA) to the conditions of office buildings in Switzerland and Finland, country specific particularities have to be taken into account like e.g. differences in billing procedures, energy carrier and units, CO_2 coefficients, postal codes, climate factors (heating degree days), etc. This report will explain how SEnerCon, Planair and VTT collected and compiled all required information, and detail which country specific particularities will be considered while adapting the iESA which will be linked to the monitoring part of the Impawatt platform.

The unique selling proposition of the Impawatt platform is that its users get customized information and materials according to the company's sector and branch and to their needs, especially after being audited or certificated. The overall aim of the platform is to enhance the implementation of recommendations suggested in energy audits, thus to increase energy efficiency and culture through technical measures as well as behavioral changes in companies. These positive changes shall be evaluated in the monitoring section of the platform, where energy saving measures and energy consumption shall be assessed.

To guarantee the smooth interaction of the iESA and the Impawatt portal especially with the monitoring section of the platform, beside national adaptations also general adaptations of the iESA are required which are also described in this report.

1.2 Relation to other activities in the project

Based on this report, national iESA versions for Finland and Switzerland will be developed to be connected to the national Impawatt platforms in Finland and Switzerland. In addition to the monitoring features of the Impawatt platform, Impawatt users shall apply iESA to monitor their energy consumption more in detail. However, like it is already indicated in the description of the project, iESA will be rather used by adminstrations and offices than by industry as industrial processes are not considered in the iESA. The national iESA versions will be due in June 2019 and then connected to the Impawatt platform.

1.3 Partners´ contribution

VTT and Planair have investigated and compiled country specific particularities with the guidance of the work package leader SEnerCon introducing the iESA to them and discussing the adaptations required for application of the iESA by companies in Finland and Switzerland. Furthermore, VTT and Planair filled in Excel Templates provided by SEnerCon with country specific parameters regarding energy consumption of buildings, energy carriers, CO_2 coefficients, postal codes and other parameters.

2 Procedure to collect country specific requirements for the iESA adaptation

2.1 General description of the procedure

The requirements for the iESA adaptation can be split into three categories:

A) Standard adaptation steps that always have to be undertaken when adapting the iESA to another country, like the integration of country specific parameters (energy carriers and units, CO_2 coefficients, degree days, postal codes, etc.) and the translation of content

B) Country specific adaptations steps that derive from different situations regarding the energy supply and demand side in countries, like e.g. the adaptation of energy consumption data entry masks according to specific energy billing and metering procedures in a country

C) Project specific adaptations to ensure the smooth interaction of iESA with the Impawatt platform, e.g. that energy consumption figures and energy saving measures and events are harmonized and may be automatically transferred from the Impawatt platform to the iESA.

Gathering of country specific particularities (category A and B) was coordinated by SEnerCon and performed by Planair and VTT. The definition of harmonising steps between iESA and the Impawatt platform (category C) was discussed in telcos with partners, especially bilaterally between SEnerCon and Planair.

2.2 Standard adaptation steps (country specific parameters and translation)

For the standard adaptation the following county specific information is required:

- Energy carriers used and their units and conversion and scaling factors (for gas and others)
- Degree days related to postal codes
- Postal codes
- CO_2 emission coefficients for different energy carriers

For the compilation and integration of country specific parameters for iESA adaptation, SEnerCon sent Excel templates listing these parameters to partners (examples are attached in Annex 1 to this report including partners' input).

For the translation of English content to partners' languages (Finnish, French, German, Italian), partners will be provided with Excel templates containing English text content to be translated.

Regarding the degree days for Switzerland, it is difficult to allocate exact degree days to a specific location as the climate can differ significantly between short distances because of the mountainous geographical situation of the country.

Regarding the CO_2 coefficients for district heating in Switzerland a new country specific procedure for data entry had to be defined which is described in the next section.

For the translation of French, German and Italian text content already existing national iESA versions can be used including an English version of the Irish iESA. Nevertheless, they have to be complemented with new text translations because several updates of the iESA have been undertaken since the end of the EECC project (2015) in which framework the national iESA versions have been adapted to Ireland, Italy, France and other countries.

2.3 Adaptation of the iESA to particular national requirements

In order to identify national particularities to be taken into account, SENerCon introduced the different iESA features during a telco with Planair and VTT and asked both partners to register a test account at www.enerspot.com where different national versions of the iESA are available from the IEE project European Enterprises Climate Cup (EECC). For Switzerland, the French iESA, for Finland the Irish iESA was used as example. This way, partners could check what has to be changed to apply iESA in their country, e.g. regarding data input from energy bills and (smart) meters or display of data. The encountered requirements out of these testing have been compiled by each partner and send to SENerCon.

2.3.1 Requirements for the adaptation of iESA to Finland

Metering and billing procedures and smart metering usage

In Finland, smart meters are predominant and used by all the energy companies. The hourly consumption data is often available, for example, from a web site of the energy company.

The consumer has a possibility to buy electricity from any producer. Various tariffs are available depending on the energy company: constant price, fixed price for a period (for example, for 24 months), day (7-22) and night (22-7) tariffs, seasonal tariffs, market price with fixed monthly price and market price dependable with the spot price. In addition, it is possible to choose a separate tariff with only wind power or other renewable energy with a guarantee of origin. In addition, local energy companies charge for the transferred electricity and for a small consumer this may form a large part of the total costs. In addition, basic prices are charged by both, by the company selling the energy and by the company transferring it to the consumer.

For district heating, similar tariffs are not available. The price of energy [€/kWh) is typically constant. In addition, a monthly basic price is paid.

Some energy companies provide a possibility to download the consumption data as csv file, so this data could be uploaded to iESA.

Energy carriers and units applied including scaling and conversion factors

For district heating various energy sources are used. In Finland, district heating emissions have been decreasing year to year. In 2017 CO2 emissions were 149 g/kWh. Further values for recent years could be included into the iESA.

Postal codes and degree days

In Finland, heating degree days data is available for 15 separate areas in the country. In addition, K1 values can be used for normalizing the closest data for each municipality. This means that the heating degree days data is available for all the 320 municipalities.

There are more than 3500 postal codes in the country. The first two characters of the postal code are related to the location (the higher numbers are in the north while the smaller numbers are in the south). The postal codes are however not fully compatible with the heating degree days data, because there are much more postal codes than municipalities and the name related to a postal code does not indicate the municipality.

A straightforward solution would be to use municipality names instead of postal codes. Another solution would be to provide users with a choice of nearest climate stations according to their postal codes and they select the most appropriate one. This will be tested using the API of the www.degreedays.net portal.

2.3.2 Requirements for the adaptation of iESA to Switzerland

Metering and billing procedures and smart metering usage

In Switzerland, most companies have either one tariff or a day-night tariff, the majority day-night tariff.

The electricity cost is generally divided in four different parts:

- Energy (Energy consumption in kWh multiplied by the energy tariff)
- Transport (Energy consumption in kWh multiplied by the transport tariff)
- Power (Monthly or yearly peak power load multiplied by the power-tariff).
- Taxes (Energy consumption in kWh multiplied by the taxes).

To keep it simple, we could use an average energy price taking into account energy, transport, taxes and power cost to approximate the real energy price. The average energy price can be calculated by dividing the total electricity cost by the total energy consumption.

Generally, the companies receive a monthly electricity bill based on the real consumption of the last month.

Most companies use a time granularity of 15 min for their load curves. However, sometimes companies have smaller scale load curves and it should be possible to also upload them as csv file to iESA and to aggregate them to consumption figures of 15 min. intervals.
For most companies, the 15 minutes load curve is recorded and stored by the electricity provider. The company can ask to have those curves.
The iESA currently is only displaying hourly periods. Thus, it has to be adapted to display shorter time intervals, like e.g. quarterly or hourly periods. iESA is neglecting seconds and does not round up to a minute.

In the iESA it is possible to enter total consumption or meter readings, for most of the cases the total consumption is adequate. Even if in some cases the possibility to enter instead meter readings could also be interesting. The electricity prices depends on canton and type of consumer (industry, services ,..) hence a mean value is not really meaningful.

Energy carriers and units applied including scaling and conversion factors

In Switzerland the main energy carriers to be considered in the iESA are fuel, natural gas, wood (pellets and woodchips), district heating and electricity (normal mix and from renewables).

Regarding district heating, in Switzerland it is difficult to provide an average CO_2 emission factor for district heating as there are a lot of local suppliers with different energy mixes (pellets, gas, fuel, bio mass). In Switzerland the federal office of energy provides a list of the main district heating suppliers and their emission factors[1].

This list will be taken into consideration and integrated into the iESA backend. Different district heating suppliers will be offered in a scroll down list in the iESA frontend. The user can select his district heating supplier in the list and iESA automatically calculates the CO_2 emission using the specific emission factor of the respective supplier. If the user does not know his supplier, he may indicate it in the scroll down list and a default value e.g. of the region Bern will be used and integrated in the iESA backend.

Postal codes and degree days

There are several weather stations available in Switzerland for which it is possible to calculate the degree days. However, to automatically link each postal code to a weather station is not an easy task because of the mountainous topography. Hence in several cases the nearest station has a different altitude and hence do not represent the temperature of the postal code.

The best solution is to use a webservice to connect the iESA to www.degreedays.net and to display several weather stations according to a postal code, so the user can select the most adequate one. If for a certain postal code no weather station is found by the portal, a default value will be indicated or the climate adjustment will not be performed. This has to be tested and decided.

Further adaptation requirements and issues identified

During the testing of the platform, Swiss energy prices could not be entered as they were to high according to the platform. Hence the entry verification limits should be adapted.

Moreover, for Switzerland, the currency has to be adapted to CHF.

[1] FW-Emissionsfaktoren-2016 → http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_979916192.pdf&endung=FW-Emissionsfaktoren-2016)

2.4 Adaptation of the iESA to particular Impawatt requirements

The Impawatt project requires particular adaptation steps for the iESA

- **Harmonisation of technical measures:** If an Impawatt platform user decides to use the iESA for monitoring, the two platforms will be connected. The user can log into the iESA from the Impawatt platform via single sign on. The energy consumption diagrams from iESA will be integrated automatically into the Impawatt platform so the user can see his load profile. Additionally, energy saving measures performed and entered into the measures monitoring section of the Impawatt platform will be displayed in the load profile of both systems. The structure of entering measures into the impawatt platform is totally different from the already existing structure of measures in the iESA.
  In order to correlate technical measures that were suggested by the Impawatt portal (and implemented by companies) with the development of the company's energy consumption, they should to be displayed in both systems, in the iESA and the Impawatt portal. Thus, a harmonisation process between both platforms has to be defined and performed each time a new measure is implemented and entered into the Impawatt platform by a company. The harmonisation will be one-directional, meaning that only new measures integrated into the Impawatt platform will be updated into the iESA and not vice versa. The main data input point will be the Impawatt portal. Most likely the energy saving measures data base already available in the iESA will be deactivated and only the measures defined and suggested by the Impawatt project will be displayed as little flags in the load profile of the company.
- **Harmonisation of behavioural measures:** VTT will provide a list of behavior changes that will be suggested within the Impawatt portal and that will be displayed like the technical measures as little flags in the load profile of companies in case they were implemented. The already existing behaviour changes measure data base and frontend selections of iESA will be deactivated.
- **Smart Meter module optimization:** Most of the companies in Finland and also Swiss companies are using smart meters for electricity. SEnerCon will optimize the import function to integrate smart metering data in csv Format into the iESA accounts aggregating different metering intervals.
- **Integration of further company types into the iESA:** Up to now, users of the non-residential iESA choose between the following usage types of the building when registering an account: Partners decided to integrate further building purposes like e.g. hotel and industry but with the main focus on electricity. For the heating section of the iESA, only the percentage of energy consumption that is used for heating shall be entered by the company and taken into account for the further evaluations in charts. The same applies for heating cost and related CO_2 emissions.
- **Solar Energy Section:** In the iESA, PV energy consumed is displayed in one chart and energy produced in another, no common chart is foreseen in iESA, only the amount of energy produced and the amount that is fed into the grid are displayed. As same parameters will be inquired and displayed within the monitoring part of the Impawatt platform, the display and data transfer shall be defined and harmonised.

3 Annex

3.1 Annex 1: Examples of templates with country specific parameters for iESA adaptation

3.1.1 Extract from the degree days template in Finland

Municipality	**Comparison area**	**Heating degree days (normal year)**	**K1 (for normalizing to the comparison area)**
Espoo	Helsinki	3878	0,96
Hanko	Helsinki	3878	1,02
Helsinki	Helsinki	3878	0,99
Inkoo	Helsinki	3878	0,98
Kauniainen	Helsinki	3878	0,97
Kirkkonummi	Helsinki	3878	0,97
Raasepori	Helsinki	3878	0,98
Hamina	Vantaa	4097	0,96
Vantaa	Vantaa	4097	1,01
Järvenpää	Vantaa	4097	0,98
Kerava	Vantaa	4097	0,99
Kotka	Vantaa	4097	0,97
Lapinjärvi	Vantaa	4097	0,96
Loviisa	Vantaa	4097	0,97
Lohja	Vantaa	4097	0,99
Nurmijärvi	Vantaa	4097	0,97
Pornainen	Vantaa	4097	0,97
Pyhtää	Vantaa	4097	0,98
Porvoo	Vantaa	4097	0,99
Sipoo	Vantaa	4097	1
Siuntio	Vantaa	4097	1,02
Tuusula	Vantaa	4097	0,98
Vihti	Vantaa	4097	0,96
Enontekiö	Ivalo	6231	0,91
Inari	Ivalo	6231	0,97
Utsjoki	Ivalo	6231	0,93
Enonkoski	Joensuu	4984	1,05
Heinävesi	Joensuu	4984	1,03

3.1.2 Extract from postal codes in Finland

Postal code	Name
00002	HELSINKI
00100	HELSINKI
00101	HELSINKI
00120	HELSINKI
00121	HELSINKI
00130	HELSINKI
00131	HELSINKI
00931	HELSINKI
00940	HELSINKI
00941	HELSINKI
00950	HELSINKI
00960	HELSINKI
00970	HELSINKI
00971	HELSINKI
00980	HELSINKI
00981	HELSINKI
00990	HELSINKI
01120	VÄSTERSKOG
01150	SÖDERKULLA
01151	SÖDERKULLA
01180	KALKKIRANTA
01190	BOX
01200	VANTAA
01201	VANTAA
01230	VANTAA
01260	VANTAA
01261	VANTAA
01280	VANTAA
01300	VANTAA
01301	VANTAA
01340	VANTAA
01350	VANTAA
01351	VANTAA
01360	VANTAA
01361	VANTAA
01370	VANTAA
01380	VANTAA
01390	VANTAA
01391	VANTAA
01400	VANTAA

3.2 Annex 3: Examples of templates for country specific modification

3.2.1 Energy carriers applied by companies in Switzerland

Energy carrier	**Unit**	**Scaling factor to convert to kWh (if applied)**	**CO2 coefficient**	**Comment**
Fuel	Liter	1 liter = 9.9 kWh Hu	277 kg CO2/MWh Hu	https://www.energie-umwelt.ch/tools/835-einheiten-umrechner-fuer-verschiedene-heizenergie und https://www.energieschweiz.ch/media/309179/richtlinie_zielvereinbarungen_mit_dem_bund_zur_steigerung_der_energieeffizienz.pdf
Gas	kWh ho oder m3	11.43 kWh Ho/m3 or 10.32 kWh Hu/m3,	202 kh CO2 /MWh Hu	Scaling m3 kWh depends on gaz and altitude. http://www.swissgas.ch/fileadmin/user_upload/swissgas/downloads/Erdgaseigenschaften_2017_SG_F.pdf
District Heating Supplier 1	kWh		von 0 kg CO2/MWh bis 205 kg CO2/MWh, see list of federal office for energ.	
District Heating Supplier 2	kWh			
District Heating Supplier x	kWh			
Wood pellets	kg	4.8 kWh/kg	0	https://www.holzenergie.ch/uploads/tx_ttproducts/datasheet/403energieinhalt_graueEnergie_DFI_05.pdf, CO2 wird generell als 0 emissionen betrachtet.
Wood chips	m3	700-1000 kWh/m3	0	
Mean renewable electricity mix	kWh		9 kg CO2/MWh	https://www.bafu.admin.ch/bafu/de/home/themen/klima/klimawandel--fragen-und-antworten.html
Mean user electricity mix	kWh		169 kg CO2/MWh	https://www.bafu.admin.ch/bafu/de/home/themen/klima/klimawandel--fragen-und-antworten.html

3.2.2 Energy carriers applied in companies in Finland

Energy carrier	Unit	Scaling factor to convert to kWh (if applied)	CO2 coefficient	Comment
District Heating Supplier 1 (average in 2017)	MWh	1000	149 kg CO2/MWh	
District Heating Supplier 2 (group with lowest emissions)	MWh	1000	20 kg CO2/MWh	https://www.motiva.fi/files/14691/Erillistuotannon_paikkakunnat_2018.pdf
District Heating Supplier 3 (group with highest emissions)	MWh	1000	450 kg CO2/MWh	https://www.motiva.fi/files/14691/Erillistuotannon_paikkakunnat_2018.pdf
Electricity (average in 2016)	MWh	1000	164 kg CO2/MWh	https://www.motiva.fi/files/14691/Erillistuotannon_paikkakunnat_2018.pdf
Peat pellets and briquettes	1000 kg = t	18 GJ/t * 278 kWh/GJ = 5000	97 t CO2/TJ = 349 kg CO2/MWh	http://www.stat.fi/static/media/uploads/tup/khkinv/khkaasut_polttoaineluokitus_2018.xlsx
Natural gas	1000 m3	36,5 GJ/1000 m3 * 278 kWh/GJ = 10100	55.3 t CO2/TJ = 199 kg CO2/MWh	http://www.stat.fi/static/media/uploads/tup/khkinv/khkaasut_polttoaineluokitus_2018.xlsx
Firewood (stems and split firewood)	1000 kg = t	14 GJ/t * 278 kWh/GJ = 3900	109.6 t CO2/TJ = 395 kg CO2/MWh	http://www.stat.fi/static/media/uploads/tup/khkinv/khkaasut_polttoaineluokitus_2018.xlsx
Light fuel oil	1000 kg = t	42,5 GJ/t * 278 kWh/GJ = 11800	261 kg CO2/MWh	https://www.motiva.fi/files/6817/CO2-laskenta_yksittainen_kohde.pdf