COGEN Europe Position Paper

Methodology & market developments for micro-cogeneration in the review of Lot1 Energy Labelling and Ecodesign legislation

Brussels, 24/08/2018

COGEN Europe[1] welcomes the European Commission's review of the Lot1 Energy Labelling and Ecodesign obligations for space heaters[2] and the ongoing assessment of its implementation carried out by the appointed consortium led by VHK.

Since the entry into force of the Lot1 legislation, the micro-CHP sector has identified several key methodology issues that would need to be addressed in order to accurately assess the efficiency of micro-CHP systems. This will ensure that the sector continues to innovate, as micro-CHP products come closer to mass commercialisation.

Key recommendations:

- **Use the industry-recognised EN 50465 standard to accurately calculate the space heating efficiency of micro-CHP appliance (Task 1),** as it accounts for both the savings associated with the heat production and the primary energy savings from the electricity not imported from the grid but produced on-site. The Lot1 legislation should be aligned with and recognize the EN 50465 standard.
- **Determine and validate the right conversion coefficient/CC (primary energy factor for electricity) for space heaters, accounting for the seasonal and marginal considerations (Tasks 1 & possibly 5)**. The Lot 1 review should provide for a comprehensive and transparent process to determine the adequate methodology and value for the CC in the context of space heaters, as required in the review clause of Regulation 813/2013. There is scientific evidence indicating that a seasonal and marginal PEF approach would be more appropriate in the context of space heaters than an average annual PEF, as the one adopted in the 2018 revised Energy Efficiency Directive (EED)[3]. In addition, in COGEN Europe's understanding the new EU PEF in the EED is likely based on net calorific values, which is incompatible with the gross calorific values approach taken in Lot1. Given that the EU PEF methodology in the EED was not developed or assessed in the context of space heaters, it would be both legally unsound and technically incorrect to automatically use the newly adopted (average) EU PEF value of the EED, as some actors are proposing.
- **Properly account for the contributions of a cogeneration system and supplementary heater that are part of integrated heaters (Task 1)** by allowing for varibale weights to determine the efficiency of those heaters (now fixed at 0.85 for the cogeneration system and 0.15 for the supplementary heater). The method in EN 50465 also addresses this issue.
- **Recognise latest progress and identified market potential for micro-CHP (Task 2):** Micro-CHP is an important emerging solution for the European economy and the energy system. It offers significant efficiency improvements and carbon reductions already today, which will further increase in the future as the gas grids decarbonise. The installed stock for both domestic and commercial micro-CHP up to 50 KW is approaching 100,000. European annual sales in 2017 were estimated at around 9,500 – 10,000 for the 0-50 kW segment, more than three time the sales in 2014, with ICE and fuel cell micro-CHP technologies being responsible for most of the growth[4]. As awareness increases and product costs reduce with scale, industry expects annual sales to increase more rapidly than in the past. Projections by EU projects ene.field and CODE2 estimate the the micro-cogeneration stock could reach between 5 and 30 million systems by 2030 in the EU, with annual sales amounting to 3 million[5].

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[1] COGEN Europe, the European Association for the Promotion of Cogeneration, is the cross-sectoral voice of the cogeneration industry. EU Transparency Register Identification Number: 38305846546-70

[2] EU Regulations No 813/2013 and No 811/2013 along with the associated Commission Communication (2014/C207/02)

[3] Research Center for Energy Economics (Forschungsstelle für Energiewirtschaft e.V.), (FfE), 2018. EU Displacement Mix. A Simplified Marginal Method to Determine Environmental Factors for Technologies Coupling Heat and Power in the European Union. Available here:

[4] Based on Delta-ee estimates, August 2018.

[5] Projections by two EU projects: ene.field Widespread Benefits of micro-CHP & CODE2 micro-CHP Roadmap

COGEN Europe sees the Lot1 ecodesing and energy labelling legislation as a driver for the adoption of micro-CHP technologies, which hold key efficiency, decarbonisation and reliability benefits for both consumers and the energy system as a whole. Addressing the inaccuracies in the micro-CHP methodology and adopting a more adequate approach on the conversion coefficient/CC will ensure a level playing field for all heating technologies, strengthening the credibility and impact of the ecodesign and labelling legislation.

Accurate micro-cogeneration methodology

The micro-CHP methodology used to implement Regulations 813/2013 and No 811/2013 (Lot 1) should be based on the principle that the same primary energy savings achieved by different systems, taking the heat output as a basis, should result in the same seasonal heating efficiency. To achieve this, COGEN Europe asks that the EN 50465 ErP methodology, including the "Specific energy consumption" approach proposed in EN 50465:2015/prA1:2018[6], is clearly enshrined in Lot1 legislation.

As identified in the draft Interim Report "Task 1 Scope – Policies & Standards" (Interim Report)[7] two different calculations methods are available for the assessment of micro-CHP seasonal space efficiency, one proposed by the EN50465 and another in the Transitional methods space heating Commissions Communication (2014/C 207/02). The VHK report also outlines several advantages of EN 50465 methodology over the one in the Communication

Further benefits of using EN50465 methodology include

- **Delivers a label that can be of "real use for customers looking for energy and cost savings"**, as intended by the 2017 Energy Labelling Regulation. The label calculation based on the EN50465 methodology provides consumers with the complete picture of energy savings achieved by the micro-CHP, accounting for both the savings associated with the micro-CHP heat production and the avoided primary energy input to power plants (due to electricity not imported from the grid, but produced on-site);
- **Ensures comparability and a level playing field between Lot1 heating technologies,** based on the principle that equal primary energy savings (on the heat output) are associated with equal seasonal heat efficiencies. Given the scope of Lot1 legislation, comparability is best ensured by taking the heat output as a basis for comparison, while deducting from the energy input to the micro-CHP the avoided primary energy input that would have been used to produce electricity in a power plant but was instead produced on-site (see Annex I). Should one wish to consider the electricity produced by micro-CHP as an output in the calculation methodology, as suggested by some stakeholders[8], it would only be fair that in addition to heat output from boilers, heat pumps or other space heaters, the methodology calculations for those installations would also consider the electricity consumed in a household for non-heating purposes as well.
- **Is consistent with the Energy Labelling regulation 811/2013**, which defines the seasonal space heating efficiency as the ratio between the space heating demand and the energy consumption to meet this demand (i.e. total primary energy input minus the portion of primary energy that would have been used as an input for electricity production in a power plant).
- **Better accounts for the higher primary energy savings achieved by higher efficiency micro-CHP packages** compared with the methodology in the Commission Communication (see Annex II);

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[6] CEN/CLC/ JTC 17 "Fuel cell gas appliances" has reviewed EN50465. The updated standard EN 50465:2015/prA1:2018 is now under voting procedure. The EN50465 update paves the way for the Specific Energy Consumption to be used instead of space heating efficiency as the new calculation and communication vehicle for the ErP

[7] Prepared by VHK for the European Commission, 2017. Review study of Commission Regulation (EU) No. 813/2013 [Ecodesign] and Commission Delegated Regulation No. (EU) No. 811/2013 (Energy Label).

[8] Bosch, February 2018. Bosch stakeholder feedback on Lot1 review study

- **Is aligned with the recognised life-cycle assessment (LCA) standards and guidelines on multifunctional systems** (see Annex III);
- **Is in line with the wider EU and national policies on energy efficiency and micro-CHP,** including the SET Plan, FP7 & Horizon2020 (via the EU projects ene.field & PACE with a total combined budget of € 140 million) or the German KfW433 programme (more in Annex IV). The EN 50465 is also recognised by Member States in their micro-CHP support schemes (e.g. C16 feed-in premium tariff in France).
- **The 2018 update to EN50465, introducing the "Specific Energy Consumption" approach, improves the method for micro-cogeneration** by addressing several issues identified so far, including the linear extrapolation, rise to infinity and the discontinuity.

Determine the right conversion coefficient CC for space heaters

The conversion coefficienct CC, used to account for the primary energy savings for space heaters using or producing electricity, should be assessed separately in the context of space heaters. The review of the conversion coefficient should go beyond a simple justification for adopting the average annual EU PEF in the revised Energy Efficiency Directive and look into the improved accurancy and validity of a seasonal and marginal approach, accounting for the specific context of heating appliances[9].

The European Commission has expressed its intention[10] to use automatically the updated EU PEF in the revised Energy Efficiency Directive (EED) 2016/0376(COD) adopted in June 2018. COGEN Europe opposes such an automatic adoption, as this would lead to unsound outcome.

A dedicated assessment to determine the right methodology and value of the conversion coefficient CC for space heaters, taking into account marginal and seasonal aspects, is justified from both a legal and technical perspective:

Legal considerations

- Article 7.e of Regulation 813/2013 mandates that "*the review* [of the Regulation] *shall include an assessment of* […] *the validity of the conversion coefficient value*" and no link is made to a potential revisions of the EU PEF in the EED
- To inform the PEF update in the EED, a study was carried out between 2014 -2016 by a consortium of consultants led by Fraunhofer Institute. During that process, no comprehensive discussion was held on the appropriate EU PEF for space heaters, under the repeatedly stated assumption that this PEF review was carried out in the context of the EED and not Energy Labelling.
- Therefore, no dedicated assessment was made to date to identify the adequate EU PEF method and value for space heaters, either in the context of the EED revision or Energy labelling/Ecodesign. On this basis, the ongoing Lot1 review represents an opportunity to undertake this task. This will not only confirm the validity of the right conversion coefficient/PEF for space heaters, but also ensure a transparent and comprehensive process for impacted sectors, accounting for all stakeholders' views.

Technical considerations

Space heaters have a specific production profile, being designed to cover a seasonal heat peak demand, which is associated with a specific electricity mix. This electricity mix associated with the heating season, is closely linked to the concept of marginal and seasonal EU PEF and is significantly different than an average annual average EU PEF established in the EED.

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[9] Revised text of Energy Efficiency Directive 2016/0376(COD), adopted on 26 June, 2018

[10] Documented in the FINAL Minutes Boilers 1st stakeholder meeting from 23 January, 2018.

The current CC value of 2.5, set in Regulations 813/2013 & 811/2013, is based on the EU PEF value established in the original EED (EU/27/2012), for which there was no clear methodology defined. While academic work and EU projects analyses have been published on the impact of electrification in the heating sector, so far the European Commission has not conducted any specific assessment on more adequate methods and values for primary energy factors for electricity to be used for space heaters.

From a technical perspective, the dedicated assessment requested as part of the review of Regulation 813/2013 should consider the following:

- **Seasonal and not annual EU PEF**: A seasonal EU PEF will better reflect the specific electricity mix available during the heating season
- **Marginal and not average EU PEF**: A marginal EU PEF will better reflect the efficiency of the additional electricity mix required to meet the additional electricity demand from space heating. Modelling shows that the full electrification of heat with efficient heat pumps could double electricity demand in Europe, even when demand reduction measures are taken into account; electrifying heat with less efficient, but more affordable, resistance heaters risks increasing electricity demand three fold[11]. Accounting for these impacts of electrification, the efficiency and carbon intensity of the specific electricity mix required to meet the additional electric heating demand cannot be assumed to be the same as the average electricity mix (see diagrams in Annex V). A recent study by FfE finds that the "replacement mix" EU PEF (i.e. simplified marginal PEF) could be estimated at 2.99 in GCV (2.81 in NCV), with national EU PEFs ranging from 2.3 to 3.4[12] – far exceeding the average annual EU PEF of 2.1 in the EED. Based on these results, the validity and calculation of the marginal PEF method for space heaters deserves further investigation.
- **A PEF based on gross calorific values (GCV) and not net calorific values (NCV):** It is COGEN Europe's understanding that the EU PEF in the EED would not provide a correct basis for the LOT1 calculations, as it appears to be based on net calorific values (NCV), while the LOT1 Regulations framework compares heating efficiencies based on gross calorific values[13].

The expected outcome of using a much lower EU PEF than the real value applicable for space heaters will undermine the objectives of Regulations 813/2013 & 811/2013, as it will:

- Mislead consumers, by signaling that their appliances is much more efficient than in reality
- Bring back into the market appliances currently outlawed by Regulations 813/2013 (i.e. resitance electric heaters)[14]
- Increase electricity demand at system level much quicker than the electricity mix can decarbonize or improve in efficiency, thus leading to re-carbonisation in the building sector
- Increase heating costs for small consumers both: 1) directly, as consumers will not save as much energy as the label would indicate & 2) indirectly, given the potential increase in electricity costs associated with heating (e.g. via variable tariffs) following the increased peak demand electricity.

A dedicated EU PEF approach is supported by a wider coalition of European renewable and efficient heat industry associations (AEBIOM, COGEN Europe, EFIEES, EGEC and EHP), with a view to determine the adequate PEF to calculate the real efficiency of heating systems.

[11] Connolly, D, November 2017. Heat Roadmap Europe: Quantitative comparison between the electricity, heating, and cooling sectors for different European countries.

[12] Research Center for Energy Economics (Forschungsstelle für Energiewirtschaft e.V.), (FfE), 2018. EU Displacement Mix. A Simplified Marginal Method to Determine Environmental Factors for Technologies Coupling Heat and Power in the European Union.

[13] While not specified explicitly in the EU PEF review report from 2016, this would be concluded from the assumptions made in the analysis. Firstly, the majority of electricity statistics use the NCV convention, including the Eurostat & PRIMES data used for the EU PEF. Secondly, the references to NCV in Annexes IV and X of the EED point in the same direction. If that is the case, the EU PEF in the EED will be incompatible with the conversion coefficient in the Lot1 Ecodesign and Energy Labelling Regulations.

[14] AEBIOM, EGEC, ESTIF, May 2017. Primary Enegry Factor for Electricity in the Energy Efficiency Directive.

Proper accounting of supplementary heater's contribution

The weighting system proposed in EN50465 should be adopted to fully reflect the different micro-CHP/supplementary heater configurations, as part of an integrated appliance, instead of the fixed weights assigned in 4.3 (d) under the Combination Heaters section of the Commission Communication (2014/C207/02).

Different micro-CHP – supplementary heater integrated appliance configurations are installed in practice, to account for specific energy profiles of customers. This is not reflected in 4.3 (d) under the Combination Heaters section of the Commission Communication (2014/C207/02), where fixed wights are assigned to the micro-CHP and the supplementary heater in an integrated appliance (0.85 and 0.15 respectively), irrespective of their size/heating efficiencies and therefore contribution to the heating demand of a home. This can lead to significant distortions in calculating the space heating efficiency of an integrated appliance, including by overestimating the efficiency of a condensing boiler by adding a relatively smaller contribution of it to the micro-CHP system[15]. Moreover it is inconsistent with the treatment of packages in Annex IV of the Labelling Regulation 811/2013, where the variable weighting coefficients are in line with the contribution to the annual heat demand.

This issue is provisionally addressed in EN50465 clause 7.6.2.3, solving the inconsistency between the legally binding but mathematically inaccurate Labelling Regulation 811/2013 and the Commission Communication and finally solved in the Specific Energy Consumption approach in Annex K of EN 50465:2015 prA1:2018[16].

Recognise latest progress & identified market potential for micro-CHP

Over the past 5 years, micro-CHP solutions have consolidated their presence on EU markets and growth has intensified in some key markets. Today there are close to 100,000 micro-CHP systems installed across Europe (around 60,000 in the 0-5.5 kWe segment and more than 20,000 between 5.5-50 kWe[17]). Annual sales in both domestic and small commercial segments are estimated at 9,500-10,000 units for 2017[18]. Product cost reductions have already been achieved in the sector, as key manufacturers[19] are concentrating resources on scaling up and standardizing they manufacturing processes especially for ICE and fuel cells technologies, while developing the market via the heating sector supply chain. Given the increasing market awareness and expected additional cost reductions, annual sales are likely grow further in the coming decade, with projections estimating an installed micro-CHP stock of 5 – 30 million by 2030.

All these developments should be better reflected in the CH Boilers Task 2 Report on Market Analysis[20]:

- Annual sales should reflect the latest market intelligence, namely 9,500 – 10,000 for 0-50 kWe segment, as confirmed by Delta-ee in August 2018. Based on the same source, installed stock could be estimated at 100,000 systems across Europe, with most installed in Germany. Sales are expected to grow over the next few years, mainly driven by fuel cel and ICE systems. Projections for 2030 estimate the micro-CHP installed stork at 5 million-30 million based on the CODE2 and ene.field projects[21].

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[15] Technical assessment in the ene.field (Politecnico di Torino) Position Paper on Regulations, Codes and Standards.
[16] Available upon request and the approval of CEN CENELEC.
[17] Based on Delta-ee, 2018 estimates.
[18] Ibid
[19] Active manufacturers with micro-CHP products in the market or close to market entry include, but are not limited to: BDR Thermea, Bosch, EC POWER, Panasonic, SOLIDpower (Blugen), Sunfire, Viessmann
[20] VHK, December 2017. Draft Interim Report Task 2 Market Analysis
[21] See footnote 5

- The overview of micro-CHP product prices is out of date both in terms of the brands (some not being produced anymore and others missing) and in terms of the prices quoted (prices will vary quite a lot between European markets and are significantly lower today than prices referenced in the Task 2 report). Given that the micro-CHP sector is currently quite dynamic (e.g. EU projects like PACE aiming at a minium 30% price reduction through standardization and increase in scale in the next 2-3 years), we would recommend that Task 2 report does not provide specific brands' prices. Referring instead to broader price ranges and expected trends would ensure that the overview is not incomplete or soon out of date.

Additional market and environmental information is presented below, based on assessments carried out by authoritative

With the ability to attain overall efficiencies above 90%, micro-CHP units meet the demand for heating, space heating and/or hot water (and potentially cooling) in buildings, while providing electricity to replace or supplement the grid supply. As per the micro-CHP definition featured in the Energy Efficiency Directive, micro-CHP can be applied in private dwellings, public and commercial buildings to supply a range of heat usages. The reduction in primary energy usage results in greenhouse gas (GHG) emission reductions and the mode of operation of the micro-CHP unit can support the grid integration of variable renewables.

Micro-CHP can contribute significantly to the achievement of EU's climate and energy objectives today and up to 2050:

1. **Empowering consumers:** In a home of average energy use in Germany or the Netherlands[22], fuel bill savings of between 26% and 34% are acheiveable today and in 2020 by using a micro-CHP compared ot using a condensing boiler and electricity from the grid[23]. Savings could be higher in homes with higher energy use or homes that are upgrading from non-condensing boilers. Given their significant primary energy savings, micro-CHP systems currently offer similar or even lower total cost of ownership compared to other efficient heating technologies (e.g. heat pumps, condensing boiler) and it is expected to drop significantly as installed costs decrease with increasing scale of production[24].
2. **Supporting the decarbonisation of energy:** micro-CHP is a highly efficient way of using gas for heating and powering millions of Europe's homes and businesses, currently reducing more than 1.5 tonns CO_2 compared to a condensing gas boiler plus mains electricity[25]. LCA assessments of fuel cell micro-CHP systems, carried out as part fo the ene.field project, confirm the significant decarbonization potential of these systems compared to incumbent technologies (e.g. by more than 30% compared to a condensing gas boiler under certain assumptions)[26]. Any further increase in the electrical and overall efficiency of micro-CHP, coupled with the decarbonisation of gas supply will result in even more CO_2 savings.
3. **Providing greater flexibility for the grid:** By generating heat and power at times of peak demand, micro-CHP can significantly improve the stability of the grid and strengthen its resilience. Estimates based on whole electricity system modelling for the EU show that an additional kW of installed micro-CHP will reduce grid reinforcement costs between € 1,500 – 2,500 up until 2050[27].
4. **Fostering innovation and high value jobs:** The move to mass commercialisation of micro-CHP will enable the European workforce to develop new and high value skills, while building on the existing expertise of employees in Europe's heating industry. The European heating industry employs around 120,000 people and is worth around €20 billion in revenues annually. Micro-CHP market success is key to the heating industry – it represents its next generation of low carbon, energy efficient heating products.

END

[22] Calculations asume a home which requires 17,500kWh of energy a year for heating and hot water, and 3,500kWh a year of electricity
[23] Delta-ee, 2015. The benefits of micro-CHP.
[24] Roland Berger, 2015. Advancing Europe's energy systems: Stationary Fuel Cells in distributed generation (pp31).
[25] Idem 20
[26] Ene.field project (EIFER), 2017. Environmental life cycle assessment (of fuel cell micro-CHP). Executive Summary.
[27] Ene.field project (Imperial College London), 2017. Benefits of Widespread Deployment of Fuel Cell micro-CHP in Securing and Decarbonising the Future European Electricity System (pp 6). Retrieved from:

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Annex I: Impact of the two methodologies on efficiency calculation of micro-CHP compared to other Lot1 technologies

In the table below the methodologies in EN50465 and the Commission Communication were applied. The results indicate that the Communication methodology generates different efficiency values (1,3 and 1,6) for the same primary energy consumption (20.000 kWh) and primary energy for heating (10.000 kWh), to cover the same heat and electricity demands. The table shows that the EN50465 addresses this problem.

Heat demand		16000 kWh	
Electricity demand		4000 kWh	
	Condensing boiler	**CHP**	**Heat pump**
Heater characteristics			
$\eta_{thermal}$	1	0,8	
$\eta_{electrical}$		0,2	
COP			4
Electricity			
Electricity production		4.000	
Electricity import	4.000	0	4.000
Primary energy			
Input for heater	16.000	20.000	10.000
Input for electricity import	10.000	0	10.000
Total	26.000	20.000	20.000
Exclude primary energy for electricity	10.000	10.000	10.000
Primary energy for heating	16.000	10.000	10.000
Efficiency prEN50465 formula		1,60	1,60
Efficiency draft Communication formula		1,30	1,60

Annex II: Impact of the two methodologies on the labelling of micro-CHP products

	eta el	eta th	Pel	Pth tot	Package with micro-CHP and supplementary heater (label and η_s values) Commission communication	 prEN 50465
Stirling	0,14	0,81	1,0	15	A+ (109%)	A+ (117%)
Stirling with buffer	0,14	0,81	1,0	15	A+ (110%)	A+ (119%)
ICE domestic	0,24	0,59	1,0	15	A+ (106%)	A+ (121%)
ICE commercial	0,24	0,65	5,4	60	A+ (114%)	A++ (142%)
Japanese PEM	0,34	0,50	0,7	15	A+ (105%)	A++ (149%)
PEM Fuel cell	0,31	0,56	1,0	15	A+ (110%)	A+++ (159%)
Solid Oxide fuel cell	0,54	0,22	1,5	15	A+ (104%)	A+++ (170%)

Note: These values were based on a polynomial approximation of the contribution of the CHP part to the heat demand. For values with exact linear interpolation according to the labelling regulation is available upon request.

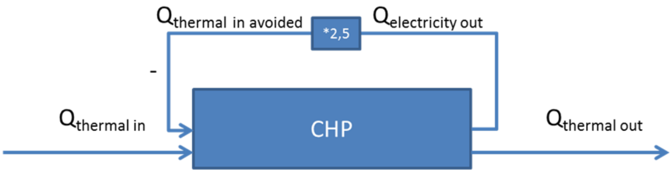
Commission communication method:

- ☹ Lower label values to higher efficient packages!
- ☹ All of these micro-CHP packages will be assigned a label of A+ → no differentiation between higher and lower efficient appliances, both today and in the future
- ☹ Innovation: no incentive to redesign / develop more efficient micro-CHP

Annex III: LCA theory on multifunctional systems

In LCA terminology:

- prEN 50465 formula based on system expansion (substitution method)



$$\eta_{son} = \frac{Q_{thermal\,out}}{Q_{thermal\,in} - Q_{prim\,avoided\,for\,el}} = \frac{\eta_{thermal}}{1 - 2{,}5 \cdot \eta_{electrical}}$$

- European Commission formula is based on partial allocation of energy savings to the heat function (allocation method)

$$\eta_{son} = \frac{Q_{thermal\,out} + 2{,}5 \cdot Q_{electricity\,out}}{Q_{thermal\,in}} = \eta_{thermal} + 2{,}5 \cdot \eta_{electricity}$$

LCA theory is in favour of the prEN 50465 formula (substitution)!

→ **System expansion** is the most appropriate way to handle multifunctionality according to LCA theory for providing comparable label information to support decisions because of

1. **Comparability:**

   *“**Comparisons** between systems shall be made **on the basis of the same function(s)**, quantified by the same functional unit(s) in the form of their reference flows.”* (ISO 14044:2006, section 4.2.3.2, page 8), so to ensure comparability all space heaters need to be assessed based on equal functionality.

2. **ISO standard on multifunctionality**:

   A *stepwise procedure* is prescribed, *whenever possible avoiding partial allocation* by **first *expanding the product system*** *to include the additional functions related to the co-products* (ISO 14044:2006, section 4.3.4.2, page 14). For cogeneration this implies in the most logical way substitution: subtracting the avoided primary energy which is avoided in the power plant for the production of the delivered electricity.

3. **EU guidelines on multifunctionality:**

   For the goal situation of decision support, the hierarchy of ISO 14044:2006 is prescribed, avoiding allocation by first using system expansion including substitution. The not required co-function shall be **substituted with the average market consumption mix** of the processes or products that are superseded. (ILCD Handbook – Detailed Guidance, European Commission, section *6.5.3, page 72-81 and* 6.5.4.2.2, page 82-83)

Annex IV: Micro-CHP in the broader EU and national policy context

Micro-CHP in Energy Efficiency Directive: Micro-CHP is recognised as an energy efficient technology in the Energy Efficiency Directive (EU/27/2012), as cogeneration installations with an installed electrical capacity below 50 kWe. As part of the EED, high efficiency cogeneration is defined as cogeneration that saved at least 10% in primary energy savings compared to the separate production of heat and electricity. Micro- and small CHP are considered high efficiency by default under the EED and Member States are advised to facilitate the installation of these systems by introducing simplified grid connection procedures (i.e. “install and inform”).

Micro-CHP in EU’s Strategic Energy Technologies Plan: Micro-CHP is also included as a key energy efficiency technology for buildings as part of Action 5 of the Strategic Energy Technologies Plan (SET-Plan)[28].

Micro-CHP supported via FP7 & Horizon2020: Key EU projects are focusing on fuel cell micro-CHP, as an innovative technologies. Ene.field project (held between 2012-2017) has demonstrated the viability of fuel cell micro-CHP by installing more than 1000 units across the EU and creating a wealth of evidence of the technology benefits. The PACE project was kick-started in 2016 and aims to facilitate the market introduction of fuel cell micro-CHP (2016-2022) by installing more than 2500 units across the EU and developing scaling up strategies, with the objective of reducing product cost by at least 30% and bringing the product closer to mass market after 2020. ene.field and PACE[29] have a total combined budged above € 140 million, of which more than € 50 million is co-financed by the European Commission’s Fuel Cells and Hydrogen Joint Undertaking.

German KfW433 Programme: In 2016, the German KfW433 Programme was launched to support the market uptake of fuel cell micro-CHP, as a key decarbonization technology. So far more than 2500 applications for funding have been submitted.

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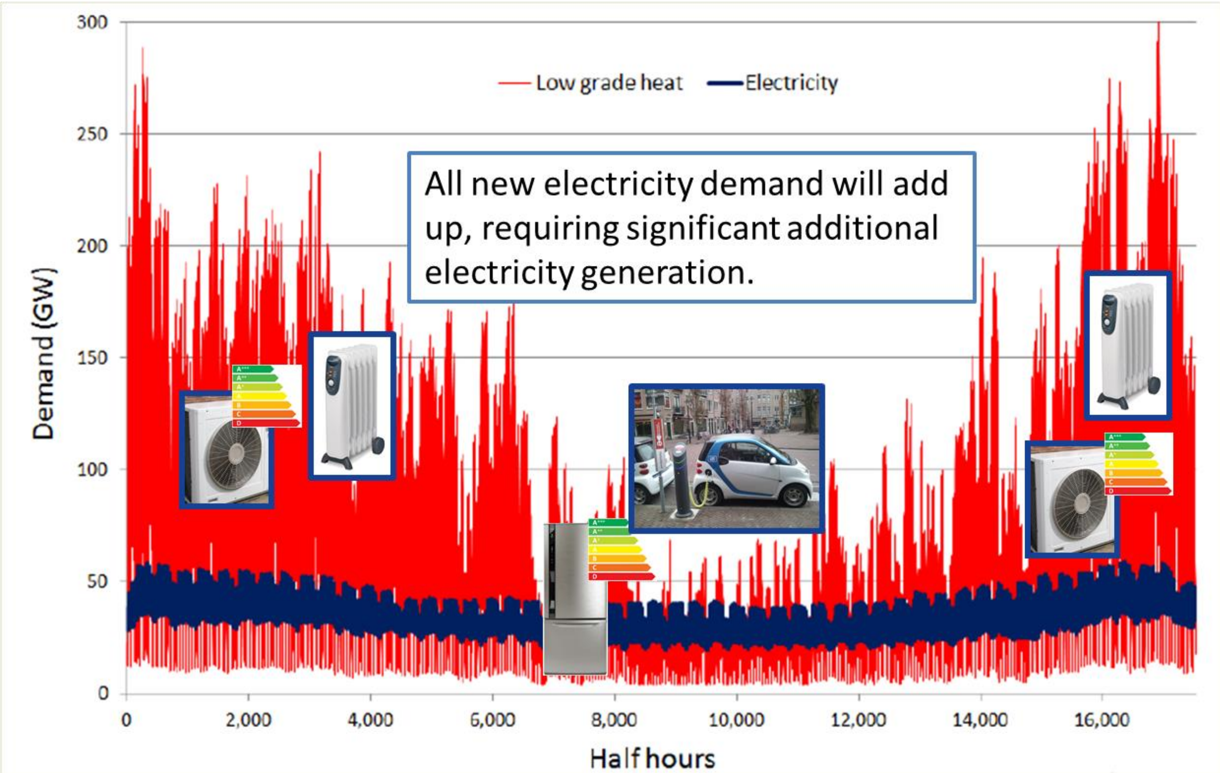
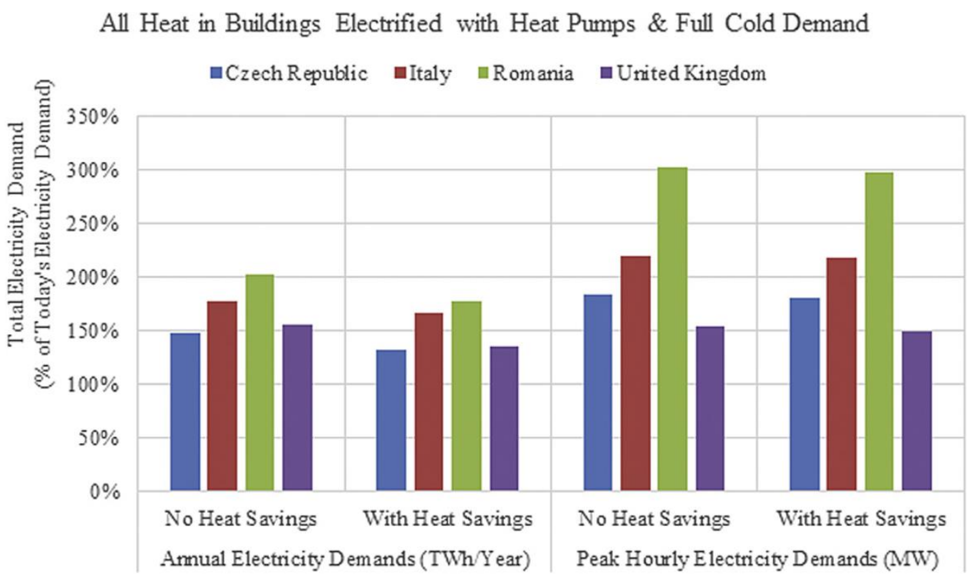
[28] Strategic Energy Technologies Plan. Actions 5 and 6

[29] ene.field and now PACE are the largest European demonstration projects of the latest smart energy solution for private homes, micro-CHP. ene.field and PACE will see over 3,500 households across Europe able to experience the benefits of this new energy solution. The projects use modern fuel cell technology to produce heat and electricity in households and empower them in their electricity and heat choices and bring together partners including European manufacturers, utilities, and research institutes making the products available across 11 European countries.

Annex VI: Why a marginal conversion coefficient and carbon intensity approach is more appropriate for space heaters



Source: D Connoly, February 2017 (Heat Roadmap Europe: Quantitative comparison between the electricity, heating, and cooling sectors for different European countries)



The marginal PEF takes into account that additional electricity generation/demand is met by dispatchable plants according to the merit order curve, whereas intermittent renewable electricity will be dispatched first, based on its low marginal cost, whenever it is available.

Marginal PEFs more appropriate for additional electricity demand/supply (e.g. power-to-heat or CHP) than the average electricity mix, which neglects the electricity mix at time of additional generation/consumption.

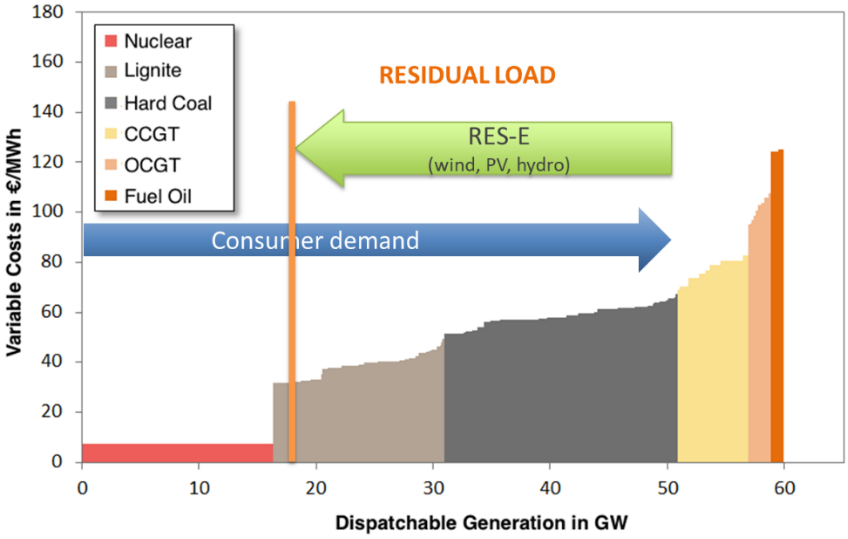


Figure 1: According to the merit oder, non-dispatchable renewable electricity (e.g. wind and PV) will be dispatched first based on their availability and low marginl cost

Figure 2: Additional demand, especially during peak demand times (e.g. in winter), will not generally be met by RES-E, but by the next peaking plants in the merit order. Assessing the marginal electricity mix will be key in identifying the impact of electrification in the heating sector in terms of efficiency and decarbonization. Correctly evaluating the magnitude of the marginal impact (via the right PEF), will allow to develop the tools o address it, thus properly rewarding potential market and technical solutions (e.g. demand response or seasonal storage of RES electricity via gas networks of heat storage).