Scoping study on the history and current context of Climate and Energy Model Regions

LINKS Working Paper 2.1

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1. Introduction: Austrian Climate and Energy Model Regions Program and its goals

The Austrian Climate and Energy Fund (KLIEN) was founded in the year 2007 (Climate and Energy Fund 2014). In the context of this fund, climate and energy model regions (CEMs) are instituted via a top-down initiative since 2009 as one particular instrument to foster the achievement of Austria's climate and energy goals. The Austrian and international policy process foresees that CEMs should take a leadership role in reaching Austria's ambitious climate goals (Climate and Energy Fund 2015b). These climate goals require, amongst others, that by 2020 34% of the gross final energy consumption in Austria have to be covered by renewable energy sources (RES) (European Parliament, 2009). The aim of the CEMs is to support this ambitious goal by striving to become independent of fossil fuels, based on a regional bottom-up approach. This bottom-up approach comprises of each CEM aiming to meet this target by setting its own goals and by implementing different, regionally tailored projects. The projects are based on the pillars of sustainability and efficiency and should lead to an accomplishment of fossil fuel independency by exploiting regional RES potentials and by fostering civil participation. These projects comprise measures of energy efficiency and RES development in all energy related areas, covering electricity, heat as well as mobility (Climate and Energy Fund 2014).

In this working paper we discuss the history and current context of the climate and energy model region (CEM) concept. We will present details regarding the implementation and funding of the CEM program in Austria as well as the monitoring process. A particular focus will be on the ambitious goal of achieving energy autarky in the model regions – is this political goal pursued by the model regions in reality and how do the specific regions define it? As a first result, we strive to present a realistic picture regarding the goal of becoming energy autarkic at the regional level. After presenting this detailed background information we set out to identify, based on different criteria – most importantly the cluster analysis conducted in the *LINKS Working Paper 1.1* – three case study CEMs for further consideration in LINKS and provide some background information on those.

2. Background

2.1. Climate Energy Model Concept

Until February 12, 2016, in total 138 different CEMs joined the CEM approach (See Figure 1). 29 CEMs left the program over the period from 2010 to 2016. The municipalities covered by two CEMs switched to another CEM over this time period, and two further CEMs have not started their work until February 2015. 107 CEMs are still operational in 2016 (See Figure 1). While we can identify a reduction in the annual number of CEMs joining the CEM program, and an increase in the number of CEMs leaving the CEM program since 2010, the absolute number of active CEMs has been relatively stable since 2013 (See Figure 1).

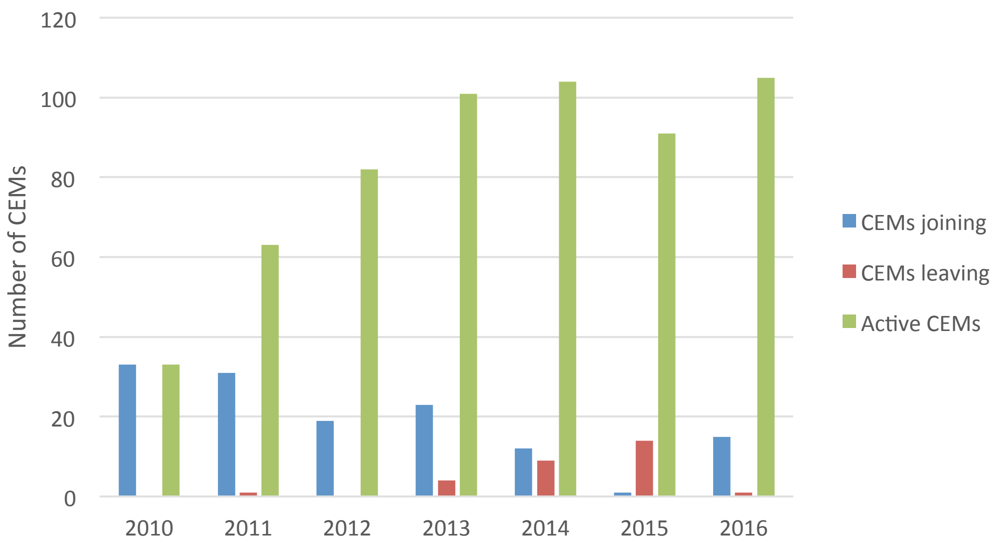

Figure 1: Annual change of participating CEMs

The number of municipalities, which have been active in CEMs from 2010 until 2016 in the respective years, can be seen in the maps of Figure 2.

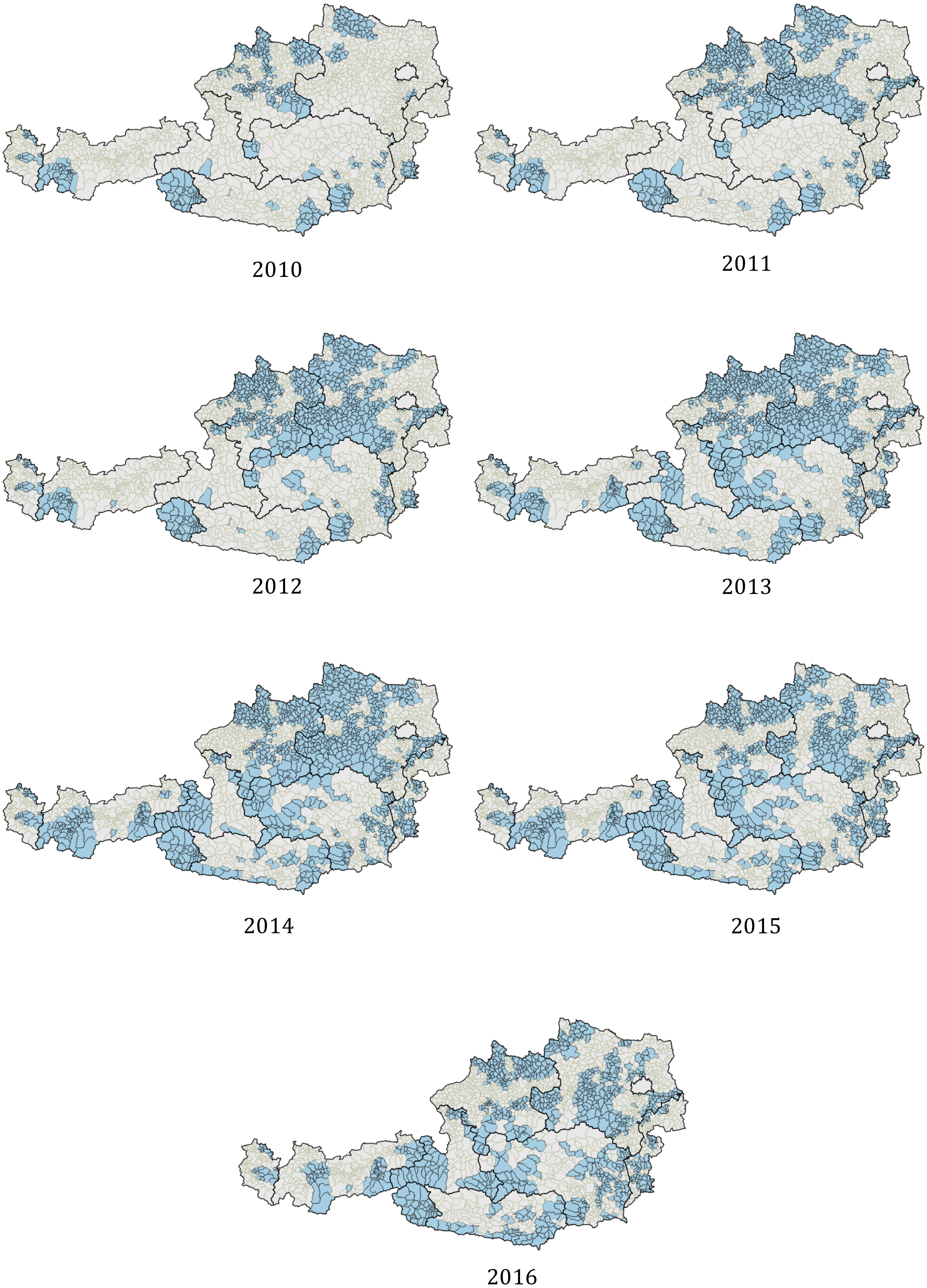

Figure 2: The active municipalities of the Austrian CEMs for the year 2010 to 2016. Source: own figure

By November 1, 2015 only 87 CEMs were operational in Austria and only 82 of those CEMs had an implementation concept. These 82 CEMs cover about 2.2 million inhabitants, 26% of Austria's population, and 37% of Austria's population living in intermediate density and thinly populated area, according to the European Commission's definition of the degree of urbanisation of local administrative units level 2 or municipality level (Climate and Energy Fund, 2014; European Commission and Statistics Austria, 2015). Additionally, the CEMs cover 42% of Austria's territory, as can be seen in Figure 3.

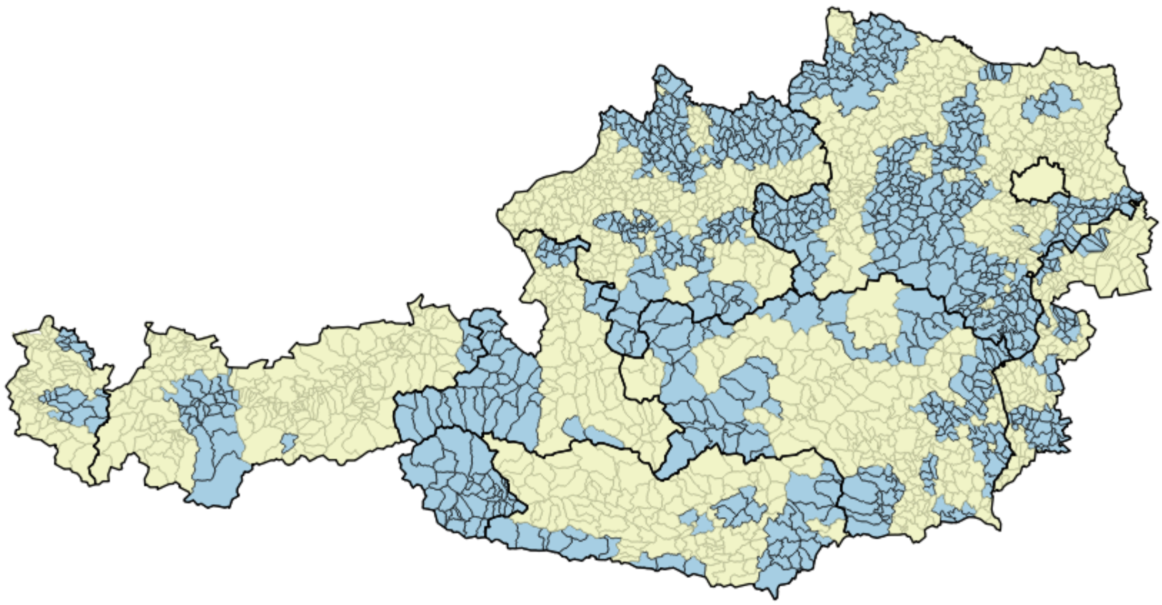

Figure 3 The municipalities of the 82 Austrian CEMs analysed in LINKS. Source: own figure

The process of becoming a CEM has changed in 2015 and starts now with an application of a group of municipalities. Before, also single municipalities, private businesses or consulting agencies were possible contractual partners. CEMs are ideally rural and structurally weak regions. New CEMs have to consist of at least two municipalities with a minimum number of 3,000 and a maximum number of around 60,000 inhabitants per region (in special cases this number can be exceeded or fall below). Being selected as a CEM by the KLIEN, the new CEM has to develop an implementation concept within the first year of the first phase of the CEM process. The second and third year of the first phase constitute the two-year implementation phase of the concept (see Figure 4). The implementation phase requires the definition and implementation of ten concrete work packages and the instalment of a CEM manager with at least a twenty-hour contract. In this phase a special focus rests on the introduction of a stakeholder network and an increase in awareness within the population in the municipalities (Climate and Energy Fund 2015b). This first implementation phase is funded by the KLIEN with a maximum of € 145,000 and requires a 25% co-financing by the municipality for the whole phase (personal communication with Christoph Wolfsegger 2015).

For the operationalization of this bottom-up approach a CEM manager is installed in each region, who is connected to the managers of the other regions within a network. This person has a key role for the success of the approach in each region and for the approach as a whole. The task of the CEM managers is to identify strengths of the regions in becoming fossil fuel independent and to first define and then implement work packages regarding energy efficiency and increased RES development (Climate and Energy Fund 2015b).

In the next phase, a three-year continuation phase, which requires a new application by the region, the CEM manager has again to identify and implement ten work packages. This continuation phase can be applied several times. The continuation phase is funded by the KLIEN for the whole period with a maximum of € 200,000 and again requires a 25% co-funding of the municipalities (personal communication with Christoph Wolfsegger 2015). There are further tasks required for a CEM to be eligible for the continuation phase. For each CEM a concluding KEM-QM, a quality management report based on the e5 methodology, is needed after the implementation phase and each continuation phase (see Figure 4; Climate and Energy Fund, 2015b).

For 2015, there is a total budget of € 10,000,000 available for the whole CEM approach. This budget provides € 1,000,000 for sample refurbishments of public buildings as well as € 500,000 for charging stations. Next to the overall financing of the model regions, the rest of the budget can be used for financing flagship projects and for investment support of photovoltaic plants (PV), biomass heating systems, thermal solar systems, sample refurbishments and charging stations for e-vehicles for public buildings and the general public. These investments are funded with € 1,750,000 per year by the Austrian program of rural development by funds of the EU and the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) (Climate and Energy Fund 2015b). However, as a large part of the budget is used up for the financing of the implementation and continuation phase, it is also necessary to find external investors for flagship projects and further investments (personal communication with Christoph Wolfsegger 2015).

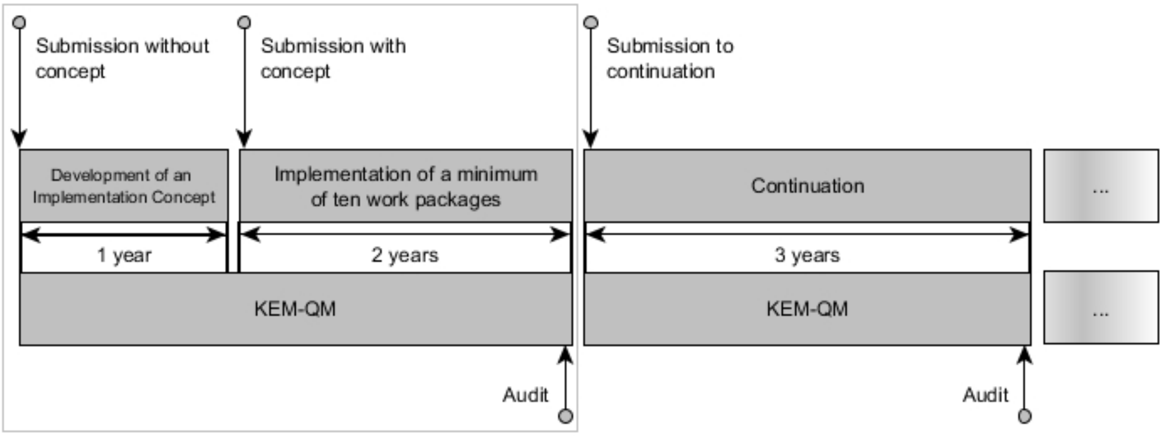

Figure 4 The CEM process

Source: Own diagram based on KLIEN (2015)

As mentioned above, a current implementation or continuation concept is required from each CEM. Therefore, all Austrian CEMs have to develop an implementation concept within the first year of participating in the CEM program. This implementation concept should cover information on the region itself, energy data, targets and potentials as well as measures, which will be implemented to achieve the proposed goals. There are guidelines regarding the structure of the concepts, though they appear not to be very strict. Hence, the 94 implementation concepts available at the homepage as of January 1, 2015, (klimaundenergiemodellregionen.at, accessed 3 December 2015) vary greatly in length, content, structure, and detail of data.

The official guideline requirements from 2015 are to identify specific location factors in the regions, undertake a SWOT-analysis, and assess the current energy situation both qualitatively and quantitatively, including also RES potentials or a CO_2 balance. Furthermore, the concepts should contain general guidelines and strategies for their implementation, the envisioned management structures, and information on the at least ten working packages covering measures to implement targets. Finally, the concepts should include information about public participation and public relations as well as the acceptance within the municipalities (Climate and Energy Fund 2015b). The great differences in the structure of the concepts can partly be explained by changing guidelines, since the available concepts are from the years 2010 to 2014.

In January 2015, officially 104 regions were part of the program, but the number changes often as contracts expire and others are established, as discussed before in section **Error! Reference source not found.**. Of the 99 CEMs listed at the official website (accessed 3 December 2015), 94 have a publicly available implementation concept, but only 82 of those with concepts are included in a list with municipality codes at the cut-off date November 2015. In this section, the 82 available implementation concepts of the CEMs which were part of the program in November 2015 are assessed regarding energy data, potentials and targets.

Some of the concepts were developed by consulting agencies or other private institutions. Concepts developed by the same agency are usually very similar in structure, e.g. concepts by 4wardenergy - Kommunalkredit Public Consulting GmbH, which developed the concepts of twelve CEMs, mainly in Styria and Burgenland, or by Energieagentur der Regionen, which assisted eleven regions in Lower Austria in developing their concepts. Some CEMs were also supported by existing structures within the regions, e.g. from the Leader program.

The implementation concepts are very heterogeneous regarding the energy data, both in acquisition and in detail. Mostly, the data on current energy demand are based on a survey, which was then projected to the whole region. Often, statistical data on the federal province or on the NUTS 3 level were used to fill gaps. Nearly all regions specify energy demand for electricity, heat and mobility, considering different sectors, e.g. private households, industry, agriculture and the public sector.

Of the 82 analysed concepts, 64 provide comprehensive data regarding their energy demand. The remaining 18 regions do not distinguish between electricity, heat and mobility, state contradicting data or provide no quantitative data at all. The concept of the CEM Hartberg, for example, contains a CO_2 balance, but no quantitative energy demand or supply.

2.2. Energy autarky concepts

The RES goals of the Austrian government as well as the goal of some CEMs to become independent of fossil fuels require a definition of energy autarky (Kettner et al., 2010; Climate and Energy Fund, 2014). To that end, the CEM managers are instructed by the KLIEN to use the definition of Jamek et al. (2014).

The definition of energy autarky used by the CEMs includes the sectors electricity, heat and mobility and strives for a largest possible independence of the regions from fossil fuels in regional energy production and in its energy imports. Jamek et al. (2014) state that this should not be translated into a state of isolation from international markets. Its aim should rather be to develop the different RES potentials in each region and to improve energy efficiency. Another aim should be to create a network between different regions, to produce the energy where potentials are available and can be exploited not only in an economically efficient but also ecologically compatible and sustainable way.

Hence, energy autarky, according to this definition, should be balanced across Austria or a certain CEM over a certain period (Jamek et al. 2014). Furthermore, this definition does not imply that Austria as a whole has to serve its energy demand at each point in time within the period under consideration by itself, rather net exports should be zero or positive on a net basis across the whole period. This definition of balanced energy autarky is especially sensible when fossil fuel imports regarding the mobility sector are considered (at least in the medium term) as it is done by Streicher et al. (2011). In the earlier stages towards energy autarky (on a net basis), net energy imports should also be possible for Austria as a whole, but they should be minimized over time.

Such definitions of balanced energy autarky are also used in other studies. Streicher et al. (2011), for example, used a similar definition in regard to achieving energy autarky by the year 2050. As energy autarky needs time for adjustment, their definition requires that Austria is able to produce its whole energy demand on its own in 2050. However, also Streicher et al. (2011) point out that their definition does not imply that energy demand is completely met by domestic production. They also include energy imports and exports, which have to be balanced over the whole period.

Another similar definition of energy autarky is stated by Müller et al. (2011), which again define energy autarky as a situation where a majority of energy is produced by local resources. However, they also state that a region is an open system with exchange of people and resources. This definition should therefore also be understood as a transition towards a more sustainable decentralized society, which increases energy efficiency and uses endogenous potentials, instead of isolated regions.

The term energy autarky was especially used in Austria in regard with the previously stated definitions. Despite that, it is important to note that recently the term energy autarky has disappeared from the discourse (Stanzer et al. 2010). A turning point was the change from Dipl.-Ing. Nikolaus Berlakovic to Dipl.-Ing. Andrä Rupprechter as Austrian minister of the BMLFUW in 2013. Since then, the concept of energy autarky has been replaced in the political discourse by concepts such as energy transition, energy self-sufficiency or by the more general terms energy efficiency and RES development. One reason for the change in the wording was that energy autarky could have been mistaken for energy isolation, which has actually never been a goal communicated by the KLIEN for its CEMs (personal communication with Christoph Wolfsegger, 2015; Stanzer et al., 2010).

2.3. The Austrian energy transition approach in the international context

Few studies exist on the CEM approach and the feasibility of an Austrian energy sector transition towards a higher share of RES and increased energy efficiency. Apart from the Austrian example of the CEM program there are also some other examples of energy autarky and energy transition in Austria, but also in the international context.

An example of such energy transition programs is the e-mobility model region approach in Austria, which was initiated by the KLIEN in collaboration with the BMLFUW. In August 2015, this program included seven, foremost urban but also some rural regions. The aim of this program is to collect information about future potentials in different living spaces (Climate and Energy Fund 2015a). In the context of energy transition, there are also some other approaches implemented in Austria, such as the klimaaktiv and leader programs. Furthermore, there are initiatives on municipal level e.g. e5 or EGEM initiated by the federal states.

Next to the Austrian CEMs, there exist international examples of energy model regions, such as the German bio energy villages and the Swiss energy regions. The German bio energy village program has a different, but similar objective as the CEM program. The aim is to meet, if possible, the largest part of electricity and heat demand of the different regions by biomass technology and to simultaneously reduce the dependency on scarce resources such as fossil fuels (Ruppert et al. 2008). The second approach, initialised by the Swiss Federal Offices for Spatial Development, Energy and Agriculture, and the State Secretariat for Economic Affairs, is based on the Austrian and German approaches and has a broader objective, as it allows for different strategies in the scope of energy efficiency and RES development, which goes from simply increased energy self-sufficiency to even energy export-regions. The Swiss approach understands energy autarky as a long-term adjustment towards energy self-sufficiency (Ribi et al. n.y.). Müller et al. (2011) have summarized the different programs in Austria, Germany and Switzerland, and give a broader overview about the existing structures in 2011.

Kettner et al. (2012) investigated energy transition in Austria on the basis of five case study CEM implementation concepts. This study employs a CGE model, which investigates the effects of different CEM measures stated in the implementation concepts, projected on federal state level. They conclude that under their assumptions, a national increase in GDP and employment is possible, but there are huge differences on federal state level, which also lead to negative outcomes for some Austrian regions.

In a follow-up study, Kettner et al. (2015) extend the number of case study CEM implementation concepts to 22, which are then used for the projection on federal state level. The study again accounts for the potential effects of different measures on the Austrian economy. For their approach they use the ASCANIO model, an Input-Output model of Austria, and include two different scenarios, which cover the differences in ambitiousness of the measures in the different regions. They find that large energy savings are possible in both scenarios, which leads also to an increased labour force and gross value added. However, these positive effects also require large investments and a change in behaviour.

Other studies investigate the technical and economic feasibility of energy transition in Austria on different regional levels. Stanzer et al. (2010) did a feasibility study of Austria's RES potentials at the district level for the base year 2007 and calculated two different scenarios of possible RES implementations until 2012 and 2020. They find that starting from 2007, in an optimistic scenario, electricity autarky could be possible in 2020 for most districts, while only a 60% self-sufficiency in the heat sector could be reached.

The study of Streicher et al. (2011) on the contrary, did not analyse the accessible degree of self-sufficiency in a certain year, but rather how a transition towards a low carbon society of maximum 20% of the GHG emissions of the year 1990 can look like. Streicher et al. (2011) conclude that such a transition could be possible for 2050 under the anticipated technological progress and energy demand reductions.

2.4. Energy autarky in the CEM concepts

In this section, 82 implementation concepts[1] of the CEMs which were part of the program in November 2015 are assessed regarding energy data, potentials and targets. Table 1 summarizes our analysis of the CEMs' energy production potentials. The average values, given as the percentage of energy production potential relative to demand, lie distinctly above 100% in the case of heat and electricity. Hence, the average CEM has the potential to become energy self-sufficient in heat and electricity according to the data presented in the implementation concepts. The potential to generate energy for mobility, e.g. biofuels, is much lower. With energy autarky defined as balanced autarky, however, it is possible to export electricity to import fossil fuels. Electricity can also be used directly in the mobility sector in the form of e-mobility. Therefore, the Austrian CEMs can potentially become energy autarkic, with the energy production potential being 1.6 times as large as energy demand. The variance in the values is very high, represented by very low minimum levels and very high maximum levels (not taking mobility into account,

[1] Each CEM has to develop an implementation concept within the first year of participating in the CEM program. This implementation concept should cover information on the region itself, energy data, targets and potentials as well as measures, which will be implemented to achieve the proposed goals. In January 2015, officially 104 regions were part of the program, but the number changes often as contracts expire and others are established, as discussed before in section 2. Of the 99 CEMs listed at the official website (accessed 3 December 2015), 94 have a publicly available implementation concept, but only 82 of those with concepts are included in a list with municipality codes at the cut-off date November 2015.

where the minimum level is 0). The median, however, still shows a potential for energy autarky in electricity production and with 95% a high degree of potential self-sufficiency in heat production.

Table 1: Potential energy production relative to energy demand

	Total	Heat	Electricity	Mobility
Data Coverage (% of concepts)	78%	80%	84%	35%
Average	160%	124%	426%	36%
Median	86%	95%	110%	4%
Minimum	17%	12%	10%	0%
Maximum	1112%	477%	4765%	160%

Table 2 shows the treatment of the term "energy autarky" in the implementation concepts in regard to the CEMs' starting year. In 20 of the 82 analysed CEM implementation concepts from the time period 2010-2014, the term energy autarky is not mentioned at all. In those concepts sometimes a different wording is used, e.g. energy self-sufficiency. In 30 concepts, the term energy autarky is mentioned but the term is not defined in more detail. The further treatment of the term in the implementation concepts, however, suggests that energy autarky is implicitly understood as balanced autarky, even if not explicitly stated. 32 CEMs provide a clear definition of energy autarky in their concepts that match the definition of balanced autarky by Jamek et al. (2014), only with slightly different phrasings.

Table 2: Mentioning and definition of the term "energy autarky" in CEMs' implementation concepts

Year	No mention	No definition	Definition	Total
2010	5	11	5	21
2011	7	10	3	20
2012	4	3	8	15
2013	2	4	12	18
2014	2	2	4	8
Total	20	30	32	82

Figure 5 emphasizes this circumstance: Even without mentioning the term energy autarky (one CEM) or defining it in detail (five CEMs), six CEMs nevertheless state a target of producing more than 100% of the energy demand in the region. In addition, 15 CEMs, again without mentioning the term energy autarky (six CEMs) or defining it in detail (nine CEMs), state at least a target towards energy self-sufficiency by relying on regionally produced RES energy. On the other hand, seven CEMs that did define the term energy autarky and 14 CEMs that at least mention the term did not define any specific targets at all in their implementation concepts.

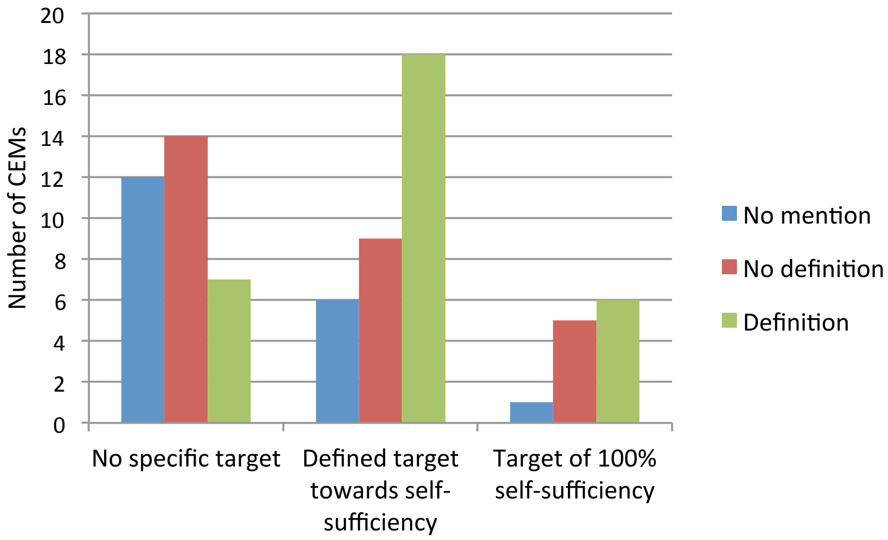

Figure 5: Contingency table – Energy autarky definition and energy self-sufficiency target

Table 3 gives an overview of the CEMs' mentioning of quantitative potentials and targets regarding energy autarky. It shows that 37% and 46% of all analysed CEMs, have the potential to become energy autarkic in heat and electricity, respectively. Only 2% have the potential for becoming energy autarkic in the mobility sector, which is highly dependent on fossil fuels.

Only 15% of the assessed CEMs indicate quantitative targets for becoming energy autarkic overall, i.e. to produce enough energy to meet the demand for electricity, heat and mobility (Table 3). It is to be noted that the goals are based on a definition of energy autarky that allows for energy trade with other regions and trading e.g. excessive electricity for biofuels. 23% of the CEMs aim to become energy self-sufficient in electricity and 24% in heating energy. Only 9% have the target of producing enough energy for the mobility demand. In some cases, this target for the mobility sector can only be met by using excessive electricity for the gap in the production of biofuels, hence fostering e-mobility.

Table 3: Energy autarky potentials and targets

	Total	Heat	Electricity	Mobility
Share of CEMs with potential	77%	80%	84%	35%
Share of CEMs with autarky potential	29%	37%	46%	2%
Share of CEMs with target	56%	45%	45%	24%

Share of CEMs with autarky target	15%	23%	24%	9%

3. Methodology

In this project a case study approach is deployed to assess the social acceptance and political commitment for regional energy transitions and to identify drivers of this commitment. The case study approach helps to understand complex social phenomena and to retain holistic and meaningful characteristics of real-life situations (Yin, 2003).

3.1 Criterions for selecting case study regions

3.1.1. Economic and energy related characteristics of CEMs

A cluster analysis is used to facilitate the case study selection process, as grouping the very heterogeneous CEMs allows for better assessing their characteristics and differences. The cluster analysis is based on economic data and energy data; the variables used in the cluster analysis are listed in Table 4. All variables are given in relative numbers to enable the comparison of CEMs with different sizes. The cluster analysis uses standardized values, so that variables with different ranges are treated equally. For more details on the cluster analysis see *LINKS Working Paper 1.1*.

Table 4: Variables for cluster analysis

Variables	Units	Source
Population density	inhabitants/ha	Statistics Austria (2013, 2015)
Gross value added per capita	€/capita	STATcube (2015a); Statistics Austria (2014a, 2014b)
Employees primary sector	%	Statistics Austria (2014a, 2014b)
Employees tertiary sector	%	Statistics Austria (2014a, 2014b)
Energy consumption	MWh/capita	CEM implementation concepts
Potential electricity self-sufficiency	%	Stanzer et al. (2010)
Potential heat self-sufficiency	%	Stanzer et al. (2010)

The three clusters that were finally obtained contain 78 CEMs and are named "suburban", "semi-rural" and "rural" cluster, respectively. They are distributed across Austria as shown in Figure 6. The average values, the total population and gross value added, as well as the number of CEMs in each cluster, are presented in detail in *LINKS Working Paper 1.1*. The relative values of the used variables for each cluster, the standardized mean values, are shown in Figure 7.

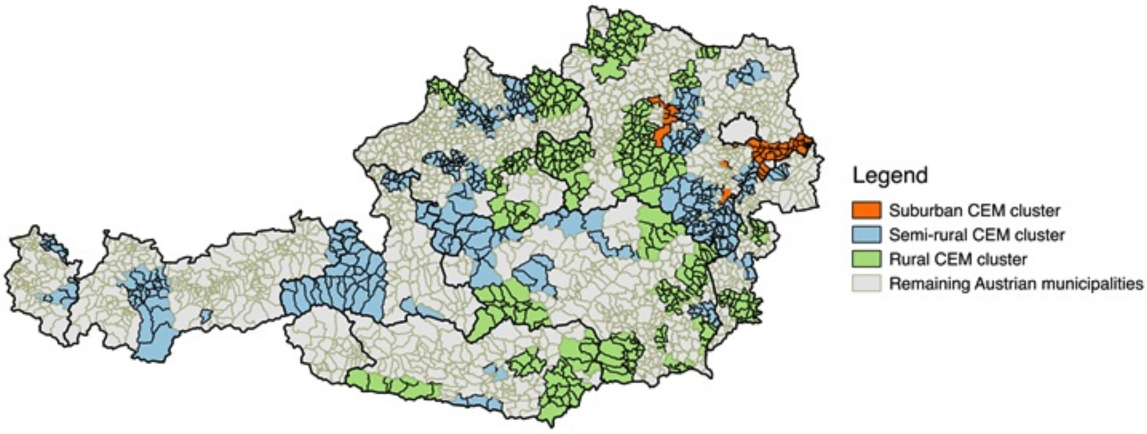

Figure 6: Mapping of clusters of Austrian CEMs

The suburban cluster is the smallest one, with only six of the 78 CEMs (8%). Its high population density gives it a share of 12% of the CEM population. The gross value added (GVA) per capita is also the highest in this cluster, yielding a share of 20% of the total GVA of the 78% CEMs. The semirural and rural clusters are closer to each other, with the highest population in the rural cluster and a somewhat larger GVA in the semirural cluster.

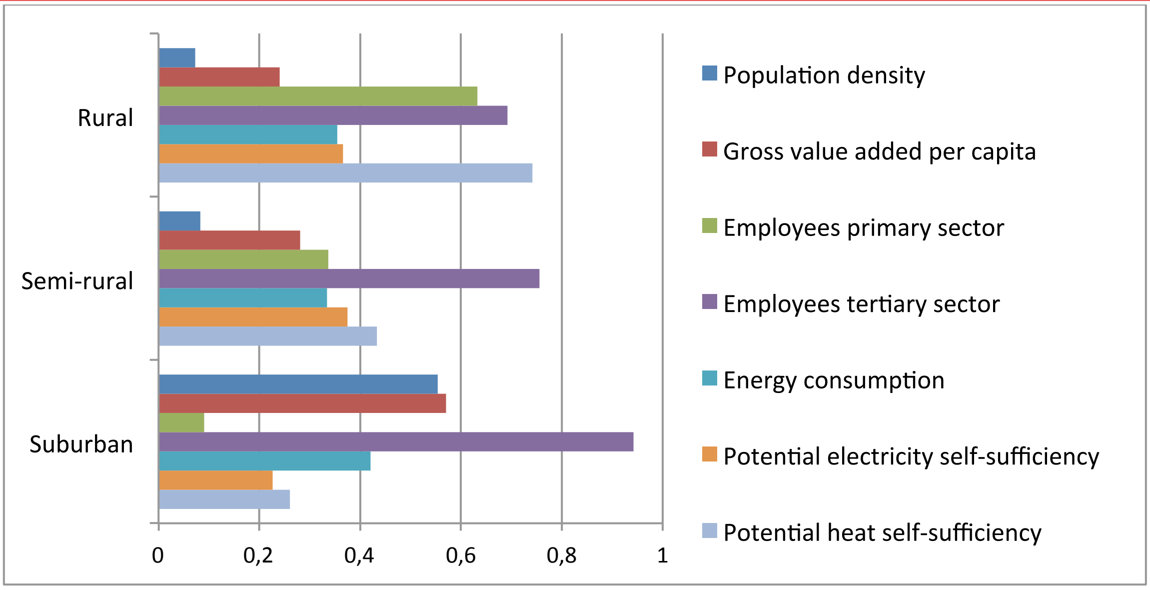

Figure 7: Results CEM clusters – standardized mean values

Regarding the regional distribution of the clusters, Figure 8 shows the clusters assigned to the Austrian federal provinces. It is interesting to note that all suburban CEMs are in Lower Austria, close to Vienna as indicated earlier in Figure 6. Furthermore, all the CEMs of the most western provinces Vorarlberg, Tyrol and Salzburg are included in the semi-rural sector. Rural CEMs are mostly found in Styria, Carinthia and Lower Austria. Upper Austria and Burgenland have similar shares of semi-rural and rural CEMs.

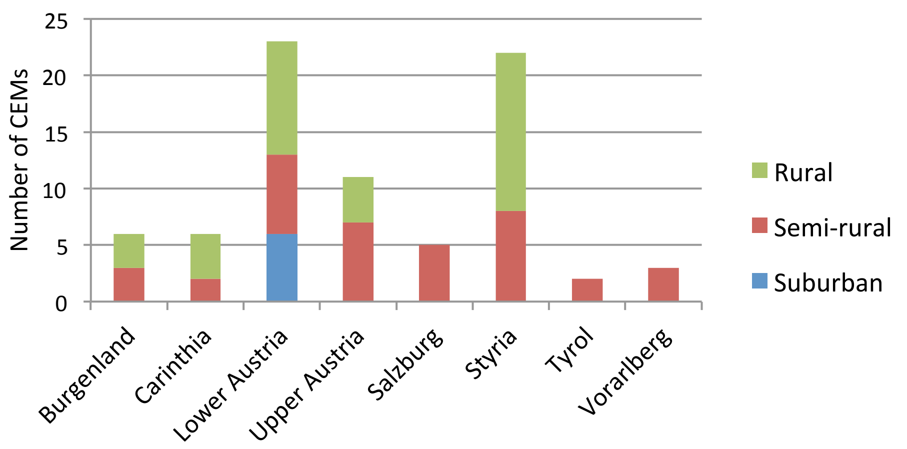

Figure 8 CEM clusters in Austrian federal provinces

3.1.2. Energy autarky targets in CEMs

Apart from energy and economic characteristics, also the treatment of energy autarky differs across the clusters. Figure 9 shows how the term energy autarky is included in the clustered

CEMs' implementation concepts. In the suburban cluster there is no CEM giving a definition of energy autarky in their concept, while two thirds at least mention the term. One third does not even mention it. Since the suburban cluster consists of only six CEMs, however, this means in absolute numbers that only two CEMs do not mention energy autarky, while four do. In the semi-rural and rural cluster, over 40% of the CEMs provide a definition of energy autarky. This definition is usually a form of balanced autarky.

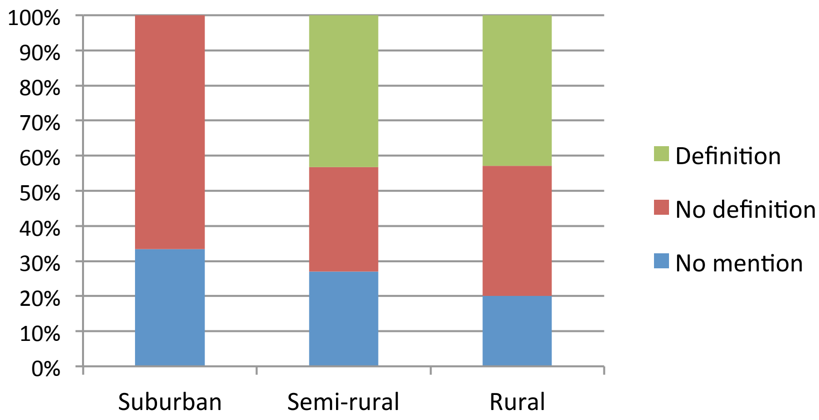

Figure 9: Treatment of term "energy autarky" in CEM clusters, based on implementation concepts

Considering the RES energy targets of Austria's CEMs (see Figure 10) it becomes clear that the lack of a proper definition of the term energy autarky (Figure 9) does not mean that it is not a goal – especially in the suburban cluster, half of the CEMs have the target of 100% self-sufficiency, i.e. energy autarky, without explicitly mentioning and defining energy autarky. In the semi-rural and rural clusters this is different: While in both clusters more than 40% of the comprising CEMs provide a definition of energy autarky, only about 15% set it as a real target.

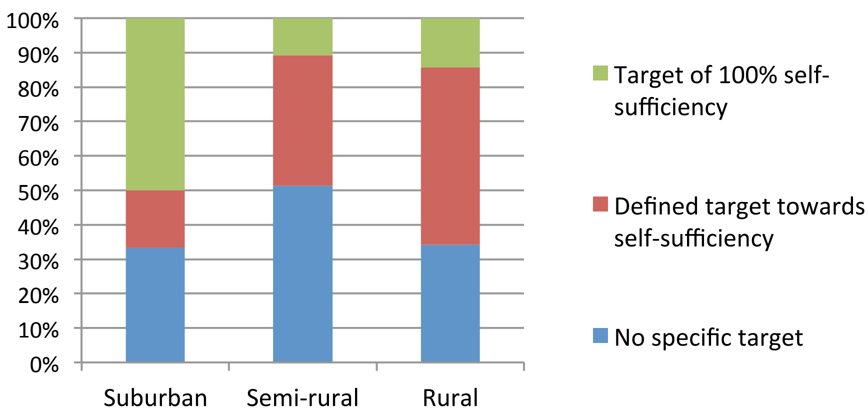

Figure 10: Energy targets set by CEM clusters

3.1.3. Year of joining the CEM program

Another criterion for selecting case study CEMs for the further socioeconomic assessment in LINKS is the year of joining the CEM program, as we aim at having a representative selection of case study regions across the time period from the start of the program up to now. As it was done in Figure 1 for all 138 CEMs, Figure 11 shows the 82 clustered CEMs according to their year of joining the CEM program. It can be seen that the number of new CEMs per year has been declining. It is to be noted, however, that only CEMs that were still members of the program in November 2015 are considered in this figure. Furthermore, it is clear that the suburban CEMs joined in 2011 and 2012 only, while rural and semi-rural CEMs are quite evenly distributed over the years, with a slight majority of rural CEMs in 2010 and 2014.

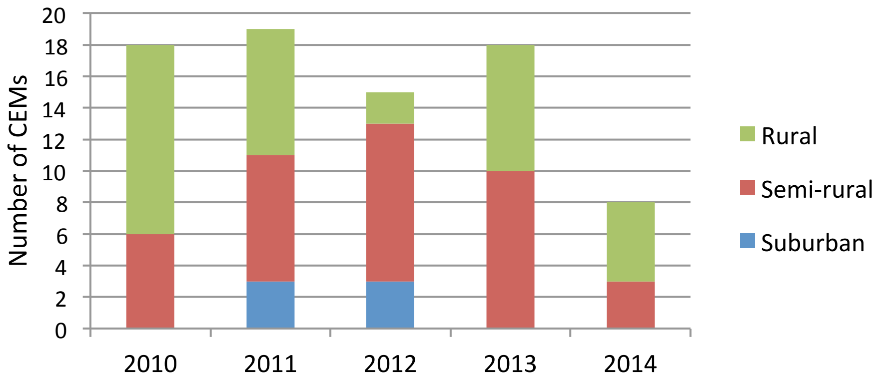

Figure 11 CEM clusters after year of joining

3.1.4. Flagship projects and participatory governance

For the selection of the case study regions, CEMs, which implemented participatory flagship projects were identified. Flagship projects last for one year and involve one or more CEM regions and focus on specific topics like e-mobility, storage technology, financial instruments for easier project implementation. Projects on citizens' participation and participatory governance are scarce in the past few years: on example is the "EnergieVehikel" a joined flagship project of several CEMs in Lower Austria strives to bring together different stakeholders on local level to discuss regional conflicts concerning RES. Additionally, CEMs that installed other participatory processes (e.g. round tables with citizens, workshops and many more) were selected.

This led to a preliminary list of ten possible CEMs, which acted as a starting point for a discussion with Christoph Wolfsegger, the project manager for Climate and Energy regions of the Climate and Energy Fund who assisted with his knowledge in identifying the case study regions. In a joint discussion we selected one case study region for each cluster (rural, semi-rural, suburban), which vary regarding population, economic situation, governance, number of participating municipalities and thematic focus.

3.2. The three case study CEMs

Taking into consideration the criteria presented above we identified "Modellregion Badener Energiekur", "Region Ebreichsdorf", and "Region Freistadt" as our case studies for further consideration in the LINKS project (see Figure 12). While Table 5 summarizes some basic characteristics of the case study CEMs, we present some more details for each of the three case study CEMs in the following chapters (including a detailed stakeholder mapping), as well as a comparison of economic and energy data in section 5.

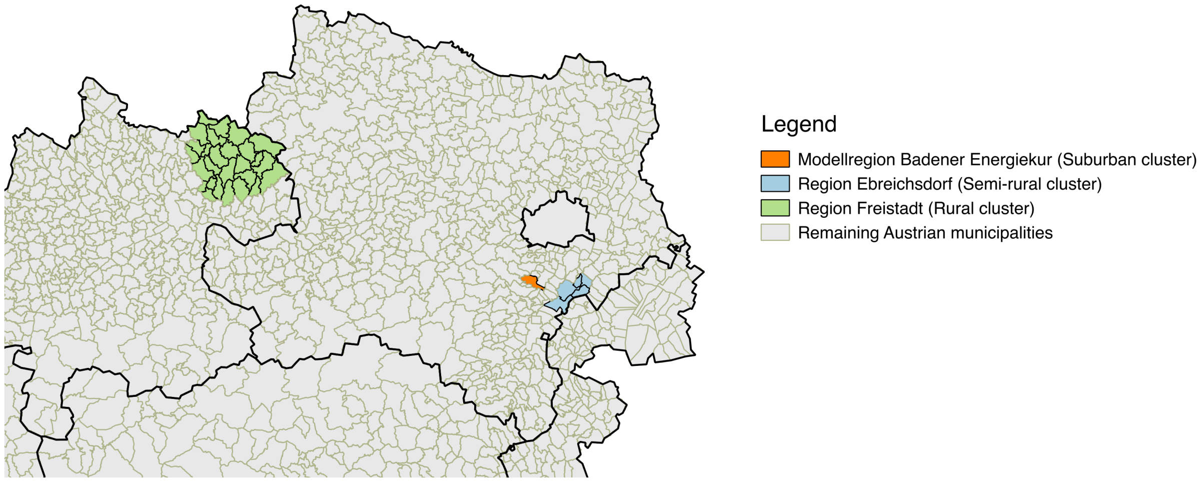

Figure 12: Mapping of the three case study regions

As indicated in Table 5 and Figure 12, the CEM Freistadt is a rural CEM in the North of Upper Austria. The CEMs Badener Energiekur and Ebreichsdorf, on the other hand, are suburban and semi-rural CEMs respectively, located in Lower Austria, South of Vienna. They are both part of the same political district, Baden. The suburban CEM Energiekur Baden consists of only one densely populated municipality and the CEM management is located within the municipal administration. CEM Ebreichsdorf, the case study representing the semi-rural cluster consists of five municipalities (since March 2016 10 municipalities) and became a CEM in 2009. The rural case study CEM Freistadt is one of the biggest CEMs regarding population and participating municipalities and builds on a long history of energy projects and bottom-up processes. None of the three case studies gives a definition of the term energy autarky in the implementation concept, although Baden aims a total energy self-sufficiency above 100%. Freistadt has specific energy targets as well, which do not account for full energy self-sufficiency.

Table 5: Basic information of the three case study regions

	Modellregion Badener Energiekur	Region Ebreichsdorf	Region Freistadt
CLUSTER	Suburban	Semi-rural	Rural
START YEAR OF KEM	2011	2012	2010
TOTAL POPULATION	25,093	21,491	65,113
AREA	2,688	13,174	99,410
TOTAL GROSS VALUE ADDED [MIO €]	900.25	387.67	1,132.12
POPULATION DENSITY [CAP/KM^2]	933	163	66
GROSS VALUE ADDED PER PERSON [€]	35,876.47	18,038.73	17,386.94
EMPLOYEES IN FIRST SECTOR [%]	3.2	3.2	15.9
EMPLOYEES IN SECOND SECTOR [%]	26.4	26.4	22.9
EMPLOYEES IN THIRD SECTOR [%]	70.4	70.4	61.2
ENERGY CONSUMPTION [MWH]	34.52	27.68	19.14
POTENTIAL FOR SELF SUFFICENY (ELECTRICITY) [%]	25.50	25.50	74.50
POTENTIAL FOR SELF SUFFICENY (HEAT) [%]	37.00	37.00	87.00
DEFINITION OF ENERGY AUTARKY	No definition	No definition	No definition
GOALS FOR ENERGY AUTARKY	More than 100%	No goal	Less than 100%

3.3. Methods for a detailed case study analysis

3.3.1. *Literature review and media analysis*

The research process started with an extensive literature survey to generate background information on different CEM regions, their history, activities and governance schemes. Various sources of information were used e.g. scientific literature, press releases and newspaper articles, web pages of CEMs and Climate and Energy Fund and PR-material. News archives of local and national newspapers were searched by using specific keywords for every CEM. This review also acted as a basis for the case study selection, mapping of relevant stakeholder and supported the development of the interview protocol.

3.3.2. Stakeholder mapping

The stakeholder mapping defines relevant stakeholder groups on different regional levels based on the literature review. In addition to providing an overview of involved groups, the stakeholder mapping also acts as a basis for identification of relevant interview partners. During the interviews the stakeholder mapping is evaluated and revised in an iterative process.

3.3.3. Interviews

Interviews with stakeholders help to gain a comprehensive understanding of activities and the process of decision-making in the CEM regions. Based on the results of the literature review an interview protocol for CEM managers was developed, which is divided in two main parts (see Appendix). One part covers general questions on the implementation of the CEM process in the region, the decision making process, former and on-going projects and communication strategies with stakeholders and residents. The second part comprises CEM specific questions on individual projects or salient processes based on the literature survey. The interview protocol consists mainly of open-ended questions in order to encourage the interviewee to express their opinion, ideas and thoughts in an open and honest way. Conducting several in-depth interviews with different stakeholders helps to better understand local processes, activities and problems regarding energy transitions and the deployment of renewable energy sources. All interviews were fully transcribed.

3.4. Methodological approach in case regions

3.4.1. Freistadt

Literature Survey and Media Analysis

In addition to scientific literature (Mautz 2014, Boeschen 2014, Guenther 2015) a comprehensive survey of grey literature was conducted. The main sources of information were webpages by the EBF, Climate and Energy Fund, Helios GmbH. Furthermore, archives of local newspapers (OÖ Nachrichten, Tips) and national newspapers (derStandard.at, diePresse.at) were used to gain a deeper understanding of the CEMs activities, main topics and its communication strategy. Keywords for this media analysis were "EBF", "Energiebezirk Freistadt" and "Helios" for which more than 100 newspaper articles in total could be found from 2008-2016. Further information came from the "Energieblicke", a leaflet published by the CEM Freistadt regularly to inform the residents of ongoing activities and events.

Stakeholder mapping

The literature review informed the stakeholder mapping and helped to identify potential interview partners. After the interviews and observation, the stakeholder mapping was validated and revised.

Interviews

After this media analysis an in-depth interview with the current CEM manager was conducted according to the interview protocol (see Appendix). This face-to-face interview was around two hours long and took place in the EBF office in Freistadt. In addition to this formal interview further information was collected in a few informal discussions with members of EBF, energy groups and residents.

Observation

We observed four stakeholder events and meetings in the CEM region on March 31, 2016. In the first meeting the CEM management informed local head officials about the planned future initiative on e-mobility, e-car sharing and funding options and elicited their interest in an e-mobility focus. The second meeting was a networking event for energy group speakers and members of local environmental panels, in which the EBF manager presented the future focus on e-mobility to them. In addition to this two events, we observed a general assembly of one local energy group (Neumarkt/Mühlkreis) and a public lecture of the Upper Austrian climate protection agent. The observations followed several key questions e.g. on topics, time management, participants, mode of discussion, conflicts, the participants' possibility to contribute and many more (see Appendix).

3.4.2. Modellregion Badener Energiekur

Literature Survey and Media Analysis

The main sources of information were webpages by the Municipality of Baden, Climate and Energy Fund. Furthermore, archives of regional newspapers (NÖN, Bezirksblatt) were used to gather further information. Keywords for this media analysis were "KEM Baden", "Klima und Energiemodellregion" and the name of the current CEM manager. In the NÖN there were in total 25 hits for these keywords.

Stakeholder mapping

The literature review informed the stakeholder mapping and helped to identify potential interview partners.

Interviews

After this media analysis an in-depth interview with the current CEM manager was conducted according to the interview protocol (see Appendix). This interview lasted for about 1.5 hours and was fully transcribed.

3.4.3. Ebreichsdorf

Literature Survey and Media Analysis

The main sources of information were webpages by the Energiepark Bruck an der Leitha, Climate and Energy Fund. Furthermore, archives of regional newspapers (NÖN, Bezirksblatt) was searched according the keywords "Ebreichsdorf", "KEM", "Klima und Energiemodellregion" and the name of the current CEM manager. In the NÖN there were no relevant hits for this keywords and in the Bezirksblatt four articles could be found.

Stakeholder mapping

The literature review informed the stakeholder mapping and helped to identify potential interview partners.

Interviews

After this media analysis an in-depth interview with the current CEM manager was conducted according to the interview protocol (see Appendix). This interview lasted for about 1.5 hours and was fully transcribed.

4. Results

4.1. Freistadt

The CEM Freistadt lies at the Northern border of Upper Austria and is equivalent to the political district Freistadt, containing 27 municipalities, which are structurally diverse. It is one of the largest CEMs regarding both inhabitants and area. 42% of the area is covered with forests and 53% are agricultural land, resulting in high biomass potentials within the region. The economy is dominated by small-scale firms, the majority being one-man operations. Unemployment is at 3.5% (September 2009) quite low, but the rate of commuters is high: 28.77% commute daily to Linz.

The CEM is separated into two LEADER regions, Mühlviertler Kernland and Mühlviertler Alm. Furthermore, all 27 municipalities are members of the Klimabündnis program and the majority takes also part in the EGEM program of Upper Austria. Starting with the third CEM period in 2015, EBF is now a public partnership between 27 municipalities. Until 2015 also private businesses were members of EBF and were represented in the board. After changes of the Climate and Energy Funds regarding the legal constitution of CEM regions, private involvement is not possible anymore. The main reason for this development is an easier acquisition of money from various sources especially from the European Union (Climate and Energy Funds 2015c, 6). CEM Freistadt focuses mostly on photovoltaics and hosts Austria's biggest solar plant financed by citizens' participation.

History and Background

In 2005, dedicated members of the local waste association established in a bottom-up approach the "Energiebezirk Freistadt" (EBF), an association that strives to increase energy efficiency and RES usage in the region. In addition to promoting a regional energy transition, the goal was to create new jobs by using the district's high biomass potential and to reduce the big share of commuters to the Upper Austrian capital Linz. One major trigger for the development of the EBF was the perceived insecurity of the nearby nuclear power plant Temelín, which aroused the citizens' concerns and led to regular demonstrations at the Czech boarder. During this time the interest in alternative energy sources grew within the region. Existing conceptual ideas of EBF and other energy regions influenced the development of the CEM process and guidelines.

The CEM's work is closely interlinked with the EBF, building on and extending the existing structures. Several projects were already implemented by local initiatives at the time of the CEM's implementation concept, including 30 district heating facilities, 5 biogas plants, and small-scale hydro power plants. The planned measures from the implementation concept include networking activities (e.g. establishing energy groups, getting in touch with local energy providers, cooperation with local businesses), implementation measures (e.g., support PVs on public and private buildings), and awareness raising (e.g. organize energy consultant courses, study trips, information events, free counsel in energy matters building seminars, etc.).

In the first implementation concept which outlined goals until 2013, the CEM stated different goals for energy saving (heat – 7%, electricity – 4% and mobility – 2%). The goals for heating should be reached by better insulation, building standards and new heating technology. For mobility the focus is on e-mobility and biogas cars and for electricity energy should be saved by more efficient household appliances.[2] Goals for an increasing energy supply should be met by an increase in solar power, photovoltaic and wind energy.

Stakeholder Mapping

Different stakeholders on various regional levels are involved in the CEM's activity (Figure 13). On the national level the most important stakeholder is the Climate and Energy Fund, which administrates the CEM process and provides further funding options. The Climate and Energy Fund is mainly financed by two Austrian ministries. Further important stakeholders are scientific partners and universities, which cooperate with the CEM in various research activities, mainly focussing on solar energy and storage technology. On state level there is a close interaction with public regional development agencies and LEADER regions. The CEM has cooperation with energy providers and implements project together with those private partners e.g. on e-mobility and e-car sharing. There is also a close interaction with the state government to work towards new laws and regulations concerning regional energy issues. On the local level important stakeholders are representatives of 27 member municipalities (mayors, environmental committee officers, head officials), which partly finance the CEM's activities. Furthermore, energy groups are influential stakeholders, which constitute of local residents who are willing to participate in a regional energy transition (find more information on energy groups below). There is also a very close interaction to the district waste association, due to a shared history.

[2] Climate and Energy Fund (2013): Endbericht Umsetzungsphase KEM Freistadt. http://www.klimaundenergiemodellregionen.at/images/doku/a974918_endumsetz.pdf

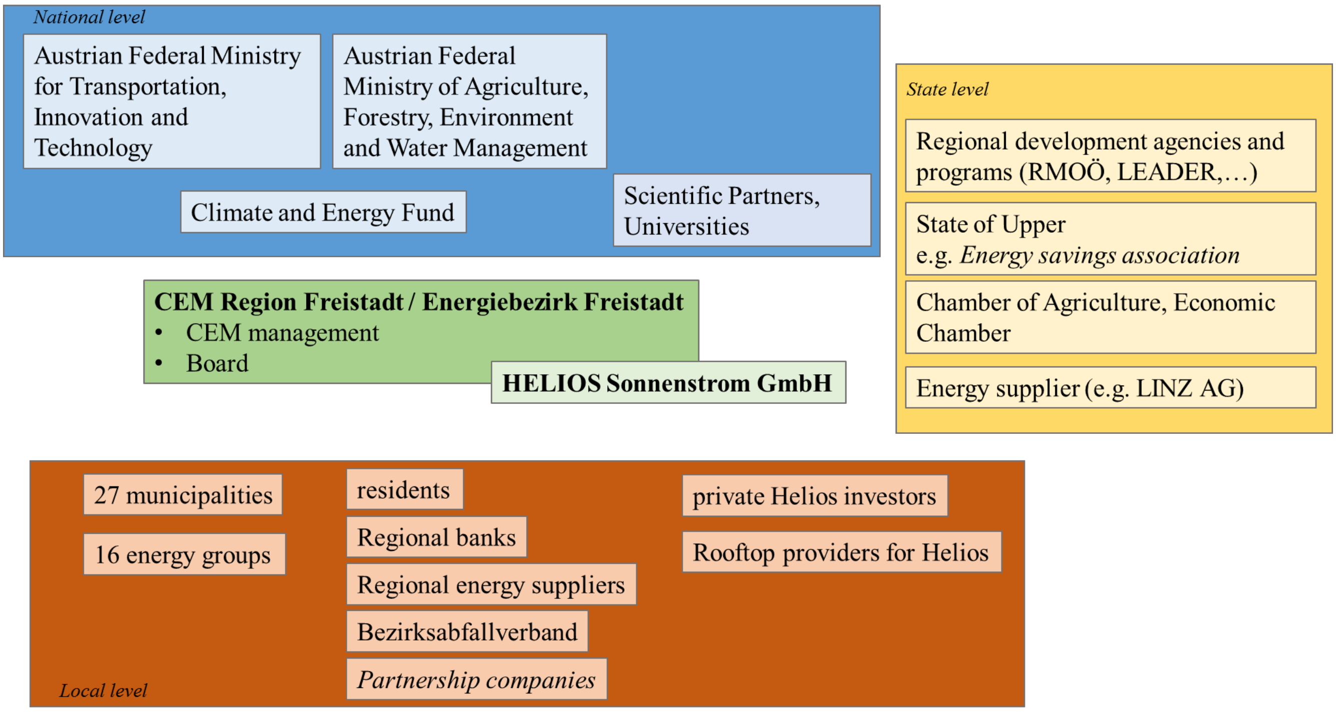

Figure 13: National, state and local level stakeholders

Freistadt aims for a total energy self-sufficiency based on locally available renewable energy sources. To reach this goal, the CEM focuses strongly on solar technology financed through citizen involvement but has only little potential for other RES except for biomass. There is a long history of regional energy projects as the EBF process was started through a bottom-up approach in 2005, on which the CEM process could build on.

4.2. Baden

Baden is a relatively small CEM in Lower Austria, South of Vienna, which consists of only one municipality, the township Baden. It is an urban centre located close to the Wienerwald and vineyards which are typical for the region. The CEM's area is mostly woodland (28%), agricultural area (24%), building area (20%), and vineyards (14%). The tourism concentrates on congresses as well as wellness tourism based on the numerous thermal baths and spas in the region. Furthermore, Baden provides opportunities for education and its schools are a good starting point for awareness raising within the younger generation.

The economic structure is based on a high share of small and medium-sized companies with a balanced mix of trades and industries and a large service sector. There is also a very energy intensive food industry company with around 700 employees. Also tourism industry and spas have high energy consumption with reduction potentials.

Due to the high commuters both in and out of the CEM, the volume of traffic is quite high with a focus on motorised private transport. Thus, there is a high potential for energy saving. Infrastructure for public traffic (train and busses) as well as for bicyclists are available. At the time of the concept development, there was one charging station for electric cars with three more in planning.

History and Background

In cooperation with local stakeholders and business partners as well as neighbour communities, several climate and energy projects have been implemented in the years before joining the CEM program. Around 10 years before starting the CEM process Baden designed an energy concept. Baden invested in energy efficient buildings for public kindergartens and biomass fired thermal power plants with district heating. The heat supply of several firms and households is generated by renewable sources and heat recovery. Furthermore, bicycle infrastructure was included into spatial planning and e-mobility was supported by the town.

In 2010 elections led to political changes in the local city council. The newly elected mayor put a focus on energy topics and installed an energy department within the city administration to efficiently cope with energy problems. This step was highly criticized by members of the oppositional parties as a waste of taxpayers' money, an unnecessary increase in the size of the city administration (Interview with CEM Manager and NÖN 2011[3]). This newly formed department made an application for the CEM and e5 program to generate additional funding options in the year 2011. The implementation concept of the CEM Baden was developed by the agency "Energieagentur der Regionen" which supported several CEMs in Lower Austria.

Stakeholder Mapping

As described above the CEM is administered at the municipal level and the CEM manager is employed by the municipality. This is an exceptional to most regions because this CEM region consists of only one township. Local stakeholders are residents, from which "energy ambassadors" act as role models for an energy efficient lifestyle. Further stakeholders are local companies for which specific assistance and projects are developed and also large companies

[3] see http://www.noen.at/baden/wasserkraft-fuer-baden/4.133.489 or http://www.noen.at/baden/protest-zum-auftakt/4.137.689)

like a food processing company and the local health spa. The community is not only a CEM region but also in the municipal funding program from the State of Lower Austria (e5) and there is a coordination of activities for both programs.

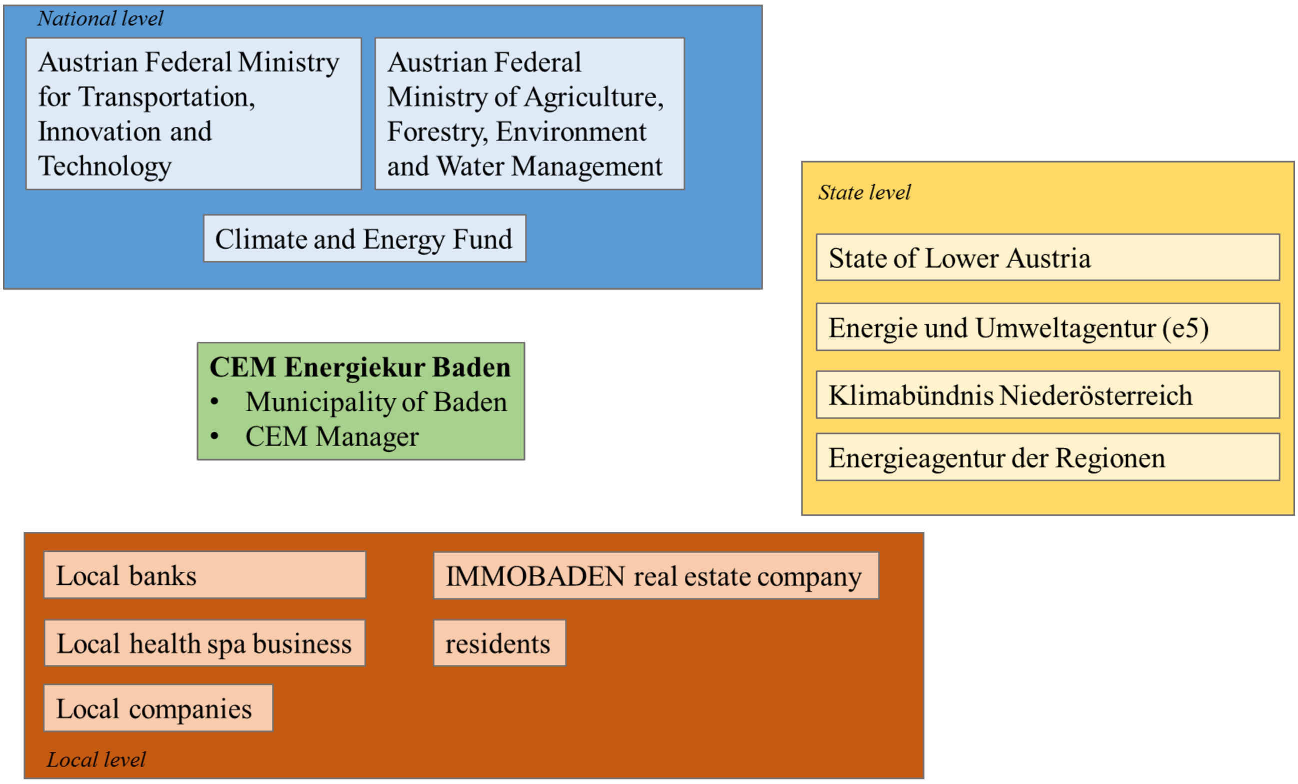

Figure 14: National, state and local level stakeholders

Baden aims to reach high degree of energy independence based on renewable energy sources but due to urban constitution the region has only limited potentials. Also construction of wind power is prohibited in the region. Currently the region engages into energy transition mainly though awareness raising campaigns and energy efficiency measures.

4.3. CEM Ebreichsdorf

The CEM consists of ten municipalities (March 2016) and lies in the political district of Baden in Lower Austria, about 20 km South of Vienna. Due to the vicinity to Vienna, the population increased greatly between 2001 and 2009 by 10%. All municipalities except Seibersdorf have more out-commuters than in-commuters, resulting in a high traffic volume, mostly in individual motor car traffic. The public transport is not sufficiently spread over the region.

The loss of industries in the region (e.g. textile industry) led to high shares of out-commuters and left no principal companies in the region. On the other hand, there are large free areas in areas zoned for economic activities. The economy is dominated by the service sector. The companies are mostly small and medium sized, with only one company with more than 100 employees and one with over 200 employees. Ebreichsdorf is also a place of research, with both the Austrian Institute of Technology and the International Atomic Energy Agency having laboratories and centres for research and development in the CEM. Hence, the share of well-educated people is relatively high.

About 71% of the CEM's area are used for agricultural purposes, forests make up for only 8% of the area. This implies high potentials for agricultural biomass, while solid biomass (wood) is relatively scarce. There is also a high potential in geothermal energy and solar energy, due to both the building structure and the global radiation in the region.

History and Background

In 2008, five municipalities (Ebreichsdorf, Mitterndorf an der Fischa, Pottendorf, Reisenberg, and Seibersdorf) joined to build the small region "Kleinregion Ebreichsdorf" to cope with regional challenges, e.g. traffic and public transportation together. This decision was influenced by the government of Lower Austria, which promotes the formation of local cooperation to deal with supra-regional issues. The municipalities then decided to become part of the CEM program in 2012. In the new CEM period, which started in March 2016, five additional municipalities joined the region and the CEM region grew in size and population. This new composition is not part of this analysis as the cutoff date for our analysis is the 1st of November. In the first period starting in 2012, the Energiepark Bruck administered the CEM. Due to changing requirements and lacking progress, a new CEM manager associated with the Kleinregion took over all duties starting with the new period in 2016. Before becoming a CEM, some participating municipalities were already part of the Climate Alliance Network.

Stakeholder Mapping

The CEM is managed by a CEM manager, who is employed by the holding association "Kleinregion Ebreichsdorf". The board of this association consists of all mayors of the member municipalities. This board has the final decision making power. On the regional level, the Regionalmanagement and Regionalverband are the leading organization at a higher level.

Furthermore, the Energiepark Bruck, which was a key player in the implementation of the CEM region and which also hosted the CEM Manager in the first phase, still has a consulting role and cooperates in project implementation. The energy ambassadors are representatives of every participating municipality (e.g. mayor, political members of local council, members of local authorities) who are the main contact person for the CEM management to discuss future projects. The Energy group constitutes of energy ambassadors, mayors and CEM management, local representatives (e.g. agriculture, industry service sector). This group works on projects within the municipality and decides on projects for their own municipality. They are supposed to meets at least four times a year. Besides the government of Lower Austria further agencies like Energie- und Umweltberatung and NÖ.regional, a state-wide regional development agency provide information and assistance for the Kleinregion.

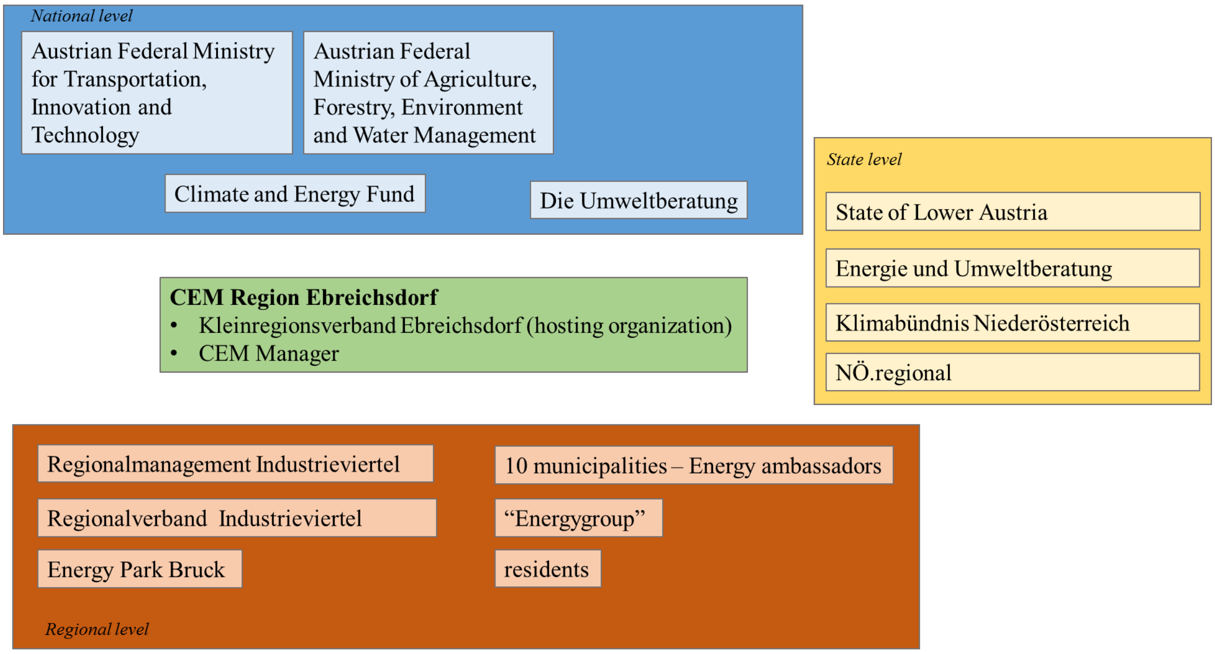

Figure 15: National, state and local level stakeholders

Before becoming a CEM in 2012, the region Ebreichsdorf had little experience in renewable energy projects. Since its start in 2012, the CEM manager changed a few times. The current focus is on awareness raising and information to promote energy saving and energy efficiency. Regional energy production besides scattered photovoltaic installation and small scale wind parks has not played a role so far and was not particularly promoted in the CEM's activities. The formation of a Kleinregion was initiated by the government of Lower Austria to promote regional cooperation. The mayors decided a few years later to focus on energy topics in addition to traffic and public transportation.

5. Comparison of the case studies regions regarding economic and energy data

For the analysis regarding population and economic data of the three case study regions, data of Statistics Austria were used. The CEM Badener Energiekur has a total population size of 25,093 inhabitants, a total area of 2,688 ha and therefore a relative high population density of 9.33 inhabitants/ha (Table 6). As the region is defined as a suburban CEM, the high population density is a reason for this classification (see Table 4). While the total GVA of 900 million € is not one of the largest within the CEM approach, the GVA per capita is with 35,876 €/capita clearly above the mean value of 25,290 €/capita and therefore another reason of the classification as a suburban CEM. The breakdown of both the GVA and employment into percentage shares of the primary, secondary and tertiary sector is based on district data. This is the reason why Badener Energiekur and Region Ebreichsdorf, which are both located in the district of Baden, have the same values for GVA in percent, but different values for total GVA due to further included data. For the cluster analysis only the total GVA was included (for methodological information of the cluster analysis and further data see (*LINKS Working paper 1.1*). In contrast to Region Ebreichsdorf, Badener Energiekur has also clearly higher GVA in million € and more absolute employees in the primary, secondary and tertiary sector, while the total population differs relatively less. This is also shown in the ratio of employees to inhabitants and therefore, Badener Energiekur can be defined as more urban than Region Ebreichsdorf.

Table 6: Population and economic data of the three case study regions

KEM_Name		CEM average	Modellregion Badener Energiekur	Region Ebreichsdorf	Region Freistadt	Source
Cluster			Suburban	Semi-rural	Rural	Own cluster analysis
Population (total)		26,516	25,093	21,491	65,113	Statistics Austria 2013
Area (ha)		43,067	2,688	13,174	99,410	Statistics Austria 2015
Population density (inhabitants/ha)		1.03	9.33	1.63	0.65	Statistics Austria (2013, 2015)
Gross value added per capita (€/capita)		25,290	35,876	18,039	17,387	STATcube (2015a); Statistics Austria (2013, 2014a, 2014b)
Gross value added (Mio €)	Total	711	900	388	1,132	STATcube (2015a); Statistics Austria (2014a, 2014b)
	Primary sector	23	8	4	72	
	Secondary sector	255	300	129	327	
	Tertiary sector	433	592	255	733	
Gross value	Primary sector	3.2%	0.9%	0.9%	6.4%	STATcube (2015a);

added (%)	Secondary sector	35.9%	33.3%	33.3%	28.9%	Statistics Austria (2014a, 2014b)
	Tertiary sector	60.9%	65.8%	65.8%	64.7%	
Employment (total)	Total	11,670	12,442	5,358	21,662	Statistics Austria (2014a, 2014b)
	Primary sector	928	392	169	3,434	
	Secondary sector	3,384	3,285	1,415	4,963	
	Tertiary sector	7,358	8,765	3,774	13,265	
Employment share (%)	Primary sector	9%	3%	3%	16%	Statistics Austria (2014a, 2014b)
	Secondary sector	29%	26%	26%	23%	
	Tertiary sector	62%	70%	70%	61%	
Employees per inhabitants (%)		41%	50%	25%	33%	Statistics Austria (2013, 2014a, 2014b)

The Region Ebreichsdorf is with 21,491 inhabitants slightly smaller than Badener Energiekur, but measured in area with 13,174 ha nearly five times larger, which is also shown in the smaller population density of 1.63 inhabitants/ha (Table 6). Regarding the GVA per capita and the GVA in million €, Region Ebreichsdorf is below the CEM average in all cases. However, the share of GVA earned in the tertiary sector is above the CEM average. Noticeable for the case study region Region Ebreichsdorf compared to Badener Energiekur and the CEM average is the relatively low ratio of employees to inhabitants, which explains why the GVA is that much smaller than in Badener Energiekur and why the CEM is clustered as semi-rural CEM.

Region Freistadt is the largest case study region measured in population and area with 65,113 inhabitants and 99,410 ha. Both variables are twice as large as the CEM average (Table 6). Nevertheless, the CEM has the lowest population density compared to the two other case study regions and the CEM average, which is one of the variables included in the cluster analysis (Table 4) and explains why the CEM is clustered as a rural CEM. While the GVA per capita is again the lowest of the case study regions and below the CEM average, the GVA in million € is the largest in this relation, even for the split in primary, secondary and tertiary sector. Regarding the distribution of the GVA over the primary, secondary and tertiary sector the comparison to the two other case study regions and the CEM average shows, that the primary sector is above-average high, the secondary sector is relatively small and the tertiary sector is higher than the average but lower than those of the two other case study regions. The employment data of Region Freistadt specify that the total employment is high compared to the average and the two other case study regions due to the large size of the CEM, but the small value of the ratio of the employees per population of 33% supports the clustering as rural CEM as the ratio is eight percentage points smaller than the CEM average and indicates that many inhabitants commute out of the Region Freistadt.

Next to the differences in population and economic data the three case study regions also differ regarding current energy consumption, current self-sufficiency and potential self-sufficiency (Table 7). While the stated data in the CEM implementation concept of each CEM were used for the current data, the potentials came from Stanzer et al. (2010) (see *LINKS Working Paper 1.1*).

Table 7: Energy data of the three case study regions

KEM_Name		CEM average	Modellregion Badener Energiekur	Region Ebreichsdorf	Region Freistadt	Source
Cluster			Suburban	Semi-rural	Rural	Own cluster analysis
Energy consumption (MWh/capita)	Total	30.0	34.5	27.7	19.1	CEM implementation concepts
	Heat	16.7	16.6	12.8	11.4	
	Electricity	6.6	5.2	3.4	2.3	
	Mobility	9.0	12.7	11.5	5.4	
Energy self-sufficiency (%)	Total	21%	5%	9%	31%	CEM implementation concepts
	Heat	33%	9%	20%	48%	
	Electricity	26%	1%	0%	18%	
	Mobility	2%	0%	0%	0%	
Potential self-sufficiency (%)	Heat		37%	37%	87%	Stanzer et al. (2010)
	Electricity		26%	26%	75%	

As stated above, the Badener Energiekur has a relatively high GVA per capita, a high ratio of employees compared to population size and a larger economy, including the thermal baths and the 700 employees' food production company, which can explain why the Badener Energiekur has a larger energy consumption for heat, electricity and mobility compared to the other two case study regions. The Badener Energiekur has also a lower current and potential energy self-sufficiency which could be used to cover the current and future energy consumption demand.

The energy data information for the Region Ebreichsdorf states lower current energy consumption but higher current energy self-sufficiency compared to Badener Energiekur (Table 7), which can be explained by the lower economy and the lower large scale production of the CEM. Compared to the CEM average both the current energy consumption and energy self-sufficiency are lower in Region Ebreichsdorf. The potential self-sufficiency is the same as in the

Badener Energiekur, as Stanzer et al. (2010) only state district data, but the potentials are less than half of the potentials of Region Freistadt.

The energy related data of Region Freistadt specify the smallest energy consumption per capita of the three case study regions and is also smaller than the CEM average (see Table 7). For the reason of low energy consumption, which makes it relatively easier to provide energy self-sufficiency and larger energy self-sufficiency potentials, the current energy self-sufficiency is higher in the case of Region Freistadt compared to the two other regions.

6. Conclusions

In this working paper we discussed the history and current context of the climate and energy model region (CEM) concept. A particular focus was on the ambitious goal of achieving energy autarky in the model regions – is this political goal pursued by the model regions in reality and how do the specific regions define it? As a first result, our analysis has shown that around half of the analysed CEMs could – based on the available data provided in the implementation concepts – potentially become energy autarkic in heat and electricity production. Fewer CEMs have defined quantitative energy targets, but around half of them which did, pursue the goal of energy autarky, at least in heat and electricity production. This shows again the problematic situation in the mobility sector, where regional energy production is much more difficult. E-mobility could be a way to substitute fossil fuel imports.

Based on different criteria – most importantly the cluster analysis conducted in the LINKS Working Paper 1.1 – we identified three case study CEMs ("Modellregion Badener Energiekur", "Region Ebreichsdorf", and "Region Freistadt") for further consideration in LINKS. Employing a multi-method social science approach (literature review, stakeholder mapping, interviews, and observations), we provided detailed background information on these three CEM regions.

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Appendix

Appendix I – CEM codes and names

Table 8 CEMs – Code and Name

CEM Code	CEM Name
b287550	K&E Modellregionen - ENERGIE KOMPASS BGLD: Energieregion Leithaland
b287549	K&E Modellregionen - ENERGIE KOMPASS BGLD: Energieregion Mittelburgenland
b287558	K&E Modellregionen - Energie Kompass Bgld: Kirschblüten Energieregion
b287562	K&E Modellregionen - ENERGIE KOMPASS BGLD: Naturpark Geschriebenstein
b287545	K&E Modellregionen - ENERGIE KOMPASS BGLD: Thermenregion Stegersbach
a974941	K&E Modellregionen - Das ökoEnergieland - vom Modell zur Wirklichkeit
b287583	K&E Modellregionen - Nachhaltiges Saalachtal
b287581	K&E Modellregionen - Nationalpark Hohe Tauern
b370022	K&E Modellregion - Oberpinzgau Energiereich
b370024	K&E Modellregion - Pillersee Tal-Leogang
b068980	K&E Modellregionen - Energieregion Salzburger Seenland
b178957	K&E Modellregionen - Ökoenergiebezirk Fürstenfeld
b178958	K&E Modellregionen - Ökoregion Lamingtal
b178945	K&E Modellregionen - Salzkammergut Ausseerland
a974948	K&E Modellregionen - Energiekultur-Region Kulmland
b370018	K&E Modellregion - Energieregion Stiefingtal
b287565	K&E Modellregionen - Klima- und Energiemodellregion Mureck KEMM
b287553	K&E Modellregionen - Klima- und Energiemodellregion "Holzwelt Murau"
b178943	K&E Modellregionen - Innovationsraum Unteres Mürztal
b069002	K&E Modellregionen - CO2-neutrale Kleinregion Hartberg
b178938	K&E Modellregion - EnergieOFFENSIVE Formbacherland
b287578	K&E Modellregionen - Klimaschutzregion NATURPARK PÖLLAUER TAL
b178944	K&E Modellregionen - Naturpark Steirische Eisenwurzen
a974944	K&E Modellregionen - Ökoregion Kaindorf
b068973	K&E Modellregionen - Modellregion am Grimming
b178936	K&E Modellregion - Energie Pölstal
b068974	K&E Modellregionen - Energie Impuls Vorau

b287577	K&E Modellregionen - Klima & Energie Modellregion Gröbming
b068998	K&E Modellregionen - 2 Kleinregionen auf dem Weg zur nachhaltigen Energie
a974942	K&E Modellregionen - Energieregion Schilcherland - Unsere Region ist am Zug!
a974945	K&E Modellregionen - Energie = MZ2 Zukunftsenergien für Mürzzuschlag
b370016	K&E Modellregion - Start up Energieregion Weiz-Gleisdorf
b178962	K&E Modellregionen - "Wechsel wirkt" im steirischen Wechselland
a974933	K&E Modellregionen - CO2-neutrale Region Osttirol
b370023	K&E Modellregion – Imst
b178937	K&E Modellregion - EnergieGemeindeTrins Nachhaltige Modellgemeinde
a974898	K&E Modellregionen - Energie- und Umweltnetzwerk Vorderwald
b287573	K&E Modellregionen - Klima- und Energiemodellregion Klostertal
a974925	K&E Modellregionen - Biosphärenpark und Energiemodellregion - E-REGIO II
a974940	K&E Modellregionen - Energiemodellregion LechWarth
b287576	K&E Modellregionen - Klima- und Energie- Modellregion "Terra amicitiae"
b287547	K&E Modellregionen - Energieparadies-Lavanttal
b370017	K&E Modellregion - Karnische Energie
a974937	K&E Modellregionen – Fenergiereich
a974905	K&E Modellregionen - Klima- und Energiemodellregion Südkärnten
b370014	K&E Modellregion - St. Veit
b287564	K&E Modellregionen - Alternatives Zwentendorf - Tullnerfeld West
b068988	K&E Modellregionen - Energie- und Klima-Modellregion Amstetten Nord
b068985	K&E Modellregionen - Energie- und Klima-Modellregion Amstetten Süd
b068984	K&E Modellregionen - Klima- und Modellenergieregion Römerland Carnuntum - Auf dem Weg zur 100% Erneuerbare Energie Region
b370020	K&E Modellregion - Schmidatal
b287561	K&E Modellregionen - Leiser Energieberge
b068989	K&E Modellregionen - Badener Energiekur
b178949	K&E Modellregionen - Krems
b178955	K&E Modellregionen - Wachau-Dunkelsteinerwald
b287567	K&E Modellregionen - Klima- und Energiemodellregion Pulkautal
a974951	K&E Modellregionen - Modellregion Kleinregion ASTEG
b069000	K&E Modellregionen - Bucklige Welt
a974930	K&E Modellregionen - Klima- und Energiemodellregion Ebreichsdorf
b178947	K&E Modellregionen - Elsbeere Wienerwald
a974954	K&E Modellregionen - Übermorgen selbst Versorgen
b068992	K&E Modellregionen - Energieregion Mostviertel Mitte

b068977	K&E Modellregionen - Klima und Energiemodellregion NÖ Süd
b178953	K&E Modellregionen - Energy Shopping Vösendorf
b068982	K&E Modellregionen - Klima- und Energiemodellregion Wagram
b069001	K&E Modellregionen - Ausbau und Erhaltung der Erneuerbaren Energie
b068997	K&E Modellregionen - Zwettler Reize ... für innovative Energiezukunft
b287559	K&E Modellregionen - Modellregion auf Schiene
b287546	K&E Modellregionen - wn.energiefit
a974950	K&E Modellregionen - Energiezukunft Thayaland
b287557	K&E Modellregionen - Welterbe- und Energieregion Inneres Salzkammergut
a974943	K&E Modellregionen - Kima- und Energie-Modellregion Donau-Böhmerwald
a974934	K&E Modellregionen - Klima- und Energiemodellregion Eferding
a974918	K&E Modellregionen - Energie-Modellregion Freistadt
b068972	K&E Modellregionen - Regionale Energie für Generationen
a974913	K&E Modellregionen - Klima-, Energie und Kulturlandschaftsmodell Donautal
b287569	K&E Modellregionen - Energie- u. Klimaschutzkonzept LAG SternGartl Guse
b068987	K&E Modellregionen - Energieeffizienz & Kleinwasserkraft Traunsteinreg.
a974931	K&E Modellregionen - Energieregion Traunviertler Alpenvorland
b068978	K&E Modellregionen - Energieoptimierung uwe (Urfahr West)
a974929	K&E Modellregionen - Energierregion Vöckla-Ager
b068971	K&E Modellregionen - Klima- und Ökoenergiemodellregion Hausruck Nord

Appendix II - Interview Protocol for KEM managers/ board members

Part I: General questions for all CEMS

1. History of CEM / Drivers and barriers of energy transition:

- What were the reasons to apply for CEM?
- Who fostered the development of the CEM? Who was involved?
- How was the process organized?
- What is the previous experience in the region with renewable energy infrastructure projects?
- Were there any obstacles? If yes, which obstacles? By whom?

2. Costs and benefits of regional energy transition

- What benefits do you perceive of the implementation of CEM for your region (economic, social)?

- Do you perceive distribution of benefits between local and national level as fair?
- What are the costs of it? Who carries the costs?
- Are the costs distributed fairly between national and local levels?

3. Social and Public Acceptance

- Are inhabitants in the region supporting energy transition? What are the major concerns of inhabitants about energy transition?
- What is the level of awareness of stakeholders and inhabitants in the region about energy transitions and their region being a CEM?
- Are they supporting the idea of their region becoming a CEM? Are there any protests?
- Do you know who are the major supporters and protesters?
- Which sources of information about CEMs do they trust? Where do they currently get information about CEMs?
- What is the image of the project manager who realizes energy transition?

4. Governance structure in the region

- How are strategic decisions made in the CEM? *(Regarding new projects, campaigns etc., who brings in the idea, who makes the final decision.)*
- Are there any guidelines/principals for decision-making proposed by KLIEN?
- What is the citizens' role in the CEM*? (Are they involved at all in the decision making process? If yes when and how? Is there a strategy for the involvement of citizens?)*
- How is the interaction with relevant stakeholders organized*? (Businesses, NGOs, policy makers, local communities)*
- Are there any contested issues? How do you deal with contested issues e.g. large scale wind energy plants? (*Not in my backyard-discussion)*