How is energy efficiency governed in the EU? Multi-level governance of energy efficiency polices, strategies and targets at EU, national, regional, and local level

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Abstract

Energy efficiency is recognised by policy makers at EU, national, and local level as a key solution for the mitigation of climate change. Targets have been established or are still under discussion for energy and climate, e.g. the EU 2030 targets, the national energy efficiency strategies, which may have 2030 or longer-term targets. Several regions (e.g. Lander in Germany) have their own strategies and targets. Finally under the Covenant of Mayors, over 7,000 local authorities all over Europe have set climate targets for 2020 and/or 2030.

The paper presents, analyses and discusses the role and importance of targets, of energy and climate planning at different levels of governance, and of monitoring energy and carbon emissions against a baseline. In particular the paper reports on successful examples of collaboration between municipalities and provinces/regions in the frame of the Covenant of Mayors and likewise coordination between regional and national strategies.

National policies could be better implemented if adapted to local situations and closer to citizens, for example urban transport strategies or local building codes. At the same time local administrations should be aware of national or EU policies (e.g. national incentives, efficiency requirements, etc.) when setting city targets and policies.

In particular local, regional and national plans should be coordinated and integrated. The same is also valid for the monitoring and reporting progresses on carbon emission reductions and energy savings.

The paper argues that both approaches, i.e. top down (EU and/or national) and bottom up (regional and/or local) are important and needed to reach ambitious climate change targets. These two approaches should be complemented and well integrated in the policy design, implementation and monitoring. The paper concludes with recommendations on how to improve the collaboration between different levels of policy-making, to maximise the benefits of multilevel governance.

Introduction

According to the Intergovernmental Panel on Climate Change, urban energy consumption generates about three quarters of global carbon emissions (IPCC, 2014). Also, in the European Union (EU) 72,4 % of the population lives in built-up areas (cities, towns and suburbs) (Eurostat, 2015). Major climate change agreement and policies are set at national level. For example EU policies, e.g. Directive are addressed to Member States (MSs). MSs tends to be far away from citizens, which are key actors for taking action on climate change (with decision on energy consumption, mobility, food, etc.). There is a wealth of literature on the role of cities in influencing climate issues, for example the 1992 Rio Earth Summit's adoption of the Agenda 21 plan of action (Musco, 2010). (Azevedo, Delarue, & Meeus, 2013) recognise that cities gather privileged socio-economic and regulatory conditions that prompt the local level as an appropriate level for action. The role of local government is identified as a key medium through which to coordinate and influence workable local level responses to the problem of developing more effective policies around energy and environmental issues (Fudge, Peters, & Woodman, 2015). Local governments are important

to develop, among others, climate mitigation strategies and, in an increasingly urbanizing world, it is important to understand how municipal authorities and other actors might intervene to reduce their impact (Bulkeley, et al., 2009), either by implementing climate objectives defined at higher government levels or take initiative autonomously (Aall, Groven, & Lindseth, 2007). Also, "local governments can be more innovative and more responsive to local environmental preferences and economic circumstances" if compared to national governments (Lutsey & Sperling, 2008). As highlighted by Fudge, Peters & Woodman (2015), policy makers, academics and practitioners recognise that local authorities are in a privileged position to involve the wider community in designing and implementing climate policies, engaging with both the technological aspects of energy generation and the delivery of sustainable demand-side energy management strategies. Despite this, the authors acknowledge a lack of appropriate structures in place to provide opportunities for real influence mostly in relation to effective connections to energy providers, funders, regulators, planners, etc. Carney & Shackley (2009) consider that in several policy fields excessive centralisation has led to failure and that sustainable energy policies could be better conceived nearer to the intended beneficiaries, hence more focused at the regional and local scale. The key role of local governments in the fight against climate change through sustainable energy planning is generally well recognised by scientific literature (Cormio, Dicorato, Minoia, & Trovato, 2003) (Stenlund Nilsson & Martensson, 2003) (Mirakyan & De Guio, 2013). Based on a review of academic research, media articles and policy reports, (Rutherford & Jaglin, 2015) acknowledge that "while cities are often seen as the source of many energy issues and problems […] they may also be part of the 'solution', offering potential, wide-ranging opportunities for contributing to shifting energy policies onto more 'sustainable' pathways".

Several initiatives are in place involving local authorities around the world in the fight against climate change, either by implementing mitigation or adaptation policies or combining the two. For example, cities engage in calculating regularly greenhouse gas inventories, setting emission reduction targets or simply implementing no-regret measures on a case by case basis. Literature suggests that some issues of governance capacity, in terms of the ability to regulate GHG emissions, to provide services and infrastructure, and to work with others, may be critical for climate action to take place (Bulkeley, et al., 2009). In most countries, lower levels of government remain legally and financially ill-equipped for assessing and addressing climate change risks and local vulnerabilities (Fünfgeld, 2010). Similar issues are relevant also when talking of climate mitigation policies (Rivas, et al., 2015).

The need of a new model of multi-level governance is increasingly recognised as key to the implementation of climate policies (Betsill & Bulkeley, 2006). In this context, the Covenant of Mayors might serve to test new governance models which are adapted to today's realities, where the best decisions are taken in an inclusive and cooperative way (Ballesteros, 2013).

Several authors have highlighted different modes of interaction in climate policies among a variety of actors: for example Ingold & Fischer (2014) emphasise that climate change mitigation policies are driven by horizontal and vertical interaction across state levels and between public and non-public actors, requiring a considerable coordination endeavour. Kern & Alber (2009) recognise different forms of collaboration relevant to successful climate policies beyond the local level: horizontal collaboration (e.g. national and transnational city networking, learning from others, sharing best practices) and vertical collaboration within nation-states (e.g. enabling role of national governments, funding schemes and authoritative modes of governing). Other authors identify a need for strategic energy planning, where national authorities support municipal planning with tools and guidelines (Sperling, Hvelplund, & Vad Mathiesen, 2011). An analysis of multi-level governance for energy efficiency in Germany has highlighted a need for formal coordination mechanisms and institutions, combined with informal, horizontal coordination to exchange best practices (Ringel, 2016).

Other research focuses on forms of collaboration within the municipality itself, with an active involvement of citizens and stakeholders and acknowledges that public acceptance is key to the successful implementation of policies (e.g. Lee & Painter (2015) (Christoforidis, Chatzisavvas, Lazarou, & Parisses, 2013), (Musall & Kuik, 2011) (Pollak, Meyer, & Wilson, 2011) (Pasimeni, et al., 2014) (Larsen & Gunnarsson-Östling, 2009).

We can say that the analysis of models of multi-level governance of climate change has focused mainly on the engagement of local authorities with stakeholders such as NGOs, groups of citizens, enterprises, etc. operating essentially within the municipal boundaries (Ingold & Fischer, 2014; Lee & Painter, 2015, Musall & Kuik, 2011, Pollak, Meyer, & Wilson, 2011). To a lesser extent research has focused on the collaboration between regional administrations and local administrations, in a mutually reinforcing effort to combat climate change (Kern & Alber, 2009; Christoforidis, Chatzisavvas, Lazarou, & Parisses, 2013; Ringel, 2016). Another study explored a governance model of climate mitigation in the agricultural sector, involving North East Scotland and the farmers (Feliciano, Hunter, Slee, & Smith, 2014): although not investigating the role of local authorities, the study emphasises the relevance of carrying out regional-level assessments to identify local barriers and drivers to design mitigation practices suitable at the local level.

This paper analyses a form of vertical collaboration for climate governance involving local and regional authorities that has arisen in the Covenant of Mayors and has facilitated the unprecedented success of the initiative - in terms of number of adjoining signatories - among small-sized municipalities, committing for the first time to develop and implement locally a Plan for mitigating greenhouse gas emissions in their territory. A good understanding of the key success factors of this model could allow seeing how to replicate it and facilitate a further dissemination of the Covenant principles and methodologies, with positive effects at the local level.

The Covenant of Mayors Initiative

The European Commission's Covenant of Mayors (CoM) is the mainstream European voluntary movement involving local authorities (LAs) in the development and implementation of sustainable energy policies. This bottom-up EU initiative, initially meant to cover "20–30 of Europe's largest and most

pioneering cities"[1], today counts more than 7,000 signatory local authorities, which have committed to reduce the levels of CO_2 emissions in their territories by at least 20 % in 2020, through the implementation of a Sustainable Energy Action Plan (SEAP)[2]. More than 5,700 signatories have already submitted their SEAP to the European Commission, around 64 % of them come from local authorities below 10,000 inhabitants. Six years after the launch of the initiative, the implementation of SEAPs developed within the Covenant of Mayors was highlighted in the Energy Security Strategy of the European Commission as a key action for Member States to achieve the 2020 energy efficiency target.[3]

By adhering to the Covenant of Mayors, a local authority commits to curb emissions mainly associated with energy consumption in its territory, by taking action in those policy areas that can be directly influenced by the local administration: essentially the buildings sector (municipal, tertiary and residential) and urban transport.

Besides the main commitment, by signing up to the CoM a local authority also commits to (Covenant of Mayors, 2009); (Cerutti, et al., 2013):

- Prepare a baseline emission inventory (BEI), which represents the starting point for the local authorities' SEAP, and allows identifying the most emitting sectors and the priority areas for action.
- Submit the SEAP, a politically approved document, describing the long-term strategy and the measures planned by the local authority to reach the target. It is also a communication tool addressing citizens and local stakeholders.
- Adapt city structures, to make sure that all the relevant departments of the local authority are involved in the SEAP process.
- Mobilise citizens and local stakeholders in the SEAP development and implementation.
- Submit an implementation report every second year after submission of the SEAP, for monitoring and verification purposes; every fourth year the implementation report has to be accompanied by a monitoring emission inventory (MEI).

A preliminary study was conducted by the European Commission Directorate General Joint Research Centre (JRC) on existing methodologies and tools for SEAP and BEI elaboration, allowing the identification of some key success factors (Piers de Raveschoot, et al., 2010); (Bertoldi, et al., 2010). The key conclusions of this review exercise have been integrated in the SEAP guidebook (Bertoldi, et al., 2010), focusing on governance, methodological and technical issues.

SEAPs submitted by Covenant Signatories are then assessed by the JRC. The analysis conducted by the JRC is essentially focusing on the compliance of the SEAP with the Covenant formal commitments and principles as well as on the evaluation of the completeness and consistency of the data inserted in the SEAP template. At the end of the analysis process, the JRC sends to the signatory a feedback report on the SEAP, presenting the outcome of the assessment and generally providing observations and suggestions for improvement, that the signatory is advised to take into consideration.

The latest overall assessment of the initiative by JRC (Kona, et al., 2016) shows that the signatories' overall commitment to reducing GHG emissions is 27 % by 2020, i.e. 7 percentage points above the minimum requested target of 20 %. Based on the data from 315 implementation reports accompanied by a MEI (covering 25,5 million inhabitants and mainly for the period 2012–2014) an already achieved 23 % overall reduction in emissions is observed.

Multi-level cooperation in the Covenant of Mayors: the role of territorial coordinators

Significant human and financial resources are needed to carry out all the steps needed to develop and implement a local sustainable energy policy. This can be really challenging for smaller or less experienced municipalities which sometimes lack the necessary skills or resources to fulfil their requirements. Also, since 2008 the economic crisis in Europe has certainly affected local governments and has undermined their capacity to pursue ambitious climate policies (Peeters, 2013).

CoM signatories can benefit from guidance and support provided by different actors in complying with the CoM requirements. In this paper we will focus on the supporting role of Covenant Territorial Coordinators (CTCs), which are public authorities at a higher territorial level (e.g. Provinces and Regions). These authorities commit to providing strategic guidance, financial and technical support by adhering to the Covenant as CTCs, a role officially recognised by the European Commission. In 2014, Provinces represented 50 % of CTCs, but a growing interest from urban communities and union of municipalities is evident as they represent 24 % of CTCs (Covenant of Mayors Office, 2014). Other examples of CTS are regions, for example Sicily in Italy. The participation of public authorities at a higher political level has indeed allowed several municipalities to become part of the initiative. Supporting the action by local authorities is also seen by Covenant Territorial Coordinators as a way to contribute to the achievement of regional targets in terms of GHG emissions mitigation (e.g. the Province of Limburg has voluntarily set a target to become climate neutral by 2020), energy savings or renewable energy production (e.g. Italian legislation sets targets on renewable energy production for Regions at the NUTS2 level) and to create local opportunities for jobs and investments. CTCs, being public authorities at a higher administrative level and often having competences in the field of energy, are in a privileged position to promote coordinated action of municipalities within their territories. Not only are they knowledgeable about energy production and distribution systems, but in the case of regions at the NUTS2 level they also implement (together with national bodies and in partnership with the European Commission) the EU Regional Policy. During 2014–2020, €40 billion from the European Regional Development Fund (ERDF) and Cohesion

1. European Commission, Action Plan for Energy Efficiency: Realising the Potential, COM(2006)545.

2. Recently the CoM has been extended to 2030 with the cities committing to at least 40 % CO_2 emission reduction by then. In addition to actions on mitigations also action on adaptation (climate risk assessment) has been includes (from SEAPs to Sustainable Energy and Climate Action Plans).

3. European Commission, European Energy Security Strategy, COM(2014)330.

Fund are scheduled to be invested in the low-carbon economy, therefore providing opportunities also for local authorities to deploy investments in sustainable energy.

The involvement of CTCs is also important in order to incorporate rural areas in territory-based sustainable development plans, taking into consideration the synergies between rural and urban areas in terms of supply of energy, products and services. One example is the one from the Province of Limburg, which included in its climate mitigation plans also the agricultural and forestry sector as a key sector to achieve climate neutrality (going well beyond the Covenant targets).

Some public authorities acting as Covenant Territorial Coordinators have taken care of:

- Organisational aspects: e.g. support in the integration of sustainable energy management into the cities' different departments; identification and involvement of stakeholders and choice of the most appropriate methods to engage them in the activities related to the SEAP development; by putting together several municipalities in their territories, CTCs have also been able to create economies of scale, e.g. for purchases (through joint public procurement), for the access to loans and to financing schemes, for the organisation of advisory services to citizens and promotional initiatives.
- Financial aspects: to finance Covenant-related activities, CTCs have allocated budget coming from different sources; according to a survey conducted by the CoM office in 2014[4], most CTCs (84 % of those who took part in it) allocate funds from their own budget (Covenant of Mayors Office, 2014). Other commonly used financing sources are European funds (e.g. ERDF) or national funds. CTCs can also provide financial support for the implementation of SEAPs, e.g. by looking for financing sources for local authorities (59 % of CTCs) or by coordinating joint projects eligible for low-interest loans (25 %).
- Technical aspects: some CTCs have adapted the existing methodology (defined in Bertoldi, et al., 2010) to better suit the local situation and to facilitate the elaboration of SEAPs for their signatories, and/or developed specific tools. For examples, some CTCs have taken care of BEI data collection and analysis, supported local authorities in identifying possible actions and estimated potential impacts and needed resources.

In some cases CTCs have even taken over the responsibility to draft SEAPs for their signatories or to finance the drafting of SEAPs. Other CTCs have performed a preliminary assessment of SEAPs under their coordination: this is typically the case of provinces that have directly financed the drafting of SEAPs and set some minimum requirements (either consistent with the analysis criteria applied by JRC or even more stringent) to be respected by the municipality to receive the contribution. In such cases, noting the similarity of SEAPs under the same coordinator, JRC has proposed to analyse them per groups (Zancanella & Melica, 2013) (JRC & Covenant of Mayors Office, 2014). In this context, CTCs adhering to this grouped approach of analysis have provided JRC with a detailed description of the methodology followed for all the SEAPs they coordinated and indicated a number of SEAPs to be analysed as a representative sample; JRC analyses the methodology and the reference SEAPs and provides feedback to the CTC, which commits to transmit and apply this feedback to all its coordinated signatories.

4. The Covenant of Mayors Office is managed by a consortium of local and regional authorities' networks, led by ENERGY CITIES, composed of CLIMATE ALLIANCE, CEMR, EUROCITIES and FEDARENE.

Methodology

The present study is based on the number of signatories, submitted SEAPs and CTCs on the 13 May 2014.

A first analysis has been based on data taken from Baseline Emission Inventories from submitted SEAPs. The sample has been designed by JRC for the calculation of performance indicators on the initiative, in order to select cities that had provided robust data in their BEIs (Kona, et al., 2015).

For the purpose of the present study, SEAPs have been grouped by population range, in order to appreciate which size of municipalities is the most represented in the initiative with respect to the number of SEAPs. An analysis on energy and emission data will also allow understanding which share of energy consumption and of emissions is associated with different category sizes of municipalities.

A second step of analysis has been necessary to identify in which EU countries the role of CTCs has been particularly noticeable and valuable. To this end, the absolute number of CoM signatories and of CTCs, and the share of signatories and population covered by CTCs have been considered for each country. The 28 EU Member States (MS) were ranked according to the share of signatories coordinated by CTCs.

The first three EU MS showing the highest share of signatories under a CTC have then been analysed in greater details. It was considered that the rapid diffusion of this model of multilevel governance in those three countries could somehow be linked to their administrative structure. The NUTS (Nomenclature of Territorial Units for Statistics) classification of territorial units and its correspondence with the national administrative units has therefore been investigated. An analysis of the distribution of municipalities by population ranges in these three countries has also been carried out, to see if there is a common pattern that could justify the relevance of the CTC involvement.

One CTC for each of the selected countries has been analysed more in depth, to highlight some interesting features of the approach they adopted.

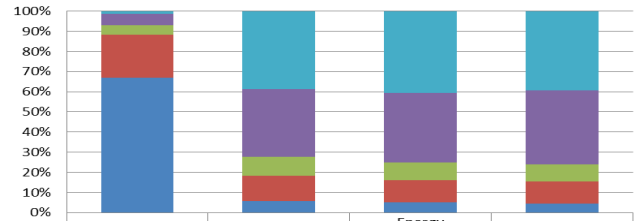
Analysis and results

ANALYSIS OF DATA BY POPULATION RANGE

Based on the SEAPs received up to mid-May 2014, an analysis on data collected from Baseline Emission Inventories (BEIs) has been performed (Kona, et al., 2015). Whilst 67 % of SEAPs have been submitted by municipalities having less than 10,000 inhabitants, they represent only 6 % of the total population, and only 5 % of energy consumption and of CO_2 emissions (Figure 1).

All the activities related to development and implementation of SEAPs need the allocation of a substantial amount of time and resources. Small local authorities are often not in a position to carry out such a process alone, but need to rely on the

support provided by organizations or authorities at a higher territorial level than the municipal one. A previous study by the JRC stresses the fact that providing adequate administrative and technical support to a big and diversified community, such as the one of the Covenant, requires increasing resources from all the actors involved in the initiative, in particular the Covenant of Mayors Office (CoMO) and the JRC. This is especially the case of small municipalities which are more in need of individual support, whilst, representing a low share of energy consumption, have a limited potential for emission reduction in 2020. The study concludes that assistance to small municipalities should be conveyed through the involvement of intermediary government levels, for example acting as CTCs (Melica, et al., 2014).



	SEAPs	Inhabitants	Energy consumption [MWh]	Emissions [tons CO2 eq]
> 500 000	47	49,056,012	945,331,166	275,178,288
100 001 to 500 000	194	42,765,429	803,111,360	255,469,497
50 001 to 100 000	172	12,068,695	206,418,530	59,553,865
10 001 to 50 000	741	15,920,933	257,461,086	75,217,205
< 10 001	2,344	7,397,574	115,414,742	32,216,540

Figure 1. Analysis of submitted SEAPs by population range.

SIGNATORIES UNDER A CTC

This paragraph analyses the involvement of CTCs in different EU countries, in relation with the number of signatories and of inhabitants. Table 1 lists the EU member states (MS), sorted by decreasing share of signatories under a CTC which has provided dedicated support. The country showing the highest share of signatories under the coordination of a CTC is Spain (94 %), suggesting that it is relatively uncommon for municipalities in this country to join the initiative in absence of an authority at a higher territorial level supporting and coordinating their activities. Spain is followed by Belgium and Italy (respectively with 68 % and 66 % of signatories under a CTC) and then by Denmark, France, Netherlands, Portugal, United Kingdom, Greece, Germany, Romania, with lower shares. The outstanding EU MS (grouped altogether in the last row) do not have any CTC, and the number of signatories in those countries is also relatively low. It is also noteworthy the fact that Italy and Spain show the highest number of signatories and of CTCs in absolute terms, suggesting that the involvement of more CTCs is directly linked to the participation of more signatories. Bigger cities (e.g. provincial or regional capitals), even though CTCs might be involved in the SEAP process, seem to deploy their mitigation policies with a higher degree of autonomy, as they can rely on more resources and wider expertise; however, the process is sometimes initiated by the CTC, for example by organising informative sessions on the CoM for municipal employees.

AN OVERVIEW OF WHAT TYPE OF SUPPORT CTCS HAVE PROVIDED SO FAR TO THEIR SIGNATORIES

This paragraph is based on information provided by CTCs to the JRC when adhering to the grouped approach of analysis, as described above. Table 2[5] presents such information in a structured manner, summarising the aspects tackled by the CTC on behalf of their coordinated signatories. More CTCs have actively supported signatories in different CoM-related activities even if they have chosen not to participate in the grouped analysis approach, and have not been included in the present study.

As shown in the table, all CTCs analysed via the grouped approach have supported their signatories in the elaboration of emission inventories. This technical task is indeed recognised to be quite time-and-resource demanding. CTCs can support signatories to different extents on this task, e.g. by acting as an interface between local authorities and energy suppliers to obtain data on electricity or fuels sales, or by elaborating data from suppliers according to the required format, or by providing dedicated tools, etc. Some Regions/Provinces take care of managing databases with annual data on energy consumption per municipality, with details per sector and per energy carrier as requested in the SEAP template. The provision of such support is valuable for small municipalities, as the technical expertise needed for energy and emission data analysis is often perceived as a barrier to SEAP development.

Almost all the analysed CTCs offered support in the definition of the key sectors to address, starting from the interpretation of BEI data and the identification of the best opportunities for reducing emissions. This has seldom been accompanied by an identification of possible financial sources to implement the actions. Nevertheless, the majority of analysed CTCs have also interacted with other stakeholders regarding the implementation of the CoM in their territory (Covenant of Mayors Office, 2014): the involvement of local actors could help to find opportunities to finance projects included in SEAPs.

A number of CTCs have also developed their own system to monitor SEAP implementation.

Finally, some CTCs have either drafted the SEAPs for their signatories or developed specific models of SEAP documents to be populated by each municipality with relevant information on their strategy for a sustainable energy use. In some cases, CTCs have asked JRC to verify the methodological approach prior to the development of the SEAPs, in order to ensure a correct adaption of the methodology.

Looking at the total number of SEAPs analysed by the JRC as of mid-May 2014, it is possible to see that SEAPs coordinated by a CTC represent almost 70 % of accepted SEAPs and only 16 % of not accepted SEAPs. SEAPs developed under the coordination of a CTC have been found to be compliant with the CoM principles more than SEAPs developed without the support of a CTC.

CASE STUDIES: PROVINCE OF BARCELONA (ES), PROVINCE OF LIMBURG (BE), REGIONE ABRUZZO (IT)

Three examples of CTCs (one from each of the three EU countries selected above) are described in this paragraph, aiming at seeing some practical models of multi-level governance developed in the context of the Covenant of Mayors.

5. PT, Comunidade Intermunicipal do Alto Alentejo: No detailed methodology sent. Conclusions drawn based on the reference SEAP.

Table 1. No. of signatories and population covered (total figure and share under a CTC) for EU-28.

Country	No. of CoM Signatories	No. of CTCs	% of signatories covered by a CTC	Number of signatories covered by a CTC	Number of cities<10,000 covered by CTCs	Ratio no. signs/no. CTCs
Spain	1,458	20	94 %	1,372	1,078	73
Belgium	104	3	68 %	71	16	35
Italy	2,731	74	66 %	1,796	1,394	37
Denmark	36	1	36 %	13		36
France	108	3	35 %	38	29	36
Netherlands	18	1	33 %	6		18
Portugal	92	4	32 %	29	18	23
United Kingdom	33	1	30 %	10		33
Greece	93	4	29 %	27	2	23
Germany	55	2	15 %	8	1	28
Romania	58	1	9 %	5	2	58
Other MSs	346	–	–	–	–	–

Spain and Italy are also the countries in which CTCs cover a larger share of the CoM population.

Table 2. List of CTCs whose methodology and SEAPs have been analysed through a grouped approach as of May 2014.

Country	CTC	No. of active signatories	No. of submitted SEAPs	Calculation of the Emission Inventories	Selection of key sectors to address	Mobilization of civil society	Identification of financial resources	Monitoring process
BE	Province of Limburg	44	40	√	√	√	√	
ES	Basque Energy Agency	19	15	√	√		√	√
	Consejería de Medio Ambiente Junta de Andalucía	542	536	√	√			√
	Province of Alicante	120	110	√	√			
	Province of Barcelona	206	189	√	√			√
	Province of Girona	183	27	√	√			
IT	Aggregazione dei Comuni dell'Est Veronese	15	15	√	√			
	ALI Comunimolisani	71	60	√	√	√		
	Comunità Montana di Valle Sabbia	27	27	√	√	√		
	Comunità Montana di Valle Trompia	19	19	√	√	√		
	Energia Calabria Network	72	64	√				√
	Consorzio Oltrepo Mantovano	12	12	√	√	√		
	Province of Chieti	104	104	√	√	√		√
	Province of Cosenza	11	6	√	√	√		
	Province of Foggia	36	36	√	√	√		√
	Province of Lecce	34	29	√	√			
	Province of Pescara	46	46	√				√
	Province of Potenza	45	20	√	√	√	√	
	Province of Rome	41	31	√	√	√	√	√
	Province of Teramo	45	45	√	√	√	√	
	Province of Torino	38	30	√	√	√		√
	Region Sardinia	24	22	√	√	√	√	√
PT	Comunidade Intermunicipal do Alto Alentejo	4	4	√	√		√	√

Province of Barcelona (ES)

The Province of Barcelona has been one of the first regions to sign as CTC in August 2009, and currently counts more than 200 supported signatories and 189 submitted SEAPs (out of 311 municipalities).

The Province has provided technical support to its coordinated signatories, namely adapting the CoM methodology to the local context and fully financing the SEAP development.

The Province has also provided guidance to municipalities in the identification of the most appropriate actions to plan in order to reach their set target.

The Province of Barcelona has made an application to the ELENA facility, which resulted in the signature of a contract with the European Investment Bank in 2010. The Province has received a grant of 2 million euros which allowed the financing of 190 feasibility studies for energy efficiency in buildings, public lighting, renewable energies and legal studies and resulted in 122,5 million euros of investments (Coopenergy, 2014).

The CTC has also helped the municipalities in the organization of low cost actions. One example is the project Euronet 50/50, supported by Intelligent Energy Europe, aiming at achieving energy savings at school through behavioural changes (Euronet 50/50, 2012).

Province of Limburg (BE)

The Province of Limburg has joined the CoM as CTC in September 2010 and counts 44 coordinated signatories. Among these, only 11 count less than 10,000 inhabitants, whereas 31 are in the range between 10,000 and 50,000. The remaining two signatories have a population above 50,000 inhabitants.

The Province of Limburg developed a common approach to prepare the SEAPs of its municipalities: they commissioned a scientific study led by the Flemish Institute for Technological Research (VITO) to define the concept of climate neutrality and to ascertain the feasibility of its objectives, which was the basis for the approach applied to the municipalities (Joint Research Centre & Covenant of Mayors Office, 2014).

The Province has provided its municipalities with the needed data to compile their emission inventories, has guided them in the identification of the most appropriate set of measures and has drafted a model of SEAP document. The CTC has also expressed the will to support municipalities in the adaptation of local administrative structures and to enhance the collaboration with local stakeholders.

The Province, in its role of CTC, has identified together with its municipalities several possible funding sources for SEAP implementation. An interesting example is the ESCOLIMBURG2020 project, an Intelligent Energy Europe – Mobilising Local Energy Investments (IEE-MLEI) project. The project is developed in partnership between the Province, an energy grid operator and a consultant and aims at making the existing heritage of municipal and provincial buildings more energy-efficient and integrating renewable energy sources. The consultant is responsible for providing guidance and developing the competencies of the municipalities, the Province of Limburg and construction professionals in order to enable them to define high-priority investments and take the right decisions during the investment process. The ESCo of the energy grid operator is responsible for making the necessary investments (EscoLimburg 2020, 2015).

Regione Abruzzo (IT)

Regione Abruzzo has adhered to the CoM as CTC in May 2010. Out of its 305 signatories, 278 have a population below 10,000 inhabitants. The Region has supported the Covenant in its territory thanks to the 2007–2013 ERDF Operational Programme: the funds available under priority axis II "Energy sustainability" corresponded to 35 million Euros (Regione Abruzzo – Patto dei Sindaci, Procedure attuative). For Covenant-related activities, the Region has set up a management body (*Cabina di Regia*) involving the four Provinces and the National Association of Italian municipalities (ANCI), with the support of the regional and provincial energy agencies. 305 SEAPs (i.e. for all the municipalities in the territory) were developed either by the Provinces directly or by their energy agencies. The allocation of 20,7 million euros from ERDF has allowed the implementation of one action in each municipality. This had a very positive effect especially for small municipalities, which could see in the short-term some positive results of getting involved in the Covenant.

Regione Abruzzo is also one of the partners of the project Alterenergy, led by Regione Puglia and addressed to municipalities in the Adriatic area having less than 10,000 inhabitants. The project aims at improving their capacity to plan and manage integrated actions of energy saving and the production of energy from renewable sources. As a result of Alterenergy, projects in the energy field were implemented in selected municipalities. Target communities (4 of which are in Abruzzo) have planned investments, business and innovation for territory's benefit (Alterenergy, 2015).

WHY SIGNATORIES RELY SO MUCH ON CTCS IN SPAIN, BELGIUM AND ITALY?

The relevance of the involvement of CTCs in Spain, Belgium and Italy suggests that the national context might be similar across the three countries. This paragraph examines the administrative structures of the three countries to possibly identify common characteristics that might have led to a success of the governance model Signatory-CTC. This analysis could allow understanding in which countries the model could be successfully replicated and could serve as guidance to the European Commission in identifying where to proactively approach new potential CTCs, to reinforce support to the initiative.

The existing regional levels in these countries, defined by Eurostat in the Nomenclature of Territorial Units for Statistics (NUTS), have been examined.[6] The NUTS is a three-level hierarchical classification, subdividing each Member State into a whole number of NUTS 1 regions, each of which is in turn subdivided into a whole number of NUTS 2 regions and so on. At a more detailed level, there are districts and Municipalities: these are called Local Administrative Units (LAU) and are not subject to the NUTS Regulation:

- The upper LAU level (LAU level 1) is defined for most, but not all of the countries.

6. Eurostat introduced the NUTS for three main purposes: a) for the collection, development and harmonisation of Community regional statistics, b) for socio-economic analyses of the regions, c) for the framing of Community regional policies. The NUTS Regulation EC/1059/2003 defines the minimum and maximum thresholds for the average size of the NUTS regions.

Table 3. Correspondence between the NUTS levels and the national administrative units for Belgium, Italy and Spain. (Excerpt from (Eurostat, 2013)).

Country	NUTS 1		NUTS 2		NUTS 3		LAU 1		LAU 2	
BE	Gewesten/ Regions	3	Provincies/ Provinces	11	Arrondissementen/ Arrondissements	44	–	–	Gemeenten/ Communes	589
ES	Agrupacion de comunidades Autonomas	7	Comunidades y ciudades Autonomas	19	Provincias + islas + Ceuta, Melilla	59	–	–	Municipios	8,111
IT	Gruppi di regioni	5	Regioni	21	Provincie	107	–	–	Comuni	8,101

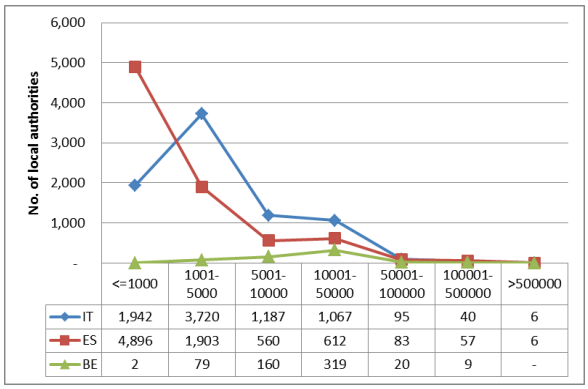


Figure 2. Number of local authorities by population range, in Italy, Spain and Belgium.

- The lower LAU level (LAU level 2) consists of municipalities or equivalent units in the 28 EU Member States.

Table 3 illustrates the NUTS and LAU classification for the three countries in question.

Since the Covenant of Mayors initiative focuses on the urban dimension of the fight against climate change, all the signatories are local authorities, hence belonging to LAU 1 or LAU 2 categories[7]. Organisations belonging to NUTS 2 and NUTS 3 categories may assume the role of CTCs[8]. Looking at the number of signatories on total number of LAU 2 units in these three countries, it appears that the interest raised by the CoM is huge: 34 % of Italian local authorities and 18 % both of Belgian and of Spanish local authorities have joined the movement.

One common feature to the administrative structures of the three countries is the absence of LAU 1 units. LAU 2 units might lack the resources and the expertise to take action alone on climate change mitigation and therefore need to take advantage of the support deployed at other administrative levels. A second common feature to the three countries corroborates this idea: looking at the distribution of local authorities by population ranges, these countries show a high administrative fragmentation. In Spain and Italy respectively 91 % and 85 % of municipalities have a population of less than 10,000 inhabitants. The share is lower in Belgium (41 %), where the majority of the municipalities are in the range between 10,001 and 50,000 inhabitants (Figure 2).

Discussion

Based on the considerations above, it can be said that local authorities with less than 10,000 inhabitants and – to a lesser extent – with less than 50,000 inhabitants could largely benefit from the support offered by a CTC. In the EU-28, six countries (besides Belgium, Italy and Spain) do not have the upper Local Administrative Unit level (LAU1) (Eurostat, 2013) in their administrative structure: Austria, Croatia, Latvia, Netherlands, Romania and Sweden. Grouping by population range municipalities or equivalent units belonging to the lower LAU level (LAU2) for each of those six countries, it can be noted that Austria, Croatia, Latvia and Romania have a vast majority of municipalities below 10,000 inhabitants, accounting for 54 %, 40 %, 20 % and 47 % of the total population of each country respectively. Hence, these small towns should not be overlooked when planning climate mitigation policies and they should be key targets for CTCs. Netherlands and Sweden respectively have 46 % and 42 % of their population living in municipalities with less than 50,000 inhabitants, which are also important to climate mitigation strategies and might receive support by CTC, as it happens in Belgium. It is likely that the governance model signatory-CTC observed for Italy, Spain and Belgium could perform well also in these six MSs, hence the European Commission should seek to engage new CTCs, to gather a new boost to the achievement of its climate and energy targets from those countries.

Looking at the remaining 19 MSs which feature also the LAU1 level, it appears that more than 90 % of the population of each country lives in LAU1-type municipalities with more than 10,000 inhabitants (with the exception of France with about 85 %). This could be a reason why in those countries the role of CTCs has not been as crucial as in Italy and Spain. However,

7. Generally, a local administrative unit (LAU) is a low level administrative division of a country, ranked below a province, region, or state. Not all countries describe their locally governed areas this way, but it can be descriptively applied anywhere to refer to counties, municipalities, etc. In the European Union, LAUs are basic components of Nomenclature of Territorial Units for Statistics (NUTS) regions. For each EU member country, two levels of Local Administrative Units (LAU) are defined: LAU-1 and LAU-2, which were previously called NUTS-4 and NUTS-5 respectively, until the NUTS regulation went into force in July 2003. For some countries, the LAU-1 level is not defined, and thus equivalent to the NUTS-3 level (Source: Eurostat, Statistics Explained – Glossary).

8. Some exceptions exist, e.g. in Italy some Provinces have acted at the same time as CTCs and as Signatories, i.e. they have coordinated local authorities in their territories in the development of municipal SEAPs and also developed a provincial SEAP complementing municipal SEAPs in the areas of competence of the Province.

having in mind the case of Belgium, we could think that the governance model signatory-CTC could be successful also in Bulgaria, France, Greece, Hungary, Luxembourg and Slovenia, where LAU1-type municipalities having up to 50,000 inhabitants host more than 40 % of the population of each respective country. To further encourage the spreading of the Covenant in those countries, an involvement of regional authorities acting as CTCs should be sought and promoted.

Conclusions

The CoM is an important EU initiative to reduce CO_2 emission at local level and it complements national policies and measures. In terms of number of signatories, the CoM has been very successful with small cities, which most probably would not have adopted policies, measures and commitments to reduce CO_2 emissions without such an initiative. However, efforts and resources required by a small local authority (<10,000 inhabitants) to comply with the CoM commitments, such as drafting a SEAP and reporting on its implementation, are very high given the limited resources if compared to a large city. In addition, the contribution by small cities represents, in terms of energy consumption and CO_2 emissions, a small share of the total CoM emission reductions.

This paper shows that climate change has to and can be mitigated at different levels of governance, national regional and local: small local authorities can be significantly aided if they are supported by other bodies such as regions and provinces acting as CTCs. Medium sized local authorities (from 10,000 to 50,000 inhabitants) should be theoretically better equipped and less in need of support in CoM-related activities. However, the experience of the Province of Limburg (BE) shows that even medium-size towns have profited of support offered by the CTC. CTCs can indeed help to create economies of scale in SEAP development, implementation and reporting activities.

To make the most of the contribution by small local authorities to the Covenant of Mayors' target in a more efficient way, the European Commission should adopt strategies to reach and foster an active participation of an increasing number of CTCs. In fact, a high share of CoM Signatories is supported by a CTC in Spain (94 %) and Italy (66 %), which are also the countries with the highest absolute number of Mayors having signed up to the Covenant (1,458 and 2,731 signatories respectively, up to May 2014). The role of CTCs is essential in spreading the culture of sustainable energy planning and designing tailor-made solutions for small local authorities. In case of Regions at NUTS2 level acting as CTC, concrete opportunities for financing SEAP actions can come from the ERDF.

The lack of the LAU1 intermediary level of government (between the NUTS3 level and the municipality-equivalent level) is thought to be a reason why the role of CTCs has been so relevant in the three countries analysed: Belgium, Italy and Spain. It is also expected that the governance model Signatory-CTC which has been successful within the Covenant of Mayors can be positively replicated in countries with an administrative structure similar to that of Italy and Spain, i.e. with a prevalence of local authorities with a population size below 10,000 inhabitants (such as Austria, Croatia, Latvia and Romania), or similar to that of Belgium, where the majority of local authorities have a population below 50,000 inhabitants (e.g. Netherlands and Sweden, but also Bulgaria, France, Greece, Hungary, Luxembourg and Slovenia). In addition, the presence of regional/provincial emission reduction and/or sustainable energy targets, either mandatory or voluntary, can also motivate regions and provinces to become CTCs. In fact, local action can contribute to the achievement of the target set for the wider territorial area.

Future studies could try to identify additional circumstances that might have favoured the development of the collaboration model between local and regional authorities observed in Italy, Spain and Belgium, analysing for example national policies on sustainable energy and the level of decentralization of competencies on energy issues. A good understanding of all the factors enabling the success of the Signatory-CTC model of governance is needed to effectively replicate the model in other regions.

Another aspect to be further examined is the role of CTCs in SEAP implementation, to evaluate whether and how regional authorities have succeeded in coordinating and executing energy efficiency or renewable energy projects in municipalities, creating economies of scale.

References

Aall, C., Groven, K., & Lindseth, G. (2007). The scope of action for local climate policy: the case of Norway. *Glob. Environ. Politics, 7 (2)*, 83–101.

Alterenergy. (2015). Retrieved October 21, 2015, from Alterenergy (Energy sustainability for Adriatic small communities) website: http://www.alter-energy.eu/.

Azevedo, I., Delarue, E., & Meeus, L. (2013). Mobilizing cities towards a low-carbon future: Tambourines, carrots and sticks. *Energy Policy 61*, 894–900.

Ballesteros, P. (2013). The idea of the Covenant. In N. Rangone, & J. Ziller, *Policies and Tools for Local Sustainable Development.* Napoli: Editoriale Scientifica.

Bertoldi, P., Bornás Cayuela, D., Monni, S., & Piers de Raveschoot, R. (2010). *Existing Methodologies and Tools for the Development and Implementation of Sustainable Energy Action Plans (SEAP).* http://publications.jrc.ec.europa.eu/repository/bitstream/111111111: European Commission - Joint Research Centre.

Bertoldi, P., Bornás Cayuela, D., Monni, S., & Piers de Raveschoot, R. (2010). *Guidebook: How to develop a sustainable energy action plan (SEAP).* http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/seap_guidelines_en-2_0.pdf: European Commission - Joint Research Centre.

Betsill, M., & Bulkeley, H. (2006). Cities and the Multilevel Governance of Global Climate Change. *Global Governance, 154*.

Bulkeley, H., Schroeder, H., Janda, K., Zhao, J., Armstrong, A., Chu, S., et al. (2009). *Cities and Climate Change: The Role of Institutions, Governance and Urban Planning.* Marseille: World Bank Urban Research Symposium Cities and Climate Change.

Carney, S., & Shackley, S. (2009). The greenhouse gas regional inventory project (GRIP): Designing and employing a regional greenhouse gas measurement tool for stakeholder use. *Energy Policy, 37*, 4293–4302.

Cerutti, A., Iancu, A., Janssens-Maenhout, G., Melica, G., Paina, F., & Bertoldi, P. (2013). *JRC Scientific Report: Cov-*

enant of Mayors in figures 5-years Assessment. http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/com_in_figures_jrc.pdf: European Commission Joint Research Centre.

Christoforidis, G., Chatzisavvas, K., Lazarou, S., & Parisses, C. (2013). Covenant o fMayors initiative — Public perception issues and barriers in Greece. *Energy Policy, 60*, 643–655.

Coopenergy. (2014). *Coopenergy - Good practice resources.* Retrieved October 21, 2015, from Coopenergy website: http://www.coopenergy.eu/sites/default/files/good_practice_files/127_Province%20of%20Barcelona%2C%20ES%20%E2%80%93%20Local%20sustainable%20energy%20policies_0.pdf.

Cormio, C., Dicorato, M., Minoia, A., & Trovato, M. (2003). A regional energy planning methodology including renewable energy sources and environmental constraints. *Renewable and Sustainable Energy Reviews*, 99–130.

Covenant of Mayors. (2009). *Covenant Official Text.* Retrieved October 21, 2015, from Covenant of Mayors website: http://www.covenantofmayors.eu/IMG/pdf/covenantofmayors_text_en.pdf.

Covenant of Mayors Office. (2014). *Covenant Territorial Coordinators: Crucial contributors to the Covenant of Mayors success.* Retrieved October 21, 2015, from Covenant of Mayors website: http://www.covenantofmayors.eu/IMG/pdf/2015-08-CTC-rapport-final.pdf.

EscoLimburg 2020. (2015). Retrieved October 21, 2015, from EscoLimburg 2020 website: http://www.escolimburg2020.be/en/.

Euronet 50/50. (2012). *Euronet 50/50. Final guide of the project: with the results and the main actions developed by the 50/50 schools.* Retrieved October 21, 2015, from Euronet 50/50 website: http://www.euronet50-50.eu/app/webroot/files/contentsfilestranslation/final-guide_50_50_def.pdf.

Eurostat. (2013). *Regions in the European Union - Nomenclature of territorial units for statistics - NUTS 2013/EU-28.* Retrieved October 21, 2015, from Eurostat website: http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-14-006.

Eurostat. (2015). *Eurostat regional yearbook 2015.* Retrieved October 21, 2015, from Eurostat website: http://ec.europa.eu/eurostat/web/products-statistical-books/-/KS-HA-15-001.

Feliciano, D., Hunter, C., Slee, B., & Smith, P. (2014). Climate change mitigation options in the rural land use sector: Stakeholders' perspectives on barriers, enablers and the role of policy in North East Scotland. *Environmental Science and Policy 44*, 26–38.

Fudge, S., Peters, M., & Woodman, B. (2015). Local authorities and energy governance in the UK: Negotiating sustainability between themicro and macro policy terrain. *Environmental Innovation and*, http://dx.doi.org/10.1016/j.eist.2015.06.004.

Fünfgeld, H. (2010). Institutional challenges to climate risk management in cities. *Current Opinion in Environmental Sustainability* , 2:156–160.

IEA. (2008). *World Energy Outlook 2008.* Retrieved October 21, 2015, from International Energy Agency (IEA) website: http://www.worldenergyoutlook.org/media/weowebsite/2008-1994/weo2008.pdf.

Ingold, K., & Fischer, M. (2014). Drivers of collaboration to mitigate climate change: An illustration of Swiss climate policy over 15 years. *Global Environmental Change 24*, 88–98.

IPCC, 2014. *Climate Change 2014: Mitigation of Climate change. Contribution of Working group III to the Fifth Assessment Report of the Intergovernmental Panel on climate change.* [Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. (2014) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Joint Research Centre & Covenant of Mayors Office. (2014). *Quick Reference Guide Grouped SEAP analysis.* Retrieved 10 21, 2015, from http://www.covenantofmayors.eu/IMG/pdf/Grouped_SEAP_analysis_guide.pdf.

Kern, K., & Alber, G. (2009). Governing Climate Change in Cities: Modes of Urban Climate Governance in Multi-level Systems. *OECD Conference Paper.*

Kona, A., Melica, G., Rivas Calvete, S., Zancanella, P., Iancu, A., Gabrielaitiene, I., et al. (2015). *JRC Science and Policy reports: The Covenant of Mayors in Figures and Performance Indicators: 6 Year Assessment.* Luxembourg: Publications Office of the European Union.

Kona, A., Melica, G., Koffi, B., Iancu, A., Zancanella, P.,Rivas Calvete, S., et al. (2016). *Covenant of Mayors Greenhouse Gas Emissions Achievements and Projections.* Luxembourg: Publications Office of the European Union.

Larsen, K., & Gunnarsson-Östling, U. (2009). Climate change scenarios and citizen-participation: Mitigation and adaptation perspectives in constructing sustainable futures. *Habitat International*, 260–266.

Lee, T., & Painter, M. (2015). Comprehensive local climate policy: The role of urban governance. *Urban Climate*, http://dx.doi.org/10.1016/j.uclim.2015.09.003.

Lutsey, N., & Sperling, D. (2008). America's bottom-up climate change mitigation policy. *Energy Policy, 36*, 673–685.

Melica, G., Bertoldi, P., Kona, A., Rivas Calvete, S., Zancanella, P., Janssens Maenhout, G., et al. (2014). The Covenant of Mayors initiative: an assessment and evaluation. *Proceedings of the 2014 ACEEE Summer Study on Energy Efficiency in Buildings.* . Washington, D.C.: American Council for an Energy Efficient Economy.

Mirakyan, A., & De Guio, R. (2013). Integrated energy planning in cities and territories: A review of methods and tools. *Renewable and Sustainable Energy Reviews*, 289–297.

Musall, F., & Kuik, O. (2011). Local acceptance of renewable energy – A case study from southeast Germany. *Energy Policy, 39*, 3252–3260.

Musco, F. (2010). Policy Design for Sustainable Integrated Planning: From Local Agenda 21 to Climate Protection. In M. Van Staden, & F. Musco, *Local Governments and Climate Change* (pp. 59–76). Dordrecht, NL: Springer.

Pasimeni, M., Petrosillo, I., Aretano, R., Semeraro, T., De Marco, A., Zaccarelli, N., et al. (2014). Scales, strategies and actions for effective energy planning: A review. *Energy Policy*, 165–174.

Peeters, M. (2013). Local Climate Action in the European Union. In N. Rangone, & J. Ziller, *Policies and Tools for Local Sustainable Development.* Napoli: Editoriale Scientifica.

Piers de Raveschoot, R., Bornás Cayuela, D., Bertoldi, P., & Monni, S. (2010). Review of Methodologies for the Development of Sustainable Energy Action Plans in the Frame of the Covenant of Mayors. *Proceedings of the 2010 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, D.C.: American Council for an Energy Efficient Economy.

Pollak, M., Meyer, B., & Wilson, E. (2011). Reducing greenhouse gas emissions: Lessons from state climate action plans. *Energy Policy, 39*, 5429–5439.

Regione Abruzzo - Patto dei Sindaci, Procedure attuative. (n.d.). Retrieved March 31, 2016, from Regione Abruzzo Web site: http://www.regione.abruzzo.it/xambiente/docs/pattoSindaci/procedureAttuative.pdf.

Ringel, M. (2016). Energy efficiency policy governance in a multi-level administration structure – evidence from Germany. *Energy Efficiency*. DOI 10.1007/s12053-016-9484-1.

Rivas, S., Melica, G., Kona, A., Zancanella, P., Serrenho, T., Iancu, A., et al. (2015). *The Covenant of Mayors: In-depth analysis of Sustainable Energy Action Plans*. Luxembourg: Publications Office of the European Union.

Rutherford, J., & Jaglin, S. (2015). Introduction to the special issue – Urban energy governance: Local actions, capacities and politics. *Energy Policy, 78*, 173–178.

Sperling, K., Hvelplund, F., & Vad Mathiesen, B. (2011). Centralisation and decentralisation in strategic municipal energy planning in Denmark. *Energy Policy, 39*, 1338–1351.

Stenlund Nilsson, J., & Martensson, A. (2003). Municipal energy-planning and development of local energy-systems. *Applied Energy*, 179–187.

Zancanella, P., & Melica, G. (2013, 03 21). Retrieved 10 21, 2015, from http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/ctc_webinar_21_03_2013_def.pdf.