

mult

facilitating multi-level governance
for Energy Efficiency



Synthesis report on European best practices for M&V schemes and coordination mechanisms



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Table of Contents

| | |
|--|----|
| Executive summary | 1 |
| I Introduction | 3 |
| II Identification of best practices and the factors affecting them | 4 |
| III Analysis of good and best practices - M&V schemes | 12 |
| IV Analysis of good and best practices - Coordination mechanisms | 34 |
| V Policy recommendations | 53 |
| V.I Monitoring and Verification | 53 |
| V.II Coordination Mechanisms | 55 |
| Appendix A: Correlation analysis' data | 58 |
| Appendix B: Databases of good and best practices | 61 |

List of Tables

| | |
|--|----|
| Table 1: <i>Criteria for the identification of the best practices.</i> | 4 |
| Table 2: <i>Performance of the examined countries to the specified criteria.</i> | 6 |
| Table 3: <i>Selected countries as good and best practices.</i> | 8 |
| Table 4: <i>Examined factors with the correlation analysis.</i> | 9 |
| Table 5: <i>Results of the correlation analysis.</i> | 10 |
| Table 6: <i>Utilised data in the correlation analysis.</i> | 59 |
| Table 7: <i>Database of good and best practices in the M&V schemes.</i> | 62 |
| Table 8: <i>Database of good and best practices in the coordination mechanisms.</i> | 67 |

List of abbreviations

| | |
|----------------|--|
| AEA | Austrian Energy Agency |
| ALTUM | Attīstības finanšu institūcija (Development financial institution) |
| ATEE | Energy Environment Technical Association |
| BRZ | Federal Computing Centre |
| CEI | Energy Sector and Investments |
| CHP | Combined Heat and Power |
| CIF | Capital Investment Framework |
| CNEN | Conseil national d'évaluation des normes |
| CNTE | Conseil National pour la Transition Energetique |
| CRES | Center for Renewable Energy Sources and Savings |
| DECC | Department of Energy and Climate Change |
| DEME | Agency for Environment and Energy Management |
| DGEC | Direction Générale de l' Energie et du Climat |
| EnR | European Energy Network |
| EE | Energy Efficiency |
| EED | Energy Efficiency Directive (2012/27/EU) |
| EEO | Energy Efficiency Obligation |
| EI | Ecologic Institute |
| EIHP | Energy Institute Hrvoje Požar |
| EPC | Energy Performance Certificate |
| ESC | Energy Saving Certificates Scheme |
| ESD | Energy Service Directive (2006/32/EU) |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH |
| HEFCE | Higher Education Funding Council for England |
| IDAE | Spanish Institute for Energy Diversification and Saving |
| IPE | Institute of Physical Energetics |
| LALRG | Association of Local and Regional Governments |
| LEC | Local energy concept |
| LEI | Lithuanian Energy Institute |
| M&V | Monitoring & Verification |
| MACEF | Macedonian Center for Energy Efficiency |

| | |
|-----------------|---|
| MEDDE | Ministry of Ecology, Sustainable Development and Energy |
| NEEAP | National Energy Efficiency Action Plan |
| NEEAP WG | Permanent Interministerial Commission for the Preparation of Energy Efficiency Action Plans |
| NGOs | Non Governmental Organizations |
| PAREER | Aid Program for the Energy Renovation of Existing Buildings |
| PIVE | Efficient vehicle incentive program |
| PNCEE | National Authority for Energy Saving Certificates |
| REA | Riga Energy Agency |
| REF | Research Excellence Framework |
| RI | Responsible Institutions |
| RUC | University of Roskilde |
| SIEA | Slovak Innovation and Energy Agency |
| SIEA | Slovak Innovation and Energy Agency |
| SMIV | System for Monitoring, Measurement and Verification of Energy Savings |
| TSO | Transmission system operator |
| ZREA | Zemgale Regional Energy Agency |

Executive summary

The current report presents the results as resulted by the analysis of the identified European best practices on the existing M&V schemes and coordination mechanisms.

The selection of the best practices and the performed analysis were conducted according to a methodological procedure, which was developed within the framework of the multEE project.

Specifically, the methodology was based on an analytical assessment procedure taking into consideration the results of the mapping of the existing M&V schemes and coordination mechanisms of the 28 Member States including the FYR of Macedonia, while a specialized template was prepared in order to report efficiently the identified best practices according to specific criteria. Moreover, specific criteria for the identification of the best practices among the examined M&V schemes and coordination mechanisms were established for the further elaboration and analysis of them.

After the implementation of the developed methodological procedure, the analysed countries were classified into best practices and good practices utilizing specific thresholds taking into consideration the findings from the mapping of the existing M&V schemes and coordination mechanisms. Then, the countries with the highest scores were analysed as best practices utilizing the specialized template. It should be noted that additionally to the best practices the participating countries were examined during the conducted analysis leading to a combination of good and best practices.

Moreover, a preliminary analysis of the potential factors, which probably can affect positively or negatively the effectiveness of the M&V schemes and coordination mechanisms, was conducted. According to the obtained results countries with no established centralized structure have implemented more efficient M&V schemes. Regarding the coordination mechanisms, countries with regionalized structure and countries with non-centralized structure have introduced more efficient coordination mechanisms. Finally, the countries, which have lower CO₂ emissions per capita, have introduced more efficient coordination mechanisms probably due to the introduction of policies for the alleviation of the climate change phenomenon.

The analysis of the best practices regarding the existing M&V schemes and coordination mechanism led to the following policy recommendations:

M&V schemes

- **Recommendation 1:** Keep political responsibility for designing and Monitoring and Verifying Energy Efficiency policies in the same hands.

- **Recommendation 2:** Involve sub-ordinate bodies or other specialized institutions in the administration of the scheme.
- **Recommendation 3:** Clearly define the responsibilities between the responsible line Ministry, possible supporting institutions and data providers.
- **Recommendation 4:** Develop and use bottom-up methodologies for monitoring wherever economically feasible.
- **Recommendation 5:** Centralized databases (e.g. for bottom-up data) with clearly defined collection procedure ensure availability and accessibility of data for reporting and evaluation purposes.
- **Recommendation 6:** The most effective verification and reporting procedures should be integrated into the M&V scheme.

Coordination mechanisms

- **Recommendation 7:** Systematically involve the implementation level (typically local and regional) in the policy formulation process and make use of their specific expertise and knowledge.
- **Recommendation 8:** Complement formal policy coordination through formal channels by informal coordination fora or networks.
- **Recommendation 9:** Involve other stakeholders from academia, economy or civil society into policy formulation and implementation.
- **Recommendation 10:** Complement legal obligations for local and regional support schemes with carefully designed financial support schemes.
- **Recommendation 11:** Introduce a review mechanism for the different policies adopted and include different stakeholders in the evaluation.

The main identified elements of the examined good and best practices are summarized in the two different databases in order to facilitate their comparison for the examined M&V schemes and the coordination mechanisms correspondingly.

I Introduction

The project **multEE - Facilitating multi-level governance for Energy Efficiency**, which is financed by the Horizon 2020 program, aims at enhancing the consistency and quality of energy efficiency policy planning and implementation on different administrative levels in the beneficiary countries. Specifically, the multEE project intends firstly to introduce innovative monitoring and verification (M&V) schemes based on bottom-up data in order to ensure that the impact of energy efficiency measures is correctly evaluated and useable for future energy efficiency planning. Secondly, the vertical coordination between administrative levels shall be improved exploiting the full potential of the integrated M&V schemes and enhancing the overall quality of energy efficiency planning and implementation.

Within the framework of the project, the conduction of a thorough analysis is foreseen about the status quo of the implemented M&V schemes and the established coordination mechanisms in the EU member states plus FYR of Macedonia. The aim of this analysis is the identification of the best practices and their utilization for the development of more efficient M&V schemes and country-specific coordination mechanisms. The most efficient elements, which will be identified by the corresponding analysis, can be utilised either for the development of new more innovative, robust and effective M&V schemes and coordination mechanisms or for the improvement of existing M&V schemes and coordination mechanisms.

The **current report presents the results as derived by the analysis of the identified European best practices on the existing M&V schemes and coordination mechanisms**. The selection of the best practices and the performed analysis were conducted according to a methodological procedure, which was developed within the framework of the multEE project. Specifically, the methodology was based on an analytical assessment procedure taking into consideration the results of the mapping of the existing M&V schemes and coordination mechanisms of the 28 Member States including the FYR of Macedonia, while a specialized template was prepared in order to report efficiently the identified best practices according to specific criteria.

Chapter 2 presents the utilized methodology and the identified M&V schemes and coordination mechanisms as best practices, while Chapters 3 and 4 outline the obtained results as resulted by the implemented analysis of the good and best practices for the existing M&V schemes and coordination mechanisms correspondingly. Finally, the derived policy recommendations are presented in Chapter 5 taking into account the main findings from the analysis of the good and best practices.

II Identification of best practices and the factors affecting them

Specific criteria for the identification of the best practices among the examined M&V schemes and coordination mechanisms were established for the further elaboration and analysis of them.

The proposed criteria are outlined in the following table for both of the M&V schemes and coordination mechanisms.

Table 1: Criteria for the identification of the best practices.

| M&V schemes | Coordination mechanisms |
|---|--|
| Existence of a fully operating M&V scheme (Question 1.1 - 3: Existence, 2: Currently in development phase or in implementation phase, 1: No existence) | Existence of formal or informal coordination bodies between the national and regional level (Question 2.4 - 3: Yes, 2: Partially, 1: No) |
| Consistency and agreement with the respective National EE Action Plans and with the legislative framework of the ESD and EED (Question 1.2 - 3: Yes, 2: Depending on the scheme, 1: No) | Active involvement of local authorities in national energy formulation (Question 2.5 - 3: Yes, 2: Partially, 1: No) |
| Highest sectoral coverage (Question 1.5 - 3: Four sectors, 2: Two or three sectors, 1: Only one sector) | Priorities and needs of the different involved authorities are taken into consideration (Question 2.6 - 3: Yes, 2: Partially, 1: No) |
| Highest spatial coverage (Question 1.6 - 3: Three levels, 2: Two levels, 1: Only one level) | Sufficient financial and human resources are dedicated to plan and implement the measures (Question 2.7 - 3: Yes, 2: Partially, 1: No) |
| Utilization of bottom-up monitoring (Question 1.11 - 3: Only bottom-up, 2: Both of bottom up and top-down, 1: No bottom-up) | Assessment of the energy efficiency measures among the involved authorities in order to redesign them (Question 2.8 - 3: Yes, 2: Partially, 1: No) |
| Regular reporting periods (Question 1.15 - 3: Report on a quarterly basis, 2: Report on a half-year basis, 1: Report on annual basis or later) | |

The quantification of the schemes and mechanisms' performances for the proposed criteria was performed utilizing a three-level qualitative Likert scale, as presented in Table 1.

The quantification of the performances was performed according to the findings of the mapping of the existing schemes and mechanisms as presented in the corresponding report within the framework of the multEE project.

Then, all the performances for each examined scheme or mechanism were added resulting in the final rank, which was used for the comparative analysis in order to identify the best practices for the examined countries (Table 2).

It should be highlighted that the current ranking is resulted taking into consideration the specified criteria according to the proposed methodology. Obviously, the potential integration into the analysis of additional criteria may differentiate the ranking of the examined countries regarding the effectiveness of the established M&V schemes and coordination mechanisms.

The main purpose of the ranking was the most efficient administration of the available workload within the project focusing on the best practices and conducting a more in-depth analysis of them. Furthermore, each involved partner had the obligation to analyze its own country despite the fact that possibly was not assessed as a best practice. As a result, the foreseen analysis integrated both of good and best practices.

Therefore, the analysed countries were classified into best practices and good practices utilizing specific thresholds. Specifically, considering the M&V schemes the countries with scores higher than 13 were characterised as best practices, while for the case of the coordination mechanisms the corresponding threshold was set to 12.

Even if the aim of the analysis was initially the in-depth examination of the best practices, it was decided to be taken into account essential and beneficial elements from the good practices enhancing the derived outcomes.

In order to depict the distinction between good and best practices more effectively, the best practices in Table 3 have been highlighted with the green colour and the good practices with the yellow colour.

Table 2: Performance of the examined countries to the specified criteria.

| Countries | M&V schemes | | | | | | Coordination mechanisms | | | | | M&V schemes | Coordination mechanisms |
|-------------------|-------------|------|------|------|-------|-------|-------------------------|------|------|------|------|-------------|-------------------------|
| | Q1.1 | Q1.2 | Q1.5 | Q1.6 | Q1.11 | Q1.15 | Q2.4 | Q2.5 | Q2.6 | Q2.7 | Q2.8 | Total score | Total score |
| Austria | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 14 | 8 |
| Belgium | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 14 | 7 |
| Bulgaria | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 13 | 11 |
| Croatia | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 15 | 13 |
| Cyprus | 2 | 3 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 3 | 11 | 9 |
| Czech | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 | 5 |
| Denmark | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 13 | 7 |
| Estonia | 2 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 12 | 7 |
| Finland | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 15 | 9 |
| France | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 3 | 3 | 1 | 3 | 13 | 13 |
| FYROM | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 1 | 3 | 1 | 3 | 14 | 11 |
| Germany | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 14 | 15 |
| Greece | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 3 | 13 | 9 |
| Hungary | 2 | 3 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 13 | 11 |
| Ireland | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 1 | 1 | 14 | 11 |
| Italy | 3 | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 14 | 15 |
| Latvia | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 1 | 3 | 12 | 13 |
| Lithuania | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 13 | 13 |
| Luxembourg | 2 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 13 | 5 |

| Countries | M&V schemes | | | | | | Coordination mechanisms | | | | | M&V schemes | Coordination mechanisms |
|--------------------|-------------|------|------|------|-------|-------|-------------------------|------|------|------|------|-------------|-------------------------|
| | Q1.1 | Q1.2 | Q1.5 | Q1.6 | Q1.11 | Q1.15 | Q2.4 | Q2.5 | Q2.6 | Q2.7 | Q2.8 | Total score | Total score |
| Malta | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 14 | 7 |
| Netherlands | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 15 | 13 |
| Poland | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 15 | 7 |
| Portugal | 3 | 1 | 3 | 1 | 2 | 1 | 1 | 3 | 3 | 1 | 3 | 11 | 11 |
| Romania | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 13 | 11 |
| Slovakia | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 16 | 13 |
| Slovenia | 3 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 1 | 1 | 3 | 13 | 11 |
| Spain | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 15 | 13 |
| Sweden | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 15 | 9 |
| UK | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 15 | 13 |

The involved partners analyzed the selected M&V schemes and coordination mechanisms utilizing the specialized template, which was developed in order to facilitate the analysis of the best practices. Nevertheless, the performed analysis includes findings from both of good and best practices, due to the fact that each partner analyzed both its own country and one additional.

More information about the implemented procedure is provided in the corresponding report of the multEE project regarding the analytical framework for the mapping and analysis of the M&V schemes and coordination mechanisms.

Table 3 presents the selected countries for the analysis of the good and best practices. It should be noted that additionally to the countries with the highest scores the participating countries were examined during the conducted analysis. Both of the M&V schemes and coordination mechanism were analyzed for the majority of the examined countries.

Table 3: Selected countries as good and best practices.

| Involved countries in the project | Other countries |
|--|--------------------------------------|
| Austria ⁽¹⁾ | France ⁽¹⁾ |
| Croatia ⁽¹⁾ | Hungary ⁽¹⁾ |
| Denmark ⁽¹⁾ | Ireland ⁽¹⁾ |
| Germany ⁽³⁾ | Italy ⁽³⁾ |
| Greece ⁽¹⁾ | Poland ⁽¹⁾ |
| Latvia ⁽¹⁾ | Romania ⁽³⁾ |
| Lithuania ⁽¹⁾ | Slovenia ⁽¹⁾ |
| Slovakia ⁽¹⁾ | Spain ⁽²⁾ |
| FYROM ⁽¹⁾ | Sweden ⁽¹⁾ |
| | United Kingdom ⁽¹⁾ |

⁽¹⁾ M&V schemes and coordination mechanisms ⁽²⁾ only M&V schemes ⁽³⁾ only coordination mechanisms

Moreover, a preliminary analysis of the potential factors, which probably can affect positively or negatively the effectiveness of the M&V schemes and coordination mechanisms, was conducted. Specifically, 18 different factors were examined (Table 4) in relation to the evaluation of the existing M&V schemes and coordination mechanisms as presented in Table 2. The selection of these factors was performed taking into consideration the available data for all the examined countries and indications about their potential contribution to the formulation of efficient M&V schemes and coordination mechanism.

The correlation analysis was performed with the estimation of the Spearman rank-order correlation coefficient, which is a nonparametric test measuring the strength and the direction of association between two variables that are

measured on an ordinal or continuous scale. The existing M&V schemes and coordination mechanisms were assessed both utilizing the continuous scale of the Table 2 and creating two different ordinal scales (*High efficient M&V scheme* with score higher than 13 vs *Low efficient M&V scheme* with score equal to or lower than 13 and *High efficient coordination mechanism* with score higher than 12 vs *Low efficient coordination mechanism* with score equal to or lower than 12). The same thresholds were utilised for the classification of the examined countries into good and best practices. The results of the correlation analysis are presented in Table 5, while the detailed matrix as utilised in the correlation analysis is provided in Appendix A (Table 6). It should be noted that only the variables with statistically significant correlation using 90% confidence level are taken into consideration (Prob>|t| less than 10%).

Table 4: Examined factors with the correlation analysis.

| Variable | Description | Source |
|--------------|--|---------------|
| Var1 | GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent) | World bank |
| Var2 | Energy use (kg of oil equivalent per capita) | World bank |
| Var3 | Industry, value added (% of GDP) | World bank |
| Var4 | GDP per capita (current US\$) | World bank |
| Var5 | Agriculture, value added (% of GDP) | World bank |
| Var6 | CO2 emissions (metric tons per capita) | World bank |
| Var7 | Services, etc., value added (% of GDP) | World bank |
| Var8 | Combustible renewables and waste (% of total energy) | World bank |
| Var9 | Alternative and nuclear energy (% of total energy use) | World bank |
| Var10 | Market share of the largest generator in the electricity market (%) | Eurostat |
| Var11 | Energy intensity of the economy (kg of oil equivalent per 1 000 EUR) | Eurostat |
| Var12 | Share of renewable energy in gross final energy consumption (%) | Eurostat |
| Var13 | Greenhouse gas emissions intensity of energy consumption - Index | Eurostat |
| Var14 | Energy dependence (%) | Eurostat |
| Var15 | Centralized Unitary (1: Yes, 0: No) | ESPON project |
| Var16 | Decentralized Unitary (1: Yes, 0: No) | ESPON project |
| Var17 | Regionalized Unitary (1: Yes, 0: No) | ESPON project |
| Var18 | Federal countries (1: Yes, 0: No) | ESPON project |

According to the obtained results countries with no established centralized structure have implemented more efficient M&V schemes (Spearman rho=-0.55 for the analysis with the continuous scale and Spearman rho=-0.59 for the analysis with the ordinal scale). Finally, the analysis of the ordinal scale led to the conclusion that the federal countries have established more effective M&V schemes (Spearman rho=0.39).

Regarding the coordination mechanisms, countries with regionalized structure (Spearman rho=0.34 for the analysis with the ordinal scale) have introduced more efficient coordination mechanisms. Finally, according to the analysis of the continuous scale the countries, which have lower CO₂ emissions per capita, have introduced more efficient coordination mechanisms (Spearman rho=-0.48) probably due to the introduction of policies for the alleviation of the climate change phenomenon. Nevertheless, the indications for correlation between the coordination mechanisms and climate change policies should be further explored deducting more robust findings.

Table 5: Results of the correlation analysis.

| Element | Variable | Spearman rho | Prob> t |
|-------------------------------|--------------|--------------|-------------|
| M&V scheme (continuous scale) | Var1 | 0.04 | 84.9% |
| | Var2 | 0.19 | 31.9% |
| | Var3 | 0.11 | 58.3% |
| | Var4 | 0.22 | 25.4% |
| | Var5 | -0.11 | 57.1% |
| | Var6 | 0.07 | 73.3% |
| | Var7 | -0.10 | 62.1% |
| | Var8 | -0.15 | 43.6% |
| | Var9 | 0.13 | 50.5% |
| | Var10 | -0.27 | 16.8% |
| | Var11 | -0.27 | 16.3% |
| | Var12 | -0.19 | 33.0% |
| | Var13 | -0.24 | 22.4% |
| | Var14 | 0.02 | 92.9% |
| | Var15 | -0.55 | 0.0% |
| | Var16 | 0.26 | 17.0% |
| | Var17 | 0.22 | 24.8% |
| | Var18 | 0.15 | 44.4% |
| M&V scheme (ordinal scale) | Var1 | 0.13 | 49.5% |
| | Var2 | 0.15 | 44.2% |
| | Var3 | 0.09 | 65.5% |
| | Var4 | 0.26 | 16.7% |
| | Var5 | -0.22 | 25.8% |
| | Var6 | 0.13 | 49.5% |
| | Var7 | -0.07 | 72.1% |
| | Var8 | -0.16 | 41.7% |
| | Var9 | 0.02 | 93.2% |
| | Var10 | -0.15 | 44.8% |
| | Var11 | -0.32 | 8.9% |
| | Var12 | -0.23 | 23.9% |
| | Var13 | -0.28 | 14.4% |

| Element | Variable | Spearman rho | Prob> t |
|---|--------------|--------------|----------|
| | Var14 | 0.17 | 36.9% |
| | Var15 | -0.59 | 0.0% |
| | Var16 | 0.15 | 42.9% |
| | Var17 | 0.19 | 33.3% |
| | Var18 | 0.39 | 3.9% |
| Coordination mechanism (continuous scale) | Var1 | 0.16 | 39.3% |
| | Var2 | -0.25 | 18.4% |
| | Var3 | -0.01 | 95.6% |
| | Var4 | -0.17 | 37.3% |
| | Var5 | 0.15 | 47.6% |
| | Var6 | -0.48 | 0.9% |
| | Var7 | -0.01 | 95.6% |
| | Var8 | -0.10 | 61.0% |
| | Var9 | 0.22 | 24.6% |
| | Var10 | -0.21 | 29.6% |
| | Var11 | -0.12 | 55.1% |
| | Var12 | 0.04 | 82.3% |
| | Var13 | 0.11 | 58.3% |
| | Var14 | 0.07 | 74.6% |
| | Var15 | 0.00 | 100.0% |
| | Var16 | -0.16 | 40.4% |
| | Var17 | 0.25 | 19.0% |
| | Var18 | -0.17 | 39.3% |
| Coordination mechanism (ordinal scale) | Var1 | 0.18 | 35.6% |
| | Var2 | -0.03 | 89.3% |
| | Var3 | -0.06 | 78.0% |
| | Var4 | -0.02 | 92.9% |
| | Var5 | -0.04 | 83.4% |
| | Var6 | -0.27 | 15.9% |
| | Var7 | 0.10 | 60.7% |
| | Var8 | -0.13 | 50.1% |
| | Var9 | 0.09 | 65.5% |
| | Var10 | -0.14 | 48.2% |
| | Var11 | -0.18 | 34.5% |
| | Var12 | -0.09 | 64.0% |
| | Var13 | 0.08 | 67.4% |
| | Var14 | 0.03 | 85.8% |
| | Var15 | -0.27 | 16.5% |
| | Var16 | -0.01 | 94.9% |
| | Var17 | 0.34 | 7.0% |
| | Var18 | -0.08 | 68.1% |

III Analysis of good and best practices - M&V schemes

The analysis of the existing M&V schemes was performed according to the methodological framework, which was presented in the corresponding report of the multEE project about the development of the appropriate methodological approach for the mapping of the existing M&V schemes and coordination mechanisms and the proposed criteria for the analysis of the best practices.

The examined good and best practices **have already introduced a M&V scheme or a certain number of M&V schemes** indicating a significant degree of capability to monitor and verify the energy efficiency measures and the achieved energy savings. Moreover, it was declared that **the developed M&V schemes are in compliance with the requirements of the EED and ESD**.

The most important findings, which were derived by the analysis of the good and best practices, are presented in the following sub chapters.

▪ Administrative authorities and their responsibilities

Generally, **the ministries, which are responsible for the formulation of the energy efficiency policy, undertake mainly the administration and coordination of the M&V scheme**. Furthermore, schemes with **shared responsibilities involving other authorities such as energy agencies or subordinate bodies** constitute another popular alternative for running the M&V scheme. Nevertheless, the measurement, monitoring and verification of the achieved energy savings is an obligation of the corresponding ministry according to the official framework about the implementation of the ESD and EED.

The analysis of the good and best practices highlighted the crucial role of the **energy agencies** for the effectiveness of the M&V schemes in cooperation with the corresponding ministries, which coordinate officially the M&V scheme, outlining a framework of shared responsibilities. Indicatively, in **Denmark** the Danish Energy Agency has the obligation to control the monitoring and documentation methods. In **Slovakia** the responsible body for administration and coordination of the monitoring system of energy efficiency is Slovak Innovation and Energy Agency (SIEA). Specifically, the main duties of the SIEA consist of the creation, running and regular update of the monitoring system. Moreover, the SIEA is also obliged to validate, process and analyze the received data in relation to the energy efficiency targets, while it has to provide information for annual energy efficiency report as well as national energy efficiency action plans. In **Austria** the Austrian Energy Agency was designated by the Austrian Federal Ministry of Science, Research and Economy as national

monitoring body in May 2015 after a national competitive bidding process. Specifically, the Austrian Energy Agency is the national monitoring body as requested by the federal law on energy efficiency. In **Slovenia** the Ministry of Infrastructure which is responsible for energy efficiency policy making in collaboration with the Energy Agency is responsible for the monitoring process. In **Croatia**, the Energy Efficiency Act has named the Croatian Institution Center for Monitoring Business Activities in the Energy Sector and Investments (CEI) as the National Energy Efficiency Authority establishing the obligation to develop, monitor and administer the M&V scheme and to train the end-users. Similarly, in **Sweden** the Swedish National Board of Housing, Building and Planning in cooperation with the Swedish Energy Agency have the responsibility for the administration and coordination of the M&V scheme. In the **FYR of Macedonia**, the administrative authority for the M&V scheme is the Energy Agency of Republic of Macedonia. Specifically, the Energy Agency is collecting data through annual reports from the local self-governments and processing the data in order to estimate the national targets.

In **Spain** the Spanish Institute for Energy Diversification and Saving (IDAE) is the administrative authority, which is responsible for the administration and coordination of the M&V scheme. The IDAE is a publicly owned business-structured entity reporting to the Ministry of Industry, Energy and Tourism through the General Secretariat for Energy. The mission of the IDAE is the promotion of energy efficiency and the rational use of energy in Spain, while it provides technical consultancy to the government at national, regional and local level. Within the framework of Article 7 of the EED, the IDAE has been defined as the managing authority of the obligation scheme supervising the fulfillment of the energy efficiency obligations by the obligated retail companies and issuing and registering the required energy efficiency certificates.

Nevertheless, few examples of non-shared responsibilities were recorded. Specifically, in **Latvia** the operation of the energy efficiency monitoring system is ensured by the Ministry of Economics. The common practice is the hiring of energy consultants from the ministry in order to assess the achieved energy savings and to estimate the final calculation about the fulfillment of the energy efficiency targets. In **UK** the Department of Energy and Climate Change (DECC) was created in 2008 in order to undertake the administration and coordination of the M&V scheme. The three overall objectives of this department are to ensure energy is secure, affordable and efficient, facilitate the transition to a low-carbon Britain and to achieve an international agreement on climate change. Finally, in **Greece** the Ministry of Environment and Energy is responsible for the administration and coordination of the M&V scheme with the technical assistance of the Center for Renewable Energy Sources and Savings (CRES).

The requirements about the administration and coordination of the M&V schemes, especially for the case that a third party is involved, should be specified by corresponding legislative interventions.

In Austria the responsibilities and duties of the Austrian Energy Agency as national monitoring body are manifold and are specified in articles 24 and 25 of the Federal Law on energy efficiency. The main responsibilities are summarized in the following points:

- Evaluation of the target's achievement of the Federal Law on energy efficiency and of Austria's energy saving obligations scheme related to the implementation of the EED, including the annual reporting on the achievement of the target.
- Compilation of the National Energy Efficiency Action Plan (NEEAP).
- Updating the list of the qualified energy auditors to carry out external audits in companies obliged to implement an energy management system or to undergo an energy audit every four years.
- Metering and evaluation of the measures implemented by companies subject to introducing an energy management system or carrying out an energy audit.
- Metering and evaluation the measures implemented by energy suppliers subject to the energy efficiency obligation scheme.
- Observation of the market on energy services, energy audits and other energy efficiency measures and suggesting proposals for further developing this market.
- Development of further bottom-up methods to meter and evaluation of additional energy efficiency measures.
- Establishment of technical and organizational structures for the monitoring and evaluation of energy efficiency measures.
- Development of procedures for data collection with the involvement of the relevant stakeholders.
- Dissemination of the information regarding the energy efficiency measures and the achievement of the energy efficiency targets.

In some MS the monitoring bodies are responsible for the administration and coordination of the M&V scheme. Their corresponding responsibilities and duties **depend on the M&V scheme.**

France can be considered as such an example for the diversification of the imposed responsibilities. The monitoring can be conducted either by a ministry (esp. Ministry of Ecology, Sustainable Development and Energy), by the energy

agency (ADEME), by the regulator (TSO- Transmission system operator) or by banks (distribution of soft loans). The monitoring body depends on the energy efficiency measure. Specifically, the ministry in charge of Energy: Ministère de l'Écologie, du Développement durable et de l'Énergie (MEDDE) and its affiliate Direction Générale de l'Énergie et du Climat (DGEC) sets the rules and the obligations and attributes the Energy Savings Certificates and controls the implemented projects. In collaboration with the PNCEE (National Authority for Energy Saving Certificates), which is linked to the Directorate General for Energy and Climate, the Ministry of Energy and the Directorate General for Energy and Climate are responsible for the administration of the scheme. Moreover, PNCEE is responsible for the surveillance, monitoring and control of energy saving certificates. The ATEE (Energy Environment Technical Association) is responsible for the operation of the platform in order to gather the involved economical actors in the energy savings market (energy suppliers, manufacturers, retailers etc.) and to defend the energy suppliers' interests. Moreover, ATEE proposes to the ministry new standardized actions. Finally, ADEME (Agency for Environment and Energy Management) provides its expertise regarding the technical analysis and evaluation of the implemented energy efficiency measures to the ministry. Furthermore, ADEME organizes information campaigns to public bodies and companies.

▪ **Sectoral and spatial analysis**

The main practice is that all sectors of final energy consumption (**public, residential, industrial and transport sector**) are covered by the different existing M&V schemes. The administration of the M&V schemes is performed **mainly at national level and in limited cases at regional and local levels**.

For example, in **Austria** the sectors targeted within the M&V scheme are the end-use sectors households, services, industries, public sector and to a minor extent transport. The regional and national administrative levels participate actively in the Austrian M&V scheme for energy efficiency by reporting energy efficiency measures they have subsidized to the national monitoring body on annual basis. Obligated parties of the M&V scheme are however only the federal bodies and the parties subject to the energy efficiency obligation scheme (energy providers) according to Article 7 of the EED. Local authorities, federal provinces and companies not being subject to Article 7 of the EED are not required to report energy efficiency measures. However, in the case that the local authorities and companies have received subsidies for implementing energy efficiency measures in their sphere of action, the effects of these measures are generally reflected in the savings reported to the national monitoring body by the respective national agency funding.

In **Croatia**, all parties participate in the M&V scheme at all levels (local, regional, national) – the public sector, the households sector, the industry sector and the

transport sector. In **Slovenia**, the local communities shall adopt a local energy concept (LEC) every ten years as a program of energy management in the local community with the prior consent of the minister responsible for energy and publish it on their websites. It should be noted that these plans are mandatory, but their implementation is voluntary.

In the **FYR of Macedonia** and in **Denmark** all the sectors are included in the national M&V scheme (residential, tertiary, industrial and transport sectors). In **Slovakia** the M&V scheme covers measures, which are implemented in all end-use sectors, while the participation is divided to three administrative levels – local (municipalities and their representatives), regional (higher territorial units) and national (ministries and other state administration bodies). 36% of the foreseen energy savings for the period 2014-2016 will be derived by interventions in the buildings, 30% in industrial sector, 19% in public sector, 8% in households (appliances) and 7% in transport sector.

In **France** the Energy Saving Certificates Scheme (ESC) was introduced in 2006 in order to reduce the final energy consumption. Specifically, the obligated parties (energy suppliers such as suppliers of gas, electricity, LPG, heating oil and district heating/cooling, as well as automotive fuel wholesalers) receive certificates for implementing energy saving measures towards energy consumers in all end use sectors (residential, tertiary, agriculture, industry, transport). The obligated parties are not the only entities that are allowed to submit requests for ESCs in exchange to measures they have performed or supported. The ESC scheme is also open to another type of participants, called “eligible” parties, which can undertake energy savings operations and have them certified in exchange for ESCs without having an obligation to fulfill. The following “eligible parties” can claim ESCs for operations they or a third party perform on buildings they manage: regional, territorial and local authorities and the public organizations under their authority, the National Agency for Housing (ANAH) as well as social housing agencies or social landlords.

▪ **Energy efficiency measures**

The analysis of the good and best practices confirmed that a **great variety of energy efficiency measures** has been implemented in order to ensure the fulfillment of the established energy savings targets.

In **Austria** the most significant energy efficiency measures consist of interventions on the building shell (62%) and the heating systems (23%) followed by district heating (9%).

In **Denmark** the energy upgrade of the process equipment, envelope, boilers, heating plants and ventilation systems comprise the most important energy efficiency measures. In the **FYR of Macedonia** the most efficient measures according to the results from the M&V schemes are the combined heat and power

production, promotion of sustainable transport systems in urban areas and reconstruction of existing buildings in terms of energy savings.

In **Greece** the most important energy efficiency measures consist of the "Energy Savings at Home" and "Substitution of old private cars with new high efficient" programs. The "Save Energy at Home" program provides financial support to households in order to implement interventions for the improvement of the energy efficiency of their buildings. The foreseen eligible technologies include the replacement of the window frames with new more efficient, the installation of shading systems, the thermal insulation of the building envelope, including the roof and the pilotis and the upgrade of the electro-mechanical equipment of the heating and hot water systems. The "Substitution of old private cars with new high efficient" program aims at the replacement of the public and private old passenger vehicles fulfilling EURO III standards with new more efficient vehicles fulfilling EURO V standards. Under this program, it is foreseen the partial or the whole exemption from the specific registration fee of the new technology passenger vehicles. Moreover, the old vehicles have to be sent for scrapping under the approved system for alternative management of End-of-Life Vehicles.

In **Spain** the implemented energy efficiency measures, which are covered by the M&V scheme, focus on the promotion of energy savings interventions in the residential, industrial, tertiary and transport sectors. Moreover, these measures are performed both at regional and national level. The most important energy efficiency measures and technologies in terms of energy savings include the Aid Program for the Energy Renovation of Existing Buildings (PAREER), the Efficient vehicle incentive program (PIVE), the Aid Program for municipal public lighting, the Aid Program for SME and large companies of the industrial sector and the Aid Program for transport. The promotion of energy savings interventions in the industrial sector constitutes the most important energy efficiency measure in terms of the achieved energy savings. It should be mentioned that the last three measures have been financed by the Energy Efficiency National Fund. This fund is supervised by the Ministry of Industry, Energy and Tourism, via the State Secretariat for Energy, and is managed by the IDAE. According to the Law 18/2014, the obligated parties (gas and electricity utilities, wholesale petroleum product operators and wholesale liquefied petroleum gas operators) are required to contribute on annual basis to the fund in order to fulfill the imposed energy saving obligation. The most widespread energy efficiency technologies consist of the improvement of the energy performance of the thermal envelope, the energy upgrade of the heating and lighting installations, the replacement of conventional energy with biomass and geothermal energy in heating installations and the further penetration of high efficient conventional, hybrid, plug-in hybrid, electric and extended range electric vehicles passenger cars and light commercial vehicles.

▪ **Measurement and monitoring procedures**

The analysis of the good and best practices showed that all the examined States have already established **specific bottom-up procedures** for the monitoring of the energy efficiency measures and the measurement of the achieved energy savings. A **diversification of the implemented bottom-up approaches** was identified as attempt to comply with the requirements of Annex V of the EED to cover all the implemented energy efficiency measures. Moreover, many States continue to utilize **top-down approaches** for the monitoring of the energy savings targets as foreseen by the ESD. Nevertheless, the utilization of top-down indicators targets the calculation of the achieved energy savings at sectoral level. Finally, the authorities, which are responsible for the administration and coordination of the M&V scheme and for the implementation of the data collection procedure, have also undertaken the **development of the bottom-up methodology** including potential revisions and additions in the existing methodologies.

In **Austria**, the Austrian Energy Agency had developed a wide range of bottom-up methods to calculate energy savings from energy efficiency measures implemented by the different bodies affected by the directive. Bottom-up methods were developed for the following measures:

- Air conditioning in non-residential buildings (service buildings): new installation and replacement of old air-conditioning systems
- Combined Heat and Power (CHP) in production and industry
- Circulating pump: installation of new circulating pumps and replacement of existing ones
- District heating: connection of residential buildings to the district heating grid
- Energy Audits for households and companies
- Improved thermal insulation of warm water tanks
- Lighting: efficient lighting in households, in office buildings, in restaurants and hotels; efficient street lighting
- Heating system: Replacement of old gas- or oil boilers with efficient gas- or oil boilers in residential buildings
- Heat pump: installation of soil- and water heat pumps in new buildings
- PV panels/plants and solar thermal panels
- Smart Meters and informative billing
- Stand-by killer in households

- Thermal refurbishment of buildings: residential and non-residential buildings
- Improved thermal insulation of warm water tanks
- White goods: purchase of highly efficient fridges and freezers; early replacement of existing fridges and freezers

It should be noted that the Austrian Energy Agency is continuously developing additional bottom-up methods as derived by its role as national monitoring body for the EED. The methods have to be updated on a regular basis; however, no specific intervals are foreseen. The Austrian Energy Agency as a national monitoring body has also defined the national default values (e.g. average specific heating demand of residential buildings in stock, average energy efficiency of wet appliances in stock) in consultation with relevant stakeholders (e.g. advocacy groups of energy suppliers).

Moreover, the Austrian Energy Agency calculated a variety of top-down indicators as recommended by the EU as presented in the following points:

Households:

- P1: Energy consumption of households for space heating per floor area in m² adjusted for climatic conditions
- P3: Energy consumption of households for water heating (and cooking) per inhabitant
- P4: Electricity consumption per appliance type in kWh/year
- P5: Electricity consumption of households for lighting in kWh/year per dwelling

Services:

- M3: Non-electricity energy consumption of the service sector per employee in full time equivalent adjusted for climatic conditions
- M4: Electricity consumption of the service sector per employee in full time equivalent

Industry:

- P14: Energy consumption of industrial sub-sectors per unit of production

Transport:

- P8: Energy consumption of cars in grams of oil equivalent per passenger-km
- A2: Energy consumption of trucks and light vehicles in tonnes of oil equivalent per vehicle

- M6: Energy consumption of rail transport in grams of oil equivalent per tonne-km

The same top-down indicators have been utilized by other countries, such as **Sweden** and the **FYR of Macedonia**. Moreover, the **FYR of Macedonia** developed and adopted specific bottom-up methodologies for 20 different energy efficiency measures consisting part of the Rulebook on energy audit. The categories of the measures are presented below:

- New residential buildings
- Improvement of the envelope of the residential buildings
- Boilers on biomass
- Installation of condensing boilers for water heating in closed system in residential buildings
- Energy efficiency cooling machines and washing machines
- Sanitary hot water in households - Solar water heaters
- Sanitary hot water in households - Heat pumps
- Improvement of the heating system in water cycle in non-residential buildings (tertiary sector)
- Improvement of lighting systems (in tertiary sector)
- Improvement of central acclimatization (in tertiary sector)
- Office equipment
- Energy efficient motors
- Variable speed drives
- Energy efficient vehicles
- Changing the transport mode of passengers
- Eco-driving
- Intelligent meters in households
- Energy audits
- Replacement and installation of new lamps in residential buildings
- Replacement and installation of new systems for public lighting

For the development of the above-mentioned bottom-up methodologies, the responsible body is the Ministry of Economy – the Energy Department. The existing methodology (bottom-up and top-down) is developed with technical assistance by GIZ and with supervision of separate working groups in which, in

addition to the other members, participated representatives from the Ministry of Economy and Energy Agency of the Republic of Macedonia.

In **Slovenia** the bottom-up methodologies for the calculation of the achieved energy savings were published in 2015 in a bylaw "Regulation of methods for energy savings calculations". The proposed methodology entails calculations for 29 different measures and they cover all sectors. The measures, which are covered by the M&V methodologies include:

- Thermal insulation of the building envelope and installation of external joinery
- Boilers
- Construction of new or renovation of the heating system group
- Heat pumps (air / water) for domestic hot water
- Solar receiver heat for hot water and heating support
- Classical, gas and hybrid heat pumps
- Control heating systems (timing, thermostats and thermostatic radiator valves in the head)
- Connection of buildings to the district heating system
- Energy advice
- New electric cars
- Use of tires with the highest energy efficiency class of passenger vehicles
- Energy-efficient (compact) fluorescent lamps
- Energy-efficient refrigeration appliances (refrigerators, freezers, etc.)
- Energy-efficient washing appliances (dishwashers, washing machines and dryers, etc.)
- Systems for heat recovery in buildings
- Advanced metering systems
- Restoration of distribution networks district heating system
- Energy-efficient devices for cooling or air conditioning
- Monitoring of energy-efficient devices for cooling or air conditioning
- Effective ventilation systems (mechanical controlled system for the discharge of exhaust air preheat the fresh air, etc.)
- Use of tires with the highest energy class of freight and light commercial vehicles

- Energy-efficient lighting systems
- Energy-efficient exterior lighting
- Energy audits
- Systems for cogeneration of heat and electricity
- Energy-efficient motors
- Frequency converters
- Effective pumping systems in industrial processes
- Efficient systems for the production of compressed air

The Minister of Infrastructure is responsible for the methodology and its update.

In **Croatia** bottom-up methodologies have been developed for 20 different energy efficiency measures (building renovation, replacement of housing appliances, boiler replacement, eco-driving etc.) and have been introduced to the SMIV as presented in the Rulebook for the M&V. The bottom-up monitoring procedure and the methodology were developed in cooperation with many relevant institutions and were built upon the already existing rulebook. They were officially proposed by the Ministry of Economy and adopted by the Minister of Economy. In the case that an end user wants to calculate the achieved energy savings for an energy efficiency measure that is not mentioned in the Rulebook, the new measure has to be proposed to the National EE Authority, which then has to approve the methodology or the new measure.

In **Spain** specialized bottom-up monitoring approaches are utilized in order to measure the achieved energy savings from the implemented energy efficiency measures. The development of the bottom-up approaches has been performed according to the proposed methods of ANNEX V of the EED. Specifically, the determination of the energy savings is performed with the implementation of various methods (scaled, deemed, surveyed savings methods) depending on the type and the characteristics of each measure separately. Indicatively, for the Aid Program for the Energy Renovation of Existing Buildings (PAREER) the Energy Performance Certificates before and after the implementation of energy saving technologies are taken into consideration for the calculation of the achieved energy savings. It should be noted that the bottom-up equations have been developed for a predefined catalogue of eligible measures, while various other issues are taken into account such as the climatic variations and the lifetime of the measures. Moreover, additional measures can be incorporated into the catalogue including the corresponding bottom-up approaches. Finally, the IDAE is responsible for the development of the appropriate methodology and the utilized indicators targeting to ensure in any case their effectiveness and applicability according to the requirements of the EED.

Similarly, in **Lithuania** the calculations are based on the final energy consumption reduction after the implementation of measures. In **Slovakia**, specific bottom-up methodologies have been developed in order to evaluate the achieved energy savings, which are implemented in conjunction with specialized information systems.

In **Denmark** the achieved energy savings are calculated either by use of standard values, by a specific inventory of the saving following the activity or by the effect of a specific market impact. The monitoring based on standard values is especially used for smaller standardized activities such as savings in private homes and other small buildings. The standard values can be selected from a standard value catalogue for the specific energy efficiency measures, which have to be evaluated. The procedure of the measurement is carried out by a simple multiplication of the standard value with the amount of units relevant for the concrete project. If a priority factor is given in the standard value, then this factor must be used on the calculated saving. For the case that the monitoring focuses on specific projects or integrated solutions it is necessary to measure the energy consumption before the implementation of the energy saving project and the energy consumption after the implementation of the energy saving project. Then, the total energy savings can be estimated for the first year of operation with correction of changes in time operations, amount of production and production compositions. All the energy savings have to be reported to the Danish Energy Agency. The effect of the energy savings is based on the energy saving after the first year, while the energy saving after the first year is weighted with a simple priority factor reflecting the lifetime of the energy saving, the gross energy consumption and the expected CO₂-effect of the energy saving. Finally, the methodologies and indicators are updated by a technical working group, where all the parties are represented.

In **France** both of bottom-up and top-down approaches have been introduced. The recommended top-down indicators from the EU, as presented previously, are utilized in order to assess the progress with reference to the targets fixed by the ESD directive (amount of energy savings to be achieved in 2010 and 2016). Considering the bottom-up procedures different methodologies for each implemented energy efficiency measure are applied for the calculation of the achieved energy savings. Moreover, the achieved energy savings can be triggered by projects either from a catalogue of "standard operations" or case-by-case i.e. "special operations" where the savings must be calculated more precisely. Development process of standard operations: These standard operating sheets are suggested by the Energy Environmental Technical Association (ATEE - l'association technique énergie environnement) which represents all parties participating in this system. Once the proposed operation is accepted and verified for technical accuracy by ADEME and after being validated by the Ministry, the standardized measure is published for official use in the

scheme in a ministerial decree in the French "Journal Officiel". Currently there are 304 possible standard energy saving measures defined and included in the official catalogue, such as condensing boilers, roof insulation or double glazing operations. The French administration regularly updates the list so as to account for technical progress by 1) removing measures that no longer provide significant savings as compared to the regulated standard, 2) modifying existing measures to better represent the present circumstance, and 3) adding newly approved measures. The measures are classified by sectors (residential, industrial, tertiary, transport, agricultural). Special operation requests are sent to the National Authority for Energy Saving Certificates (PNCEE) which validates the requests for ESCs with support from ADEME on the highly technical portions of the project. ESCs are only awarded to a qualified project proponent (an obligated or eligible party) after a professional installer finishes the operation and the PNCEE validates the eligible energy savings. For alternative measures, the savings calculation is tailor-made. It can be conducted either by a ministry (for example, ministry of finance for a tax rebate) or by a regulator (TSO) or by banks (distribution of soft loans).

In **Greece** the monitoring of the energy efficiency measures is performed through the establishment of specialized bottom-up procedures. These procedures were developed from the Ministry of Environment and Energy. The foreseen approaches were improved according to the requirements of the Article 7 of the EED. The bottom-up approach for the case of "Energy Savings at Home" program is based on the analysis and the evaluation of the EPC data for these buildings, which are financed by each Operational Program. Specifically, for each building it is estimated the savings in final energy consumption by the provided savings in primary energy consumption through a specialized calculation procedure utilizing specific reference values. For the case of "Substitution of old private cars with new high efficient" program the bottom-up approach is based on the total number of replaced vehicles and on assumptions about their mean specific consumption and their average covered distance on annual basis.

▪ **Data collection procedures**

The national statistics office, national databases and data from paid subsidies comprise the most common data sources utilized. The coordination of the data collection process is undertaken mainly either by a governmental body, an agency, an energy regulator or by a combination of the involved authorities including the corresponding ministry. The national databases can be either an integrated information system or a simplified tool developed in excel or access formats aiming at the collection of specific types of data, which can be utilized for the measurement and the monitoring of the energy savings.

In **Austria** the majority of the data on energy efficiency measures stems from the regional and national funding agencies, which provide subsidies for financing part of the investment cost of energy efficiency measures.

In **France** most of the data on energy efficiency measures are derived by the White Certificate Scheme. Specifically, Emmy, the national registry, collects data on the number of ESC generated by each obligated party, the type/number of operations declared, and the operations by region. The white certificates are only materialized when registered on the Emmy. Moreover, the institutions which are involved as administrative authorities are also responsible for the data collection process.

In **Spain** the main data sources for monitoring the implemented energy efficiency measures in different sectors include national databases, databases on regional level and data from paid subsidies. The Ministry of Industry, Energy and Tourism, which is responsible for the formulation of energy efficiency policy, have undertaken the monitoring and operation of the data collection process in collaboration with the IDAE.

In **Poland** national databases are the main data sources for the monitoring of the implemented energy efficiency measures in different sectors. For the data collection process, the responsible body is the National Statistical Office, while some statistical duties were attributed also to the National Statistical Office and to the regional governmental administration.

In **Greece** the main data sources for the monitoring of implemented energy efficiency measures and the measurement of the achieved energy savings in different sectors consist of the corresponding unit of the Operational Programs, which are responsible for the implementation of the programs and the Hellenic Statistical Authority. Moreover, the Registry of Energy Performance Certificates is utilized as additional source for the acquisition of necessary data regarding the implementation of energy efficiency interventions in buildings. The Ministry of Environment and Energy with collaboration of the Hellenic Statistical Authority are responsible for the coordination and the implementation of the data collection process.

In the **FYR of Macedonia** the acquisition of data in the public sector is performed through regular reporting on annual basis from the public building owners to the Energy Agency of the Republic of Macedonia. Also, regular energy audits provide data for this sector. The acquiring data for the residential sector, as well as for the industry sector is mainly based on statistical data, surveys and analyses. The transport sector data that is used mainly stems from the national statistical office. For data collection, the responsible body is the State Statistic Office. Though, for energy related statistics, the local self-governments are also responsible to gather data and submit reports. Data from other sources are used including data from public sector enterprises, data for imported devices and

appliances in Macedonia by the Custom of the Republic of Macedonia, data from distributors of electrical devices and appliances, data from separate industries which are received through bigger Chamber of Commerce, data from the Ministry of Economy for solar water heaters for which subsidies are provided. For the data collection process, especially for the energy related data from the local self-governments, the responsible body is the Energy Agency of the Republic of Macedonia.

In **Austria** the Austrian Energy Agency as national monitoring body is responsible for setting up the data collection process and for informing all relevant stakeholders about the process. The main actors concerned of the data collection process are energy suppliers subject to the energy efficiency obligation scheme and federal bodies. They have to report energy efficiency measures to the national monitoring body on a yearly basis.

In **Croatia** the necessary data for monitoring and implemented energy efficiency measures in different sectors comes from paid subsidies – meaning that whichever institution gives out incentives is obligated to enter savings into SMIV. The largest amount of subsidies (and achieved savings) is achieved by the Croatian Eco fund (Fund for Environment Protection and Energy Efficiency). The organizations responsible for the data collection processes are the National EE Authority, part of Center for Monitoring Business Activities in the Energy Sector and Investments, founded by Ministry of Economy, appointed for monitoring and data collection through the EE Act.

In **Slovakia** the organizations representing individual sectors are responsible for collecting data based on their tasks. Official statistics are created by the Statistical Office of the Slovak Republic, while additional data are provided by representatives of sectors, which are members of interdepartmental working groups collecting the data for the ministry. The main data sources comprise the ITMS, the INFOREG and the SLOVSEFF, which is a mechanism for the financing of investments in residential and industrial energy efficiency and renewable energy since 2007. SIEA has undertaken the responsibility for data collection.

Finally, in **Denmark** each party is responsible for the collection of data in respect of their energy savings and in respect of the defined monitoring and documentation methods, controlled by the Danish Energy Agency. The data of energy savings must be reported to the Danish Energy Agency each year, when the energy saving is realized and the documentation is finished.

In **Lithuania** the main data sources for the monitoring of the implemented energy efficiency measures consist of the national statistical office and various other national databases. Most of the data are submitted by the institutions, which are administrators of the measures and entities participating in the planning and implementation of energy efficiency measures. Upon completing the implementation of energy efficiency measures, entities receiving financial

support from programs register the entity's indicators during the same calendar year and for one calendar year afterwards and then transmit the data collected to the administrator of the respective program. Apart from each entity's indicators, the monitoring of energy resources and energy consumption covers the following: the type and number of measures implemented, energy properties and the amount of investment in specific measures. It is relevant program's administrators, who evaluate individual program's indicators, review the monitoring exercise and make the forecast and file the program monitoring report on efficient consumption of energy resources and energy for the previous calendar year to the Ministry of Energy.

In **Latvia** the main data sources for the monitoring of the implemented energy efficiency measures consist of data from paid subsidies as well as national Statistics Office (Latvia Central Statistical Bureau) data and other national information sources. Regarding the data from paid subsidies, the information submitters are the Responsible Institutions (RI) which has granted or provided any type of financial aid for implementing the energy efficiency improvement project. A 2-step process is followed. Specifically, in the 1-step the information for the RI shall be submitted by each individual implementer of the project, while in the 2-step the RI examines and compiles the individual reports, thus eliminating the risks of double counting of savings, and then submits the reports to the Ministry of Economics.

▪ **Verification procedures**

The most common approach for the verification of the measured energy savings comprises the conduction of inspections of a representative sample of the implemented energy efficiency measures in compliance with the requirements of the EED. Nevertheless, **various other means for verification have been introduced** such as specific databases and specialized reports in order to facilitate the efficient verification of the achieved energy savings.

In **Austria** the energy savings reported are verified by means of plausibility checks and in depth sample checks of statistically significant proportions of projects. In addition, selected projects are verified through on site visits. In **France** at the end of each period, the PNCEE verifies that each obligated party holds at least the amount of ESCs (in kWh cumac) on its Emmy account as is required by their obligation. Their precise obligation is based on energy sales during the period so an obligated party can only know the exact volume of ESCs required of them after the period is completed. Nevertheless, obligated parties are still able to estimate fairly accurately what their target will be prior to the end of the period and plan their operations/programs accordingly. For the strategic measures, each monitoring actor uses its own verification process.

In **Sweden** the measures are verified by impact assessment from the Mure Database, while in **Slovenia** the Energy Agency verifies a statistically important percentage and examines a representative sample of measures for improving energy efficiency implemented by liable entities.

In the **FYR of Macedonia** the verification of energy savings is through officialization of results of measurements, through preparation of annual reports for achieved energy savings by the Energy Agency of the Republic of Macedonia. Also, as verification could be treated the adoption of each Energy Efficiency Action Plan in which consisting part is information for achieved energy savings for the previous period of 3 years. In **Denmark** the grid- and distribution companies have the responsibility of securing that their documentation is fulfilling the demands in the agreement. Once every year the Danish Energy Agency is carrying out an independent sample of the involved grid- and distribution companies. The sample focuses on controlling whether the activities of the companies are fulfilling the demands and the obligations in respect of the agreement. Besides extensive evaluations are carried out by consultants.

In **Spain** as managing authority of the energy efficiency obligation scheme, the IDAE is responsible to inspect and supervise the proper implementation of the energy saving and efficiency measures. The IDAE verifies the implemented energy efficiency measures in order to issue energy efficiency certificates for the obligated parties with the prerequisite that there is the evidence that the measure has led to the final consumers the specific amount of energy savings. The IDAE may be supported from external entities or specialists in order to complete the appropriate verification procedures. For the case of the alternative policy measures, the IDAE follows up and monitors the aid granted by means of sampling, without prejudice to any procedures, which must be in compliance with the Law 38/2003. Indicatively, these audits may include the control of the energy performance certificates, the invoices and the bank documents providing evidence for the realization of the payments. Moreover, the accepted savings (deemed savings), which are included in the catalogue for each of the measures, are utilized as a benchmark in order to perform an independent check in similar installations and energy efficiency interventions regarding the achieved energy savings.

In **Croatia** the measured energy savings are being verified through algorithms in SMIV – the M&V system. Targets for each measure in SMIV are related to those same measures planned through Croatian NEEAP. Targets at the local level (municipalities, cities and counties) are monitored through EE plans, but they are not mandatory. In **Lithuania** the required verification is performed on random checks of the reports on the energy savings submitted by beneficiaries or administrators of the energy efficiency measures.

Finally, in **Greece** the measured energy savings are verified within the framework of the M&V schemes through the conduction of random inspections to

a representative sample of the participating either building or vehicles. In any case the details about the verification procedure are specified by each energy efficiency program separately complying with the requirements of each Operational Program and the National Strategic Framework (both for the programming periods of 2007-2013 and 2014-2020). To this purpose each Operational Program has established a corresponding unit, which is responsible for the verification of the implemented actions and interventions.

▪ **Penalties for non-compliance**

Considering the existence of **penalties for cases with no compliance** the common practice is the imposition of specific fines as required by the European legislation.

In **Austria** for measures that were partially financed with subsidies, the beneficiary usually has to hand in invoices proving that he has invested in energy efficiency measures (e.g. thermal refurbishment of building shell, replacement of an old boiler). Energy suppliers subject to the energy efficiency obligation scheme have to pay a fine of 50,000 € if they provide incorrect information related to the savings calculation of energy efficiency measures.

In **Poland** in accordance with the national legislation audits confirming energy savings achieved, as well as declarations, are subjected to a verification procedure by the President of the Energy Regulatory Office, or at his request. The Law provides for penalties for energy savings lower than indicated in the declaration of interest if the verification procedure finds that this is the case.

In **Croatia** penalties exist in the Energy Efficiency Act, but they are only foreseen for the part of not planning the measures, or not entering the implemented measures into SMIV, but there is no penalty for failing to implement the measures. However, local plans, once approved, were passed through local administration, which means the necessary budget was approved and reserved by the local government.

In **France** the obligated parties incur a penalty for any short-fall in ESCs at the end of the period. The verification process by the PNCEE and the calculation/establishment of each obligated party's target only begins once the period has finished so the results and any associated penalties are announced months later (e.g. results are expected in mid - 2015 for the 2011 - 2014 period). The obligation targets are set for each obligated party for a three-year period. Within this period, there are no annual deadlines to be respected, the targets being verified only at the end of the period. For the second period, as for the first, obligated parties that fall short of their individual targets must pay € 0.02 for each missing kWh cumac (20 €/MWh cumac). However, paying the penalty fulfils their obligation for that period and the target is not carried over to the next obligation period as is true in some schemes.

▪ Reporting obligations

The reporting period has been established on annual basis for the majority of the States as requested by the EED. Nevertheless, in some cases the formulation of **the reporting obligations takes into consideration the peculiarities of each energy efficiency measure.**

In **Austria** the reporting of energy efficiency measures and savings is made on an annual basis. The national monitoring body has to report on the progress of target achievement to the Federal Ministry of Science, Research and Economy on a yearly basis. The Federal Ministry of Science, Research and Economy has to report to the National Assembly on the progress in implementing the federal law on energy efficiency (e.g. progress of target achievement and further energy saving potentials, measures implemented in (low-income) households, development of total energy consumption) on a two-year basis. In **Poland** the reporting period for the M&V scheme is on annual basis. Also, central register is planned to be created. The central register will help potential clients to more efficiently seek licensed specialists and will facilitate an efficient verification of certificates and inspection protocols. It will also be used for reporting tasks connected with the improvement of energy efficiency of the public sector.

In **France** the reporting period of the M&V schemes depends on the considered EE measure. As far as the ESC scheme is concerned targets are set for each obligated party for a three-year period. Within this period, there are no annual deadlines to be respected, the targets being verified only at the end of the period.

In **Denmark** the reporting procedure requires the completion of specific templates. Similarly, in **Latvia** unified reporting templates have been introduced. The Annex 1 "Energy Savings Report Regarding Energy Efficiency Improvement Measures Which Have Received Any of the Aid Types" of the Cabinet of Ministers Regulation No923 (2010) "Procedures by Which State Energy End-Use Savings Shall Be Measured and the Operation of the Energy Efficiency Monitoring System Shall Be Ensured" defines the project compilation form which shall be completed by the Responsible Institution. Also voluntary providing of information is foreseen stating that the implementers of energy efficiency improvement projects, which are not referred as the Responsible Institutions, shall inform the Ministry of Economics about the energy savings achieved by the energy efficiency projects, utilizing the saving report forms specified in the following Annexes, anytime, when they have become aware of such possibility:

- Annex 2 "Energy Savings Report for the Household Sector (Buildings)"
- Annex 3 "Energy Savings Report for the Service Sector"
- Annex 4 "Energy Savings Report for the Industrial Sector (Energy Efficiency of the Technological Process and Equipment),

- Annex 5 “Energy Savings Report for the Transport Sector”.

Finally, in **Slovakia** specific templates regarding the provision of input data have to be completed by the ministries and organizations for the related energy efficiency measures.

▪ **Administrative costs**

The analysis of the good and best practices provided significant insights about the **assessment of the administrative costs dedicated to collection and interpretation of the data of the M&V schemes**. Specifically, in **Austria** approximately 4-6 full-time equivalent per year are currently needed to fulfill all tasks of the national monitoring body.

In **Denmark** the administrative costs in percentage of the total cost of the energy savings is for Electricity Grid companies 9.3% in 2013 as an average, and 12.7% for District Heating companies in 2013 as an average.

Finally, in **France** for the white certificates scheme, about 15 people work on the scheme are required.

▪ **Integrated tools**

Some States have already introduced an integrated IT tool for the homogeneous monitoring and reporting of the M&V schemes.

In **Austria** the necessary data on implemented energy efficiency measures is collected in a central online database. The online database is developed by the Federal Computing Centre (BRZ) which is the IT service provider and market-leading e-government partner of the Austrian federal administration. The BRZ was commissioned by the Austrian Federal Ministry of Science, Research and Economy, owner of the online database, to set up this monitoring tool in consultation with the national monitoring body.

The database has three different functions:

- To register those enterprises subject to carrying out an energy audit or to implement an energy management system (Article 8, EED).
- To collect information on the enterprises energy consumption, on results of the energy audits, energy savings potentials etc.
- To report energy efficiency measures implemented by energy suppliers subject to the energy efficiency obligation system and the federal state. Additionally, the provincial states and other funding agencies of energy efficiency measures may report their measures also through the online database.

The Republic of **Croatia** has an M&V scheme in the form of an IT-tool called SMIV (System for Monitoring, Measurement and Verification of Energy Savings) that is currently in its implementation phase, in line with the Croatian National Energy Efficiency Action Plan as requested by the EED Directive and was set up for the Energy Efficiency Directive (Article 5 and 7, as well as Article 3 targets) monitoring. The legal implementation of energy efficiency started with the ESD and Croatia's first Act for efficient energy use in the final consumption (OG 152/2008). The M&V then started as a project developed in cooperation with GIZ, and SMIV has become an official Croatian M&V tool through the new EE Act (OG 127/2014). The owner of the Croatian version is the Ministry of Economy.

SMIV serves as a tool for monitoring savings for Article 7, but also for entire monitoring of energy efficiency. This integral monitoring through SMIV involves the following:

- Collecting all public EE plans and uploading them to the system. All measures mentioned in the plan are linked to the provided algorithms in SMIV.
- Bottom-up monitoring of EE targets under Article 3 EED
- Bottom-up monitoring of EE targets under Article 7 EED – since all measures are in the same system, there is a diminished possibility of double counting.
- Monitoring of EE targets under Article 5

CEI reports that 5 people administering SMIV and tracking inputted energy efficiency measures would be optimal.

In the **FYR of Macedonia** two voluntary (not defined in the legislation) software solutions for M&V are available. ExCITE is a software solution that is used by the local authority for monitoring the energy consumption. The software also provides several types of reports. The software is developed by the UNDP, and it is operated by the Association of the units of local self-government of the Republic of Macedonia – ZELS. The second tool, MVP was presented on national level, but is still not in permanent use. It takes into account all national and local plans, as well as other sectors (industry, households etc.) and its aim is to facilitate the effective monitoring of the implemented energy efficiency measures.

In **Slovakia**, the calculation of the achieved energy savings is implemented through the following IT tools:

- ITMS - Central information system, which serves for evidence, subsequent processing, export and monitoring of data about programming, project and financial management, controls and audits of projects financed by Structural Fund and Cohesion Fund.

- INFOREG - Information system which is used for collecting and processing information about socio-economical events and activities of partial actors in regional development, which has influence on overall regional development.
- The energy performance certificate database.

The energy performance certificate database is utilized also in **Greece** for the estimation of the achieved energy savings through the development of the appropriate bottom-up equations.

Finally, in **France** the application of the established bottom-up procedures for each implemented energy efficiency measure and the calculation of the achieved energy savings is performed with the SceGES® tool.

IV Analysis of good and best practices - Coordination mechanisms

The analysis of the existing coordination mechanisms was performed according to the methodological framework, which was presented in the corresponding report of the multEE project about the development of the appropriate methodological approach for the mapping of the existing M&V schemes and coordination mechanisms and the proposed criteria for the analysis of the best practices.

The most important findings, which were derived by the analysis of the good and best practices, are presented in the following sub chapters.

▪ Institutional and legal setting

The analysis of the good and best practices for the case of the coordination mechanisms confirmed **that the legal responsibility of energy policy formulation lies mainly at national level and in limited cases also at regional and local level** such as in the case of Austria and Germany.

Indicatively, in **Austria** the energy policy making is not only within the legal responsibility of the national state, but also within the regional provinces. On the other hand, local authorities are free to develop their own energy policies suitable for their sphere of action; however, they have no legal competence and responsibility respectively to adopt laws and decrees.

In **Germany**, the energy efficiency policy competencies are shared between federal government (here with the Ministry of Economic Affairs and Energy, supported by the Federal Energy Efficiency Centre) and the federal states. This implies that all laws and regulations are passed in a co-decision policy process which safeguards that during the law-making regional and local concerns can be voiced and adequate funding and staffing agreed. Whereas federal laws and initiatives only designate minimum regulations, federal state and local entities are able to step up on these regulations so as to safeguard that energy efficiency policies are most effective in their regional or local circumstances. Unlike in centralized countries, the federal structures of Germany imply that all levels of government (federal government, regional federal states and local level) have competencies in the various fields of energy policy. Partly these are shared competencies and partly they are exclusive competencies. In the case of energy efficiency policies, the federal government and regional states act as co-legislators. Federal laws usually define the bulk of energy efficiency policies and are implemented at regional and local level. However, any federal state wishing so can step up on national provisions by putting forward legislation which is more

ambitious than national level. To only cite one example, the federal state of Baden-Wuerttemberg has adopted building codes asking for a more comprehensive use of renewable energies than is foreseen in federal law. Likewise, the conditions for the (federal) KfW-funding for energetic refurbishment of existing buildings which offers grants and loans to private and commercial actors is stepped up in Baden-Wuerttemberg so as to enable loan conditions which are more attractive and more comprehensive than the federal KfW. In addition, local governments can and do add programs which go beyond the programs and measures at federal and regional level. The logic applied in Germany is closely related to the principle of subsidiarity. According to this logic, it is the task of the Federal Government to define a (minimum) set of policies in the energy efficiency field. Regional governments can then decide whether they agree with the level of ambition or whether further action is needed to satisfy the regional policy stance on energy and climate change policies. Finally, it will be up to local level governments to (a) implement these frameworks but also (b) to decide if this framework fits to the local needs or whether additional action is necessary.

▪ Allocation of responsibilities

Due to the fact that the energy efficiency policies are implemented in different end-use sectors, more than one ministry is involved in the formulation of energy policies. Nevertheless, the responsibilities for energy efficiency policy making and implementation are usually clearly defined between the different involved governmental layers in the majority of the examined cases.

In **Austria** at national level, the Federal Ministry of Science, Research and Economy, the Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Federal Ministry of Transport, Innovation and Technology have the legal responsibility in energy efficiency policy formulation. The Federal Ministry of Science, Research and Economy is the main government institution responsible for energy matters at the federal level. The Federal Ministry of Agriculture, Forestry, Environment and Water Management is responsible for environmental protection, including climate change and emissions from combustion. The Federal Ministry of Transport, Innovation and Technology is responsible for transport policy and energy Research & Development. These ministries cooperate on a regular basis, for example when launching research and funding programs or developing strategies covering their different thematic focuses altogether. Finally, the Federal Ministry of Finance is responsible for setting energy taxes.

In **Croatia** the Ministry of Economy is responsible for energy efficiency targets and the transposition and implementation of the EED through close collaboration with the Ministry of Construction and Spatial Planning (responsible for building

codes, energy audits and other related to EPBD), and the Ministry of Environment (responsible for public procurement. Also, all other ministries are involved such as the Ministry of Transport, which is responsible for measures in transport etc. The National Energy Efficiency Authority is a coordination body in CEI, working with all these institutions in order to achieve the set goals and monitor the savings. Executive institution for the establishment of energy efficiency incentives is the National ECO Fund, whose financing is approved by the three above mentioned Ministries and which supports programs in form of grants and subsidies to end-users. Furthermore, over 200 bodies are named in the NEEAP as the implementing bodies undertaking the responsibility to implement measures. Such bodies are, for example, local and regional authorities which are responsible for the formulation of energy efficiency plans.

In **Romania** the ministry of Economy and Commerce and the Ministry of Energy, Small and Medium –Sized Enterprises and the Business Environment are responsible for the establishment of the national energy regulation. The Ministry of Agriculture, Forests, Waters and Environment is responsible for the development of the general environmental policy and specific legislation related to water management and environmental protection. The Romanian Agency for Energy Conservation, established in 1991, is in charge of promoting energy efficiency. Finally, the administrative authority for the M&V scheme is the energy regulator of Romania.

In the **FYR of Macedonia** the Energy Agency of the Republic of Macedonia and Ministry of Economy examine whether the preparation and adoption of local EE policies is in accordance with the national EE policies. Each municipality after the preparation of Energy Efficiency Program submits it on opinion to the Energy Agency of the Republic of Macedonia and after receiving of this opinion the Council of the municipality could adopt the program. The purpose of this opinion is to ensure that the municipal Energy Efficiency Program for the period of 3 years is in accordance with the national Strategy for energy efficiency and the National Energy Efficiency Action Plan. The national authorities (e.g. Ministry of economy) in the process of preparation of the Strategy for energy efficiency and National Energy Efficiency Action Plans submit them on opinion to relevant stakeholders, including association of local self-governments. Also, draft documents are being published on the web site of the Ministry of economy. In that process local self-government units have right to give their opinion and to express their needs and priorities.

Nevertheless, in **Latvia** the Ministry of Economics is the leading state administrative institution in the field of economic policy, including energy policy, formation in Latvia. The Ministry of Economics is responsible for the formulation of energy efficiency objectives, while it is the responsible authority for EU ERDF and Cohesion Fund co-financing and supervises the implementation of major part of energy efficiency programs co-financed by EU Funds. The particular division of

the ME, consisting of three departments (Energy Market and Infrastructure Dept., Renewable Energy and Energy Efficiency Dept., Construction and Housing Dept.) is in charge of energy sector. At local level the municipalities have the opportunity to elaborate the local energy plans but not on a mandatory basis. According to the Energy Law the municipalities have the obligation to organize heat supply in their territories, while in 2014-2020 programming period it is promoted the linkage between integrated local development planning and energy efficiency planning. Indicatively, within the framework of the on-going Latvia Operational Program "Growth and Employment 2014-2020" it is co-financed the increase of energy efficiency in municipal buildings in accordance with the integrated development program of the municipality.

Similarly, in **Lithuania** the majority of the administration and coordination tasks for implementation of energy efficiency policy is delegated to the State Enterprise Energy Agency. The State Enterprise Energy Agency was founded in 1993 following the recommendations of foreign experts having participated in drafting the first National Energy Strategy and considering operation of analogous enterprises in European countries. The incorporator of Energy Agency is the Ministry of Energy of the Republic of Lithuania. Under instructions of the Ministry of Energy, Energy Agency deals with drafting the National Energy Strategy, National Energy Efficiency Plans, other energy efficiency programs regarding the improvement of efficient use of energy resources and energy and use of local, renewable and waste energy resources; organization of their implementation, updating and revision; preparation of legal, economic and organizational energy efficiency measures for implementation of the national policy, calculation of energy savings on country level. In the policy formulation process also are involved research institutions, as the Lithuanian Energy Institute (support for National energy strategy, national EE programs), Universities, as the Vilnius Gediminas Technical University (support for buildings renovation programs), the Kaunas Technological University (support modernization of energy production technological processes) and other organizations.

In **France** while laws, decrees, orders and tax credits are in the competence of the state, the local authorities can pass regional schemes, local plans for energy, air and climate and give financial support. Moreover, they may also contribute to finance "one-stop-shop" networks that give advice to households wishing to refurbish their homes. Local public societies can also be involved in the third party financing of building refurbishment. On the national level, it is the Ministry of Ecology, Sustainable Development and Energy as well as the Ministry of Housing (EE in buildings, EPBD, building codes, Article 4) which have a legal responsibility in energy efficiency policy formulation. The following ministries have a legal competence for EE policy formulation: Ministry of Ecology, Sustainable Development and Energy (MEDDE) together with its affiliate Direction Générale de l'Énergie et du Climat and Ministry of Housing.

Furthermore, the Agency for the Environment and Energy Efficiency (Agence de l'Environnement et de la Maîtrise de l'Énergie, ADEME), which is a government institution under MEDDE implements energy policy regarding sustainable development in the fields of energy and the environment. Its energy-related mandates include developing techniques to encourage efficiency in industry, transport and buildings, while also promoting renewable energy technologies.

In **Slovakia** the Ministry of Economy, SIEA (Slovak Innovation and Energy Agency) and the Ministry of Transport, Construction and Regional Development have undertaken the main responsibilities for energy efficiency policy making and implementation. Nevertheless, the main responsible body for energy policy including energy efficiency policies is the Ministry of Economy. The ministry is also responsible for reporting of practically all development in this area towards the EU through the evaluation of NEEAPs and review of transposition of EU EE legislation. In this process, a supporting role has the national energy agency SIEA. There are partially involved other state administration bodies e.g. ministries with their subordinated organisations e.g. Ministry of Transport, Construction and Regional Development under their scope.

▪ **Coordination bodies**

Various types of coordination bodies for the formulation and/or implementation of the energy efficiency policy between national and regional level for energy policy have already been introduced.

In **France** a dedicated consultation body, the CNEN (Conseil national d'évaluation des normes) aims at taking into account the point of view of local authorities regarding energy policy. Moreover, regulations require local authorities to implement regional schemes and local action plans regarding energy, air and climate. The priorities and needs of the different involved authorities have been taken into consideration during the design of the energy efficiency measures through the above quoted CNEN. In 2001, ADEME, the French Environmental and Energy Management Agency, launched the nationwide network of local energy advice centers called Espace Info Energie or EIE. The aim is to disseminate information on energy efficiency on national, regional, departmental and municipal level. At the local level, the regional coordinator of the ADEME leads the regional network of EIEs and negotiates the action program with the EIEs management and the financial partners. At the national level, the network's organization is governed by a Strategic Committee comprising representatives from the Environment and Energy Ministry and national associations of municipalities, departments and regions (AMF, ARF, ADF). A Coordination Committee made of various national associations (of Local Energy Agencies, Environmental NGOs, etc.) advises the Strategic Committee on the EIE program's orientations. This enables regions and departments to have influence over the contents of the program despite the fact that France is a centralized

country. The CNTE (Conseil National pour la Transition Energetique) is a consultation body bringing together representatives from State, Parliament, local authorities, trade unions, businesses, NGOs and civil society. It gives advice especially on strategic policy documents, like for example the final draft of the Low Carbon National Strategy. Moreover, local authorities are represented through some associations such as associations of mayors, associations of departments, associations of regions and they are involved into national energy policy formulation.

In **Italy**, the Conferenza Stato Regioni is a joint committee established by the State, the regions and the autonomous provinces of Trento and Bolzano. The aim of this committee is to foster the cooperation between central and regional administrations and to deal with all aspects of EU policy, constituting the basis for the conduction of political negotiations among the central and regional governments. All the regions including the autonomous provinces of Trento and Bolzano participate in the Conferenza Stato Regioni. Moreover, this committee targets to launch the discussion about the major regulatory and administrative acts of regional interest and to provide the opportunity to the regions to participate during the formulation of the decisions of the government in matters of common interest. The committee is convened and chaired by the Secretary of State for Regional Affairs, as delegated by the President of the Council of Ministers. Moreover, it is composed by the 20 presidents of the regions with special status and by the two presidents of the autonomous provinces of Trento and Bolzano. The Office of the Conferenza Stato Regioni operates directly under and within the guidelines of the President, is governed by a general manager and is currently divided into the six different structures, run by state and regional leaders:

- Service I- Education, research, technological innovation and general affairs
- Service II - Institutional reforms, public finance, labor and international relations
- Service III - Health and social policies
- Service IV - Production activities and infrastructure
- Service V - Environment and territory
- Service VI - Agriculture and Forestry

The aim of these structures is to investigate and analyse the potential implementation of measures, providing the necessary input to the meetings in order to facilitate the most efficient agreement among the governmental, federal, state and local authorities. These structures contribute with the organization of specific surveys and analyses, prepare any supporting documents and research material and support the management of the information systems and monitoring activities.

Generally, the contributions of the Conferenza Stato Regioni include advices, agreements, deliberations, facilitation of the connection, information and

cooperation of the involved parties, the exchange of data and information, the establishment of committees and working groups and the designation of regional representatives. Finally, the local authorities are involved in the formulation of the national energy policy through the energy section of the committee Conferenza Stato Regioni.

In **Slovakia** the relevant representatives of ministries are vital part of working groups under the lead of Ministry of Economy, those are mostly responsible for conceptual work in the responsibility area of each individual ministry. In 2007, a so-called Permanent Interministerial Commission for the Preparation of Energy Efficiency Action Plans (NEEAP WG) was established, where the most relevant ministries were represented. The NEEAP WG is coordinated by the Energy Section of the MH SR and since 2007 has been extended in order to include other institutions responsible for support mechanisms with impact on energy savings. Members of this group propose all measures and with this group are covered individual needs, which are taken into account during the design of the energy efficiency measures. Moreover, their role is to prepare, consult and coordinate the preparation of conceptual documents related to energy efficiency and NEEAPs. In addition, in 2014 the Order No. 350/2014 was adopted, which requires each central body of state government to nominate a person responsible for data submission to the provider of the MSEE (SIEA), as well as to annually provide data on energy efficiency measures, energy savings and related used financial sources in their respective institutions. The NEEAP WG meets both with the aim to ensure information provision in the energy efficiency field to the WG members as well as to ensure data collection for the preparation of NEEAPs and annual reports.

Sweden has a lot of networks for energy efficiency. The goal of the networks is to help municipalities, county councils, industries, estate owners, public sector, households etc. in energy efficiency issues. Specifically, the ENIG, which is a network since 2009 for the improvement of energy efficiency, comprises a network of experts, industries, energy offices and energy and climate advisers in the field of energy efficiency. The BEBO is a network including a large part of Sweden's apartments, which were built in the years 1965-1975 and having a significant potential for energy efficiency interventions. The Swedish Energy Agency supports projects to demonstrate that the energy measures are worthwhile to bet on. The network runs development projects with a focus on energy and environment issues, while participants in this network include real estate owners, managers and others directly involved in the maintenance of buildings. The BEBO network represents 70% of Sweden's apartments. BELOK is a network constituted between the Swedish Energy Agency and sixteen of Sweden's largest real-estate owners. The goal with the network is to promote and support energy efficient systems and products to come out earlier on the market. The implemented projects focus on energy efficiency in the property

while function and comfort improve. The BELOK network represents 20% of Sweden's commercial spaces. HYLOK is a network for energy efficiency in government agency facilities. The network supports the government agency energy efficiency of buildings and aims to be an exemplary case improving energy efficiency in its own operations and reducing the total energy use in the premises. Furthermore, HYLOK targets to spread knowledge and information on energy efficiency, support dialogue between authorities and property owners, identify methods for improving energy efficiency etc.

In **Latvia** the Riga City Council has established the Riga Energy Agency (Rīgas enerģētikas aģentūra, REA). The REA was legally established in 2007, under the legal form of non-profit municipal agency having the following functions:

- Elaborate and update the Development Concept of Riga District Heating System,
- Develop the Riga city sustainable energy action plan (currently the "Riga smart city Sustainable Energy Action Plan 2014-2020" are in force approved by the Riga city council on 8th July, decision No1358), and related projects,
- Prepare an annual report on the current situation and the progress made in area of energy efficiency in Riga city,
- Run the Energy Efficiency Information Center unit within Agency,
- Provide service of energy auditors,
- Publish information materials and to provide information to mass media in the area of authority of the Agency,
- Liaise with foreign and international institutions and organizations according to the area of authority of the Agency,
- Cooperate with governmental and municipal institution, NGO, other legal as well as physical entities, etc.

Moreover, REA elaborates and monitors Riga city's SEAP within the framework of Covenant of Mayors. REA is regularly invited to participate in the working groups established by the Ministry of Economics. Another type of coordination authority can be considered the Zemgale Regional Energy Agency (Zemgales reģionālā enerģētikas aģentūra, ZREA), which was established in the end of 2008 and started its activities in March of 2009 in order to facilitate the improvement of energy efficiency in public and private sectors, as well as to ensure the information availability on these issues for residents. The establishment of ZREA is the initiative by Jelgava City Council, involving four other municipalities of the region Jēkabpils, Bauska, Auce and Ozolnieki, companies - district heating company Fortum Jelgava Ltd. and a housing maintenance management company Jelgavas Nekustamā īpašuma pārvalde Ltd., as well as two other societies - Zinātnes inovāciju un testēšanas centrs (Scientific Innovation and Testing Centre) and Zemgales reģionālais nevalstisko organizāciju atbalsta centrs (Zemgale Regional NGO Support Centre). The tasks of ZREA include to provide

consultancy, informative and educational services both, in the office and via the Agency's website, to create and maintain the energy data base of the region, to develop regional and municipal planning documents in the field of energy and coordinate respective implementation activities, to identify and attract investment for energy efficiency improvement purposes, to facilitate cooperation in the energy sector between legal and physical persons in local, national and international level, to participate in the development of legal acts, policy planning and normative documents within the framework of its competence. The ZREA (in co-operation with Kaunas (Lithuania) regional energy agency) had elaborated within the Covenant of Mayors the Zemgale region SEAP 2012-2020. However, in practice not all local governments of Zemgale region are participants of the ZREA. Furthermore, the Latvian Association of Local and Regional Governments (LALRG, Latvian: Latvijas Pašvaldību Savienība) is the main actor to promote inclusion of self-government interests in national policies, including energy policy. The LALRG, founded in December 1991, is a public organization associating local governments of the Republic of Latvia on voluntary basis. In accordance with the Article 96 of the law "On Self-Governments", the LALRG has authority to represent municipalities in the negotiations with the government (Cabinet of Ministers). The LALRG is the only municipal organization of such level in Latvia, 118 municipalities (from 119) are members of LALRG. The main objectives of the LALRG consist of the development of self-government politics in Latvia, the provision of solutions to self-government problems and the protection of self-government interests. The Association of Heat Producers (AHP, Latvian: Latvijas siltumuzņēmumu asociācija) is a society uniting district heating utilities. The LALRG as well as AHP are active in preparing opinions, comments and proposals for content changes/improvements in legislative acts and policies documents. E.g., they had submitted their opinions/proposals regarding the new draft "Energy Efficiency Law". Also the LALRG submits its opinion on those Cabinet of Ministers Regulations regarding details in the procedure and quantitative criteria of energy efficiency measures co-financed by EU Funds, etc. LALRG has part-time advisor for advising on energy issues.

▪ **Involvement of regional and local authorities**

Regional (especially in federal states) and to a lesser degree local authorities are involved generally in national energy policy formulation and implementation though in different intensity ranging from formal collaboration in working groups to possibility of voicing their opinion in public consultation procedures. Moreover, the priorities and needs of the different involved authorities seem to be taken into consideration during the design of the energy efficiency measures in most of the examined cases.

In **Austria**, the provincial states are usually represented in task forces, strategic coordination groups and similar settings when important strategies such as the Austrian Energy Strategy are developed. In such cases, representatives from the provinces are involved in the development and/or adaptation of energy efficiency measures through participation in different working groups, each working group being in charge of a different energy topic. On the other hand, regional energy strategies are usually formulated without involving representatives from the national level. When implementing the ESD, an additional mechanism, the 15a agreement, has been introduced. The 15a agreement was a binding agreement between the federal government and the provincial governments about matters falling within their sphere of competence. The agreement between the federal government and the provincial governments stipulated common quality standards for the promotion of the construction and refurbishment of residential buildings in order to reduce greenhouse gas emissions. Currently no new 15a agreement has been negotiated.

In **Croatia** for visibility and openness reasons, the National Energy Efficiency Authority is currently in the process of developing a National INFO WEB site for all matters relating to energy efficiency, presenting information about subsidies for citizens as well as about the energy efficiency legal framework. Local authorities are involved in national energy policy formulation, since they are obliged by law to make yearly and three-year energy efficiency plans. All energy efficiency plans need to be approved by the National energy efficiency Authority on annual basis. The priorities and needs of the different involved authorities have been taken into consideration during the design of the energy efficiency measures. Since energy efficiency plans from local authorities (counties) already existed, the measures mostly mentioned in the plans were taken into account. Also, it was inspected to realize for which measures on the ECO fund the local authorities show the strongest interest.

In **Slovakia** representatives from regional administration and municipalities are members of the NEEAP WG having the opportunity to promote their needs and priorities related to energy efficiency and NEEAPs.

In **Slovenia** according to the Energy Act of 2014 the local communities shall adopt a local energy concept (LEC) every ten years as a program for energy management in the local community with the prior consent of the minister responsible for energy, and publish it on their websites. The local energy agencies are considered as the energy manager to municipalities, which monitor the energy consumption and propose and advise municipalities on energy efficiency projects as independent experts. Moreover, many municipalities and cities have prepared SEAPs.

In **Romania**, the local authorities are involved in national energy policy formulation, through mandating preparation of an energy efficiency master-plan.

In **Croatia** the main informal role is carried out by the regional energy agencies and in great extent by the regional development agencies, which are responsible for drafting and implementing energy efficiency measures at local level.

The **Swedish** Energy Agency's program for a Sustainable Municipality is a unique cooperation between the Agency and 38 municipalities. It is based on the participating municipalities' ambitions to make their local communities more sustainable. The Swedish Energy Agency contributes with their knowledge, information and networks.

In the **FYR of Macedonia** the Energy Agency can be considered as formal vertical coordination body between national and regional level for energy policy. The main role of the Agency is to collect data for planned and implemented measures from the local authorities. The regulation and collection of data goes through submitting annual reports and Programs with action plans by the local authorities to the Energy Agency. Nevertheless, the local authorities are involved in the implementation of the national legislative, but not in the national energy policy formulation.

In **Germany** the formal vertical coordination is performed largely in the legal context set up by the shared competences of the federal level and the federal states for energy efficiency. Most laws on energy efficiency action require the approval of the Bundesrat, the second chamber of Parliament, where the federal states are represented. In the process towards adoption of legislation the respective committee of the Bundesrat (committee on economic affairs and energy or environment and climate change) will ensure that the federal state ministries in charge of energy issues provide the federal government with their comments and amendments for the given legislation and finally cast a vote on the legal proposal from the federal government. Along this line the federal states will assure that the monetary and human resources needed to transpose a federal law will be granted to them by the federal level or will negotiate compensations in case the transposition is to be financed by their own resources. In case local governments are impacted by this legislation, the federal state ministries will ensure coordination with the respective associations of local level representatives (Städtetag – German Association of Towns and Cities etc.). As this process of law-making is common to most fields of policy, it is an established procedure in law making which proves to be relatively slow in comparison to centralized states but highly effective in terms of coordination and concentration. To underpin the formal law-making, the Federal Ministry of Economic Affairs and Energy hosts an annual working group of the responsible government officials of federal and federal state level (Bund-Länder-Arbeitskreis Energieeffizienz). Key aims of this working group are facilitating the policy process, informing about intended policy changes or amendments and exchanging best practices on a regular basis. Supplementary to the formalized annual meetings, the working group can be called upon at ad hoc basis if need be. Additional working groups

have been set up for dedicated sub-topics on energy efficiency, such as the implementation of energy efficiency in buildings or the combination of energy efficiency and renewable energy sources.

- **Other coordination fora and energy networks**

The motivation of the different involved authorities for participation into the formulation and implementation of the energy efficiency measures is achieved through specific organized actions and adopted regulations.

In **Austria** at regional level there exists a nationwide cooperation forum on climate and energy between the provinces and the Austrian Energy Agency. The forum meets three times a year and aims at improving collaboration and communication between the institutions involved. However, it needs to be noted that this forum has no duties or responsibilities related to horizontal energy efficiency policy formulation and as a result the meetings are informal. Moreover, political culture is characterized of being highly cooperative. The term "Social Partnership", the institutionalized co-operation between the representatives of employers and labor in Austria, is used to describe the cooperative political culture in Austria. The Austrian Social Partnership aims at solving diverging interests through achieving consensus via negotiations between the different parties and to minimize open conflicts. The political culture probably facilitates certain types of policy measures. Moreover, various initiatives have been developed at national level such as the European Energy Award® that municipalities, wishing to become frontrunners in the field of sustainable energy and climate, may join on a voluntary basis. These municipalities admit to implementing measures related to energy efficiency, renewable energy and climate change mitigation and adaptation. The set-up of the necessary organizational structures including human and financial resources is fundamental for the success of the program.

In **Germany** once the lead ministry drafts a legislation (including legislation to set up a financial support program), it is obliged to install an inter-ministerial working group (Interministerielle Arbeitsgruppe, IMA) with all ministries concerned to ensure policy coherence. The same kind of horizontal coordination process is used as well to inform the concerned federal state ministries on legal proposal by the responsible lead ministries for energy efficiency in the federal states (Ministerium für Inneres und Kommunales des Landes Nordrhein-Westfalens 2014). At local level a direct horizontal coordination is organized only in an indirect manner. Here, the coordination and dissemination of information is usually taken up by the associations representing cities and communities. Adding to the presented formal coordination approaches, informal coordination plays an important role. At federal state level, informal coordination is used to guarantee exchanges of best practices between the senior civil servants dealing with energy. A horizontal informal coordination of the regional

directors for energy is supposed to complement the formal horizontal coordination on ministerial level. With changing federal state governments the responsibility for the energy dossier is often shifted from one ministry to another, or attached to different ministries. As the traditional meeting formats foresee formal exchange fora of energy ministers or environment ministers etc., they fall short of assembling energy efficiency competence in case this field is attached to an energy ministry in one federal state (e.g. Bavaria) but attached to climate and environment ministries in other federal states (e.g. Baden Wuerttemberg and North Rhine Westphalia). This gap in the formal horizontal coordination will be bridged by the informal director meetings. Furthermore, a clear political and societal consensus exists concerning energy efficiency policies. Basically, all actors agree that an ambitious stance on energy efficiency is necessary to enable and support the overall energy transition towards a sustainable energy system. In this sense, the coordination mechanisms are based on a cooperative culture which clearly facilitates the law-making and implementation of policies. The Ministry of Economic Affairs and Energy ensures the coordination of policy formulation and will include all relevant stakeholders in a staged process. These stakeholders include representatives from the other ministries, subordinate bodies (Federal Centre for Energy Efficiency), and the national energy agency (dena) for concentration. Usually, research institutes are tasked to deliver an evaluation or impact assessment for a given sector/measure to start the concentration on a quantitative basis in terms of energy, environmental, economic and societal impacts. In further rounds of concentration, the responsible lead ministries of the federal states will be included. Depending on the dossier, stakeholder consultations and stakeholder debates will be organized, assembling representatives from industry, NGOs, consumer associations and representatives of civil society. To guarantee a successful implementation and monitoring of the energy system transformation, the Federal Ministry for Economic Affairs and Energy has established a number of informal "coordination platforms" (Energiewende-Plattformen), among those the coordination platforms for energy efficiency and energy efficiency in buildings. Key tasks of these platforms are to develop and discuss joint solutions together with the relevant stakeholders from business, civil society, science, the affected government departments and the federal states. This informal coordination mechanism was activated for the first time for the development of the NEEAP. Via these platforms, federal states, associations and non-governmental organizations submitted a variety of proposed measures for NEEAP and the Energy Efficiency Strategy for Buildings in a standardized format, including estimates on energy saving impacts. These have been evaluated and included in the working process on the NEEAP. The proposals were subsequently circulated and discussed among the platform participants so as to assess additional innovative approaches. Even if it is still too early to draw final conclusions, the present experience with the platforms seems to suggest that the local, regional and sectoral knowledge of all

actors is assembled in an effective manner. Similar informal coordination mechanisms exist at federal state level, although here, energy efficiency is often only one cornerstone in a larger climate policy context. At federal state level, many regional strategies and programs were established and discussed in a similar stakeholder setting. Most notably the Climate Change Plan of the state of North Rhine-Westphalia was drafted, discussed and finally adopted in an extremely comprehensive stakeholder platform process including the feedback of individual citizens.

In **Latvia** the Ministry of Economics has several Advisory Boards, regarding the energy sector and the most important energy efficiency issues of them are:

- National Economic (Advisory) Board
- Latvian Building (Advisory) Board
- Housing Development Advisory Board,
- Biofuel Development Advisory Board.

The function of the Economic Board is to assess the economic and business policy issues and make proposals on the priorities with the aim of promoting the Latvian economic competitiveness, improve the business environment, influence the cross-cutting policies that affect the development and the potential of business (taxes, energy, infrastructure development, education and innovation, human capital), provide opinion on the major policies under the liability of the Ministry of Economics, review and follow up on the draft laws and regulations, economic development concepts, state budget and other documents development. The Board members represent a wide range of stakeholders' spectrum, represented by the senior representatives (chairpersons, board chairs/members, directors, etc.). The Board has established six committees, the Committee on Energy and Construction and Housing Policy Committee among them. It is important to note, that the Board invites to its meetings independent experts (who are often highly qualified universities teaching and research staff), and representatives from both the specific Ministry of Economics departments, as well as other ministries (Ministry of Finance, Ministry of Environmental Protection and Regional Development, other ministries). The Latvian Building (Advisory) Board is a consultative coordinating body whose aim is to promote public participation in the development and implementation of building policy. The Board in accordance with the public interest provides to the Ministry of Economics and other ministries proposals for normative acts, policy planning documents, as well as EU international draft legislation affecting the building industry. The Board promotes integration of construction issues into sectoral policies, considers proposals for the improvement of construction process. The Housing Development Advisory Board is a coordinating and consultative cross-sectoral body, whose purpose is to link-up the housing development related legal persons in order to identify and effectively address the problems of housing development as well as to promote co-operation for long-term housing policy and

its instruments' development and implementation. The Biofuel Development Advisory Board is a coordinating and consultative inter-branch body, established by Latvian state administrative structures, universities and business operators unifying NGO representatives. The Board's aim is to co-ordinate the work of institutions involved in the implementation of Biofuel Law, to participate in the development and implementation of joint national and EU policy-making in the field of biofuel, as well as to support the development of the biofuel branch and competitiveness of Latvian entrepreneurs in the international market. The Latvian National Accreditation Bureau is a consultative body for the accreditation of testing and calibration laboratories, certification and inspection bodies, as well as environmental verifiers, in the regulated and non-regulated areas. The Bureau participates in the public policy development in the field of accreditation, promotes co-operation with international accreditation bodies, as well as provide advice to the conformity assessment bodies on accreditation matters. Finally, during the elaboration process of energy efficiency policy and energy efficiency policy measures the Ministry of Economics has established close co-operation with the LALRG and the AHP. Members of these associations are usually invited to be members of ministerial working groups on different energy efficiency policy topics. In turn, representatives of the Ministry are often invited to the municipal workshops and meetings to inform and consult on actual energy issues.

Since 2008 all county administrative boards in **Sweden** have been commissioned by the government to cooperate with other regional and local actors in order to produce regional strategies for climate and energy policies. The administrative boards have a key function in implementing the government policies on climate and energy in Sweden. In 2010 this role was further emphasized by the government when targeted funding for this activity was introduced as a part of a five-year program for energy-efficiency.

In **Slovakia** the SIEA is a member of the platform supporting municipalities in activities related to Covenant of Mayors, while specific workshops are organized to this targeted audience (e.g. on monitoring, financing, public lighting activities).

In **UK** the universities are already making a unique and substantial contribution through their teaching and research, their business operations, and through their influence on communities and the lives of their staff and students. Research into new solutions is of critical importance. The Higher Education Funding Council for England (HEFCE) is introducing new arrangements for the assessment and funding of research - the Research Excellence Framework (REF). This will include an explicit assessment of the impact that research has on society, the economy, culture, the environment, health and quality of life. HEFCE published an update to its sustainable development strategy and action plan, setting out how the Higher education sector in England will work towards sustainability and tackle climate change. HEFCE, Universities UK and GuildHE have published a carbon

reduction strategy for higher education in England. The sector has demonstrated strong commitment to this strategy including agreeing to a reduction in scope 1 and 2 emissions of 34% by 2020 and 80% by 2050 against a 1990 baseline. Progress will be measured on an annual basis and published by HEFCE. HEFCE's Capital Investment Framework (CIF) links the provision of infrastructure funding to performance in reducing carbon emissions. Universities face a 40% reduction in capital funding unless they have a carbon management plan and have made absolute or relative reductions in carbon emissions.

- **Legal and economic instruments for involving local and regional authorities'**

The most common instruments for the incentivisation of the local and regional governments for implementing energy efficiency measures consist of the adoption of legal obligations and the development of specific financial support schemes.

In **Croatia** the participation of responsible bodies is motivated through large financial incentives such as the Eco fund which subsidizes up to 80 % of certain EE measures, envisaged by National programs. In order to facilitate better knowledge and information sharing, one of the measures in NEEAP is creating a central WEB INFO POINT for all sectors and levels – from citizens to ministers, on which they will be able to follow all EE activities in the country. The website is responsibility of CEI and it is currently being developed.

In **Slovenia** the financial incentives are provided by different financial mechanisms. As the main source can be considered the Eco fund, while ministries and big energy distributors also give loans to legal entities – companies and the public sector. For the financing of the Eco Fund program, the Energy Act (Article 317 (1)) prescribes an energy efficiency fee, which shall be provided through an energy consumption fee for increasing energy efficiency. The energy efficiency fee shall be charged on district heating, electricity and solid, liquid and gaseous fuels. The final customers who are supplied with electricity and natural gas from the network shall pay the energy efficiency fee to the network operator, whereas final customers who are supplied with heat from the distribution network and final customers of solid, liquid and other gaseous fuels shall pay the aforementioned fee to the energy supplier.

In **Sweden** financing energy and climate advisors in 290 municipalities and 14 regional energy offices support the implementation of energy efficiency interventions at local and regional level (290 municipalities and 20 county councils developing a capacity building network and subsidizing energy efficiency projects in front-runner municipalities (37 selected municipalities)).

In **Slovakia** the local/regional governments are incentivised through the possibility of financing their energy efficiency activities from the EU investment

and structural funds as well as through provision of information and guidance (conferences, consultancy of SIEA to municipalities).

In **Lithuania** the financing mechanisms consist of State budget, EU Structural, Cohesion Funds and other sources. According to existing practice energy efficiency measures include financial transfer vertically. For implementation measures the local governments are motivated by financial support from various sources (State budget, ES Structural and Cohesion Funds, local EE Funds, other support). It should be noted that this model with the utilization of the specific financial mechanism is considered as the most popular.

In **France** the implementation of energy efficiency measures at regional and local level is incentivized through subsidies schemes targeting, among others, local authorities, and the energy efficiency obligation scheme facilitating the implementation of energy efficiency measures in the end-use sector including local authorities.

In **Latvia** the energy efficiency improvements' programs are financed from different sources thus they have a different implementation structure. Specifically, the main sources for energy efficiency policy implementation in Latvia are co-financing from the available EU Funds, and national budget Green Investment schemes, namely, revenues from GHG Assigned Amount Units selling under procedures of UNFCCC Kyoto protocol in the years 2010-2015 (national Climate Change Financial Instrument) currently followed by the revenues from EU ETS quotas auctioning (national Emissions Quotas Auctioning Instrument).

▪ **Capacity building**

In some cases, specific procedures for the development of appropriate skills and for the enhancement of the existing knowledge of the different involved authorities during the planning and implementation phase of the energy efficiency measures are introduced.

In **France** no procedures are foreseen or in place to develop appropriate skills and enhance the existing knowledge at administrative level during the planning and implementation phase of measures. However, such skills and knowledge can be sourced from hired shared energy experts. Some initiatives of cities network are also implemented in cooperation with the French energy agency. Resources centers are made available by the ADEME regarding local energy and climate plans, GHG assessment, Cit'ergie® process or the "Climat Pratic" tool.

▪ **Policies redesign and access to data and information**

An assessment of the energy efficiency measures among the involved authorities in order to redesign them is mostly performed. Moreover, specific procedures to facilitate access to data and information from the

different involved authorities during the planning and implementation phase of the energy efficiency measures are implemented in some examined cases.

In **Germany** all governmental actors and bodies which participated during the process of law-making are responsible for the implementation of the necessary measures. As a result, this guarantees that the policy-formulation directly considers matters of implementation and potential implementation problems from the very start. Authorities interact to safeguard access to data and information. This usually is done informally and on ad hoc basis. As local, federal state and federal statistics are interlinked the overall energy aggregates can be tracked at any point in time for an evaluation. In general terms, all major energy efficiency instruments are assessed in regular intervals in order to allow for redesigning them.

In **Latvia** two examples regarding the re-design of the measures' content were identified in order to increase their effectiveness within EU Funds 2007-2013 planning period. Specifically, the energy efficiency program on renovation of district heating systems was redesigned by increasing the eligible number of participants, namely, industrial boiler installations were included. Moreover, the basic version of Cabinet of Ministers Regulation regarding the program "Increasing Heat Energy Efficiency in Multi-Apartment Buildings (Measures to Improve the Thermal Stability of Apartment Blocks)", adopted in 2009, stated only the threshold requirement for relative decrease (in %) of heat consumption after project implementation. The re-casted version of Regulations, adopted in 2011, introduced in addition to it the threshold criterion for the annual heat energy consumption for heating after implementation of the project, in kWh/1m², as well, this allowed to enhance the higher return of investments and higher energy savings within this program.

In **Slovakia** current database modules of MSEE will be updated and improved in order to simplify the access and data input. In preparation would be new interface to the database enabling the on-line addition and editing and verification of data.

In **Latvia** the Ministry of Economics are active provider of information regarding energy efficient renovation of multi-apartment buildings. In 2007-2013 EU Funds period the Ministry organized the info campaign "Let's Live Warmer" which in 2013 had received the EU Sustainable Energy Weak Winner Award in the category "Communicating", the campaign will be followed in 2014-2020 period as well. Moreover, the Regional Energy Agencies (Riga city Energy Agency, Zemgale region Energy Agency) are active providers of information relevant for energy efficient renovation of multi-apartment buildings. As an exemplary case the Riga Energy Agency's experience on organizing and promoting the work of the Discussion Club on Energy Efficiency can be considered. Riga Energy Agency runs also its Energy Information Centre, regularly publishes easily understandable and

at the same time highly professional information on different energy efficiency and RES topics for different target groups, etc. Moreover, for the EU Funds 2014-2020 period the structure for implementation of energy efficiency programs is re-designed. "Attīstības finanšu institūcija ALTUM", according to governmental mandate, is the implementer of the given financial instrument (ERAF co-financing) for energy efficiency improvements in multi-apartment buildings and submitter of a general project to the EU Funds co-operation institution Central Finance and Contracting Agency (subordinated to the Ministry of Finance). Thus, ALTUM develops business plan describing the establishment, principles of work, conditions and terms of the given financial instrument, procedures of supervision of loan repayment and recovery, procedure for co-operation with other financial institutions (credit institutions, investment funds, ESCO, etc.). ALTUM provides consultative support for potential beneficiaries and supervises the technical documentation of the energy improvement project (energy audit, technical inspection report, technical project, etc.) before granting financial assistance to particular beneficiary.

V Policy recommendations

The main policy recommendations, as derived by the analysis of the good and best practices, are presented in the final section. All the identified elements of the examined good and best practices are summarized in the Tables 7 and 8 of Appendix B in order to facilitate their comparison for the examined M&V schemes and the coordination mechanisms correspondingly. The following tables can be utilized as a type of databases so as to depict the most important identified elements.

V.I Monitoring and Verification

Recommendation 1: Keep political responsibility for designing and Monitoring and Verifying Energy Efficiency policies in the same hands.

According to the results of the analysis the countries, which tend to be good and best practices for Monitoring and Verification, have placed the official responsibility for M&V in the hands of the same Ministry regarding the design and implementation of the energy efficiency measures.

Recommendation 2: Involve sub-ordinate bodies or other specialized institutions in the administration of the scheme.

Taking into consideration the lack of resources or specialized expertise for the majority of the schemes, it is suggested involving other authorities in the coordination and administration of the M&V schemes in cooperation with the responsible line Ministry. These are first and foremost energy agencies or subordinate bodies which possess the required technical expertise. In some countries like for instance Austria these are selected on a competitive public procurement procedure for a specific period of time.

Recommendation 3: Clearly define the responsibilities between the responsible line Ministry, possible supporting institutions and data providers.

The allocated responsibilities lines of reporting and coordination among all the involved institutions should be defined by the adoption of primary and/or secondary legislation.

Recommendation 4: Develop and use bottom-up methodologies for monitoring wherever economically feasible.

The development and use of a diversified range of bottom-up methodologies is considered as an advantage in order to cover all the potential energy efficiency measures. Its introduction will ease evaluating the efficiency and effectiveness of the applied measures, will facilitate the comparative analysis of the examined measures and will improve and standardize the reporting of the achieved energy savings. Regarding the sectoral and spatial dimension, the analysis confirmed that all the sectors of the final energy consumption and all the administrative levels should be integrated into them broadening the scope of the implemented M&V schemes. The development of bottom-up methodologies for all the implemented measures will facilitate the most accurate monitoring of the achieved energy savings, while simultaneously can be an essential part of the established coordination mechanisms. Moreover, no differentiation was observed regarding the different examined governance structures about the selected sectoral and spatial aspects. Nevertheless, taking into consideration the relatively high administrative costs the development of the bottom-up methodologies should be performed with the most cost-effective way ensuring the economic viability of the M&V scheme.

Recommendation 5: Centralized databases (e.g. for bottom-up data) with clearly defined collection procedure ensure availability and accessibility of data for reporting and evaluation purposes.

The official national statistics office, national databases and data from paid subsidies comprise the most common data sources utilized. Moreover, the provided data from the White Certificate Schemes, from the obligated parties within the framework of Article 7 of the EED and from the conducted energy audits (including the energy investigations according to the requirements of the EPBD) consist of additional data sources. Good practice countries have introduced one or few centralized databases or information systems, which help to standardize and facilitate the data collection procedure.

Recommendation 6: The most effective verification and reporting procedures should be integrated into the M&V scheme.

Considering the implemented verification procedures, the conduction of inspections in a representative sample of the implemented energy efficiency measures is the most usual from the identified. Nevertheless, the completion of specific information systems and reporting templates can be implemented as an alternative mean of verification. Furthermore, the utilization of specialized

templates is considered as an effective approach in order to fulfill the reporting obligations homogenizing the collection of data. Nevertheless, taking into consideration the relatively high administrative costs the development of the appropriate verification and reporting procedures should be performed with the most cost-effective way ensuring the economic viability of the M&V scheme.

Obviously, the **development of integrated IT systems** can enhance significantly the effectiveness of the M&V schemes fulfilling various aspects of the measurement, monitoring and verification and reporting requirements. Specifically, the introduction of IT-tools will facilitate the homogeneous measurement of the achieved energy savings, the continuous monitoring of the implemented energy efficiency measures in conjunction with the corresponding imposed targets, the implementation of effective verification procedures and the homogenous and accurate reporting of the achieved energy savings.

Finally, it is more probable the countries that have **no centralized governance structure** to be considered as best practices for the case of the **M&V schemes**. This outcome should be taken into account during the identification of the relation between M&V schemes and the coordination mechanisms and the formulation of a new concept regarding the design and the implementation of the energy efficiency measures.

V.II Coordination Mechanisms

In none of the countries surveyed the responsibility for designing and implementing Energy Efficiency policies is concentrated in a single national institution. Usually responsibilities for policy formulation are shared between different national line ministries whereas typically most of the implementation is done on the local level calling for an effective coordination both horizontally among the ministries involved but also vertically between national, regional and local level.

Recommendation 7: Systematically involve the implementation level (typically local and regional) in the policy formulation process and make use of their specific expertise and knowledge.

Local and regional authorities should have the chance to voice their opinion safeguarding their needs and priorities about political initiatives and legal acts in obligatory consultation procedures or other forms of lobbying. Especially in more decentral organized this will ensure the involvement of all levels and will support the effective implementation of policies. Specifically, countries with regionalized structure have introduced more efficient coordination mechanisms according to the results of the correlation analysis. Indisputably, the main reason for this is

the essential role of regional and local authorities in the design and implementation of energy efficiency measures. Finally, this outcome should be linked with the fact that countries have no centralized governance structure seem to have introduced more effective M&V schemes.

Moreover, an additional characteristic should be the actual involvement of the different ministries due to the fact that they are responsible for specific sectors and can undertake the design and implementation of specific types of energy efficiency measures according to the field of expertise. In any case the responsibilities for the energy efficiency policy making and implementation should be clearly defined among the different governmental layers and the different involved ministries.

Recommendation 8: Complement formal policy coordination through formal channels by informal coordination fora or networks.

To this direction, the establishment of formal or informal coordination bodies for the formulation and/or implementation of the energy efficiency policies among the administrative levels will increase the effectiveness of the introduced coordination mechanisms. According to the results of the analysis, specific types of coordination bodies have already been introduced in regionalized and decentralized governance structures.

Various initiatives can foster the more active involvement of the local authorities in the design and implementation of energy efficiency policies and measures. These actions comprise the creation of task forces and working groups, the preparation of energy efficiency plans and the engagement of the regional energy agencies and the regional development agencies. All these initiatives have as a result the priorities and needs of the different involved authorities to be taken into consideration during the design of the energy efficiency measures.

Recommendation 9: Involve other stakeholders from academia, economy or civil society into policy formulation and implementation.

Moreover, the motivation of the different involved authorities for participation into the formulation and implementation of the energy efficiency measures is achieved through specific organized actions and adopted regulations. These initiatives include the establishment of working groups, cooperation forums, platforms and partnerships, the organization of stakeholder consultations, the constitution of advisory boards, the conduction of workshops and the encouragement of the universities for more active involvement. It should be noted that these initiatives should lead to the enhancement of the existing level of skills and knowledge and to the facilitation of the access on the required data

and information. Indisputably, these benefits will counterbalance the limited human resources, which are available currently for the majority of the States.

Recommendation 10: Complement legal obligations for local and regional support schemes with carefully designed financial support schemes.

Regarding the instruments for the incentivisation of the local and regional governments, the most efficient of them consist of the adoption of legal obligations and the development of specific financial support schemes. Specifically, the financial mechanisms foresee mainly the exploitation of the available EU Structural and Cohesion Funds and national, regional and local Funds through the provision of subsidies. Probably, in some cases the establishment of a specialized fund can foster the implementation of the energy efficiency measures.

Recommendation 11: Introduce a review mechanism for the different policies adopted and include different stakeholders in the evaluation.

Finally, the continuous assessment of the implemented energy efficiency measures with the participation of the involved authorities in order to redesign them should be considered as a vital part of the coordination mechanisms.

Appendix A: Correlation analysis' data

The detailed data, which were utilized for the conduction of the correlation analysis, are presented in the following tables for all the examined States.

Table 6: Utilised data in the correlation analysis.

| Countries | M&V continuous | M&V ordinal | CM continuous | CM ordinal | GDP per unit of energy use | Energy use | Industry | GDP per capita | Agriculture | CO2 emissions | Services |
|-----------------|----------------|-------------|---------------|------------|---|-----------------------------------|------------|----------------|-------------|--------------------------|------------|
| | | | | | (constant 2011 PPP \$ per kg of oil equivalent) | (kg of oil equivalent per capita) | (% of GDP) | (current US\$) | (% of GDP) | (metric tons per capita) | (% of GDP) |
| Austria | 14 | 1 | 8 | 0 | 11.24 | 3928 | 28.27 | 50558 | 1.43 | 7.77 | 70.30 |
| Belgium | 14 | 1 | 7 | 0 | 8.08 | 5028 | 22.21 | 46625 | 0.79 | 8.85 | 77.00 |
| Bulgaria | 13 | 0 | 11 | 0 | 6.26 | 2511 | 27.56 | 7657 | 5.34 | 6.71 | 67.10 |
| Croatia | 15 | 1 | 13 | 1 | 10.88 | 1855 | 27.36 | 13575 | 4.39 | 4.80 | 68.25 |
| Cyprus | 11 | 0 | 9 | 0 | 12.30 | 1971 | 11.48 | 27911 | 2.52 | 6.74 | 86.00 |
| Czech Republic | 9 | 0 | 5 | 0 | 6.98 | 4057 | 36.87 | 19814 | 2.70 | 10.43 | 60.44 |
| Denmark | 13 | 0 | 7 | 0 | 13.82 | 3101 | 22.85 | 59819 | 1.36 | 7.25 | 75.78 |
| Estonia | 12 | 0 | 7 | 0 | 6.06 | 4174 | 28.94 | 19155 | 3.50 | 14.05 | 67.56 |
| Finland | 15 | 1 | 9 | 0 | 6.42 | 6151 | 26.93 | 49493 | 2.99 | 10.16 | 70.08 |
| France | 13 | 0 | 13 | 1 | 9.68 | 3844 | 19.75 | 42628 | 1.60 | 5.19 | 78.65 |
| Macedonia, FYR | 14 | 1 | 11 | 0 | 8.07 | 1434 | 24.55 | 5195 | 11.04 | 4.52 | 64.41 |
| Germany | 14 | 1 | 15 | 1 | 11.07 | 3886 | 30.31 | 46442 | 0.79 | 8.92 | 68.90 |
| Greece | 13 | 0 | 9 | 0 | 10.32 | 2394 | 16.37 | 21719 | 3.73 | 7.56 | 79.90 |
| Hungary | 13 | 0 | 11 | 0 | 9.44 | 2366 | 30.11 | 13585 | 4.55 | 4.86 | 65.33 |
| Ireland | 14 | 1 | 11 | 0 | 15.81 | 2888 | 26.07 | 51815 | 1.43 | 7.88 | 72.50 |
| Italy | 14 | 1 | 15 | 1 | 13.05 | 2667 | 23.62 | 35421 | 2.32 | 6.70 | 74.06 |
| Latvia | 12 | 0 | 13 | 1 | 9.44 | 2171 | 23.70 | 15026 | 3.40 | 3.79 | 72.90 |
| Lithuania | 13 | 0 | 13 | 1 | 9.61 | 2469 | 30.05 | 15692 | 3.95 | 4.54 | 65.99 |
| Luxembourg | 13 | 0 | 5 | 0 | 11.44 | 7707 | 11.72 | 113727 | 0.29 | 20.90 | 87.99 |
| Malta | 14 | 1 | 7 | 0 | 17.68 | 1599 | | 22776 | | 6.03 | |
| Netherlands | 15 | 1 | 13 | 1 | 9.75 | 4690 | 21.93 | 51425 | 1.92 | 10.06 | 76.15 |
| Poland | 15 | 1 | 7 | 0 | 8.90 | 2571 | 32.32 | 13776 | 3.33 | 8.34 | 64.35 |
| Portugal | 11 | 0 | 11 | 0 | 12.76 | 2035 | 21.47 | 21619 | 2.37 | 4.71 | 76.17 |
| Romania | 13 | 0 | 11 | 0 | 10.23 | 1741 | 26.97 | 9587 | 6.18 | 4.21 | 66.84 |
| Slovak Republic | 16 | 1 | 13 | 1 | 8.28 | 3079 | 32.96 | 18110 | 3.97 | 6.37 | 63.08 |
| Slovenia | 13 | 0 | 11 | 0 | 8.14 | 3401 | 32.30 | 23144 | 2.06 | 7.50 | 65.64 |
| Spain | 15 | 1 | 13 | 1 | 11.85 | 2672 | 22.68 | 29371 | 2.82 | 5.79 | 74.50 |
| Sweden | 15 | 1 | 9 | 0 | 8.21 | 5269 | 26.08 | 60283 | 1.39 | 5.52 | 72.53 |
| United Kingdom | 15 | 1 | 13 | 1 | 12.18 | 3018 | 21.28 | 42309 | 0.69 | 7.09 | 78.02 |

| Countries | Combustible renewables and waste | Alternative and nuclear energy | Market share | Energy intensity | Share of RES | GHG intensity | Energy dependence | Centralised Unitary | Decentralised Unitary | Regionalised Unitary | Federal |
|-----------------|----------------------------------|--------------------------------|--------------|--------------------------------------|--------------|---------------|-------------------|---------------------|-----------------------|----------------------|-----------------|
| | (% of total energy) | (% of total energy use) | (%) | (kg of oil equivalent per 1 000 EUR) | (%) | (Index) | (%) | (1: Yes, 0: No) | (1: Yes, 0: No) | (1: Yes, 0: No) | (1: Yes, 0: No) |
| Austria | 19.87 | 12.73 | 55.5 | 123.6 | 32.6 | 85.6 | 65.9 | 0 | 0 | 0 | 1 |
| Belgium | 9.53 | 19.61 | 64.9 | 172.4 | 7.9 | 83.9 | 80.1 | 0 | 0 | 0 | 1 |
| Bulgaria | 6.16 | 25.28 | | 610.4 | 19 | 103.3 | 34.5 | 1 | 0 | 0 | 0 |
| Croatia | 6.96 | 5.58 | 84 | 240.8 | 18 | 88.9 | 43.8 | 1 | 0 | 0 | 0 |
| Cyprus | 2.06 | 3.76 | 100 | 153.8 | 8.1 | 108.5 | 93.4 | 1 | 0 | 0 | 0 |
| Czech Republic | 7.07 | 19.56 | 58.2 | 353.8 | 12.4 | 84.8 | 30.4 | 0 | 1 | 0 | 0 |
| Denmark | 21.39 | 5.37 | 41 | 87.2 | 27.2 | 84.7 | 12.8 | 0 | 1 | 0 | 0 |
| Estonia | 14.86 | 0.74 | 87 | 512.7 | 25.6 | 94.4 | 8.9 | 1 | 0 | 0 | 0 |
| Finland | 25.91 | 22.47 | 25.3 | 207.1 | 36.8 | 85.5 | 48.8 | 0 | 1 | 0 | 0 |
| France | 6.09 | 46.70 | 83.8 | 142.9 | 14.2 | 87.9 | 46.1 | 0 | 0 | 1 | 0 |
| Macedonia, FYR | 6.41 | 3.39 | 90 | 448 | | | 52.9 | 1 | 0 | 0 | 0 |
| Germany | 8.95 | 11.21 | 32 | 130.7 | 12.4 | 96 | 61.4 | 0 | 0 | 0 | 1 |
| Greece | 5.32 | 4.00 | 67 | 151 | 15 | 95.7 | 66.2 | 1 | 0 | 0 | 0 |
| Hungary | 7.13 | 18.44 | 51.9 | 251.3 | 9.8 | 88.6 | 61.1 | 1 | 0 | 0 | 0 |
| Ireland | 3.33 | 3.20 | 54 | 82.2 | 7.8 | 89.7 | 85.3 | 1 | 0 | 0 | 0 |
| Italy | 6.56 | 7.23 | 27 | 116.8 | 16.7 | 86.2 | 75.9 | 0 | 0 | 1 | 0 |
| Latvia | 31.21 | 7.44 | 79.8 | 310.6 | 37.1 | 93.1 | 40.6 | 1 | 0 | 0 | 0 |
| Lithuania | 14.56 | 1.18 | 24.4 | 266.4 | 23 | 107.6 | 77.9 | 1 | 0 | 0 | 0 |
| Luxembourg | 3.67 | 0.48 | 58.4 | 127.6 | 3.6 | 96.6 | 96.6 | 1 | 0 | 0 | 0 |
| Malta | 1.11 | 0.33 | 100 | 149.4 | 3.8 | 99.5 | 97.7 | 0 | 0 | 0 | 1 |
| Netherlands | 4.68 | 1.95 | | 148.7 | 4.5 | 86.7 | 33.8 | 0 | 1 | 0 | 0 |
| Poland | 8.80 | 0.63 | 17.3 | 294.1 | 11.3 | 91 | 28.6 | 0 | 0 | 1 | 0 |
| Portugal | 14.16 | 7.49 | 43.9 | 150 | 25.7 | 87.9 | 71.6 | 1 | 0 | 0 | 0 |
| Romania | 11.24 | 12.25 | 26.8 | 335.5 | 23.9 | 88.8 | 17 | 1 | 0 | 0 | 0 |
| Slovak Republic | 6.02 | 26.97 | 83.8 | 332 | 9.8 | 93.6 | 60.9 | 0 | 1 | 0 | 0 |
| Slovenia | 9.73 | 26.17 | 57.1 | 225.9 | 21.5 | 89.4 | 44.6 | 1 | 0 | 0 | 0 |
| Spain | 6.17 | 19.58 | 22 | 129.5 | 15.4 | 85.6 | 72.9 | 0 | 0 | 0 | 0 |
| Sweden | 23.22 | 48.06 | 44.8 | 143.9 | 52.1 | 80.8 | 32 | 0 | 1 | 0 | 0 |
| United Kingdom | 3.51 | 10.79 | 29.3 | 103.2 | 5.1 | 90.6 | 45.5 | 0 | 0 | 1 | 0 |

Appendix B: Databases of good and best practices

The main identified elements of the examined good and best practices are summarized in the Tables 7 and 8 facilitating their comparison for the examined M&V schemes and the coordination mechanisms correspondingly.

Table 7: Database of good and best practices in the M&V schemes.

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|---|---|
| Denmark | Decentralized | Good | Administrative authorities and their responsibilities | Shared responsibilities - Role of Danish Energy Agency |
| Slovakia | Decentralized | Best | Administrative authorities and their responsibilities | Shared responsibilities - Slovak Innovation and Energy Agency |
| Austria | Federal | Best | Administrative authorities and their responsibilities | Shared responsibilities - Austrian Energy Agency |
| Slovenia | Centralized | Good | Administrative authorities and their responsibilities | Shared responsibilities - Energy Agency |
| Croatia | Centralized | Best | Administrative authorities and their responsibilities | Shared responsibilities - Croatian Institution Center for Monitoring Business Activities in the Energy Sector and Investments |
| Sweden | Decentralized | Best | Administrative authorities and their responsibilities | Shared responsibilities - Swedish Energy Agency |
| FYR of Macedonia | Centralized | Best | Administrative authorities and their responsibilities | Shared responsibilities - Energy Agency of Republic of Macedonia |
| Spain | - | Best | Administrative authorities and their responsibilities | Shared responsibilities - Institute for Energy Diversification and Saving |
| Latvia | Centralized | Good | Administrative authorities and their responsibilities | Non-shared responsibilities - Role of Ministry of Economics |
| UK | Regionalized | Best | Administrative authorities and their responsibilities | Non-shared responsibilities - Role of Department of Energy and Climate Change |
| Greece | Centralized | Good | Administrative authorities and their responsibilities | Non-shared responsibilities - Role of Ministry of Environment and Energy |
| Austria | Federal | Best | Administrative authorities and their responsibilities | Legislation about the specification of the Austrian Energy Agency's role |
| France | Regionalized | Good | Administrative authorities and their responsibilities | Diversification of the imposed responsibilities among the involved authorities in the different measures |
| Austria | Federal | Best | Sectoral and spatial analysis | Involvement of all sectors and regional level |
| Croatia | Centralized | Best | Sectoral and spatial analysis | Involvement of all sectors and levels |
| Slovenia | Centralized | Good | Sectoral and spatial analysis | Involvement of local authorities |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|---------------------------------------|---|
| FYR of Macedonia | Centralized | Best | Sectoral and spatial analysis | Involvement of all sectors |
| Slovakia | Decentralized | Best | Sectoral and spatial analysis | Involvement of all sectors and levels |
| France | Regionalized | Good | Sectoral and spatial analysis | Involvement of all sectors and authorities from all the administrative levels |
| Austria | Federal | Best | Energy efficiency measures | Interventions on building shell and heating systems |
| Denmark | Decentralized | Good | Energy efficiency measures | Interventions on process equipment, envelope and boilers |
| FYR of Macedonia | Centralized | Best | Energy efficiency measures | CHP production, promotion of sustainable transport systems in urban areas and reconstruction of existing buildings |
| Greece | Centralized | Good | Energy efficiency measures | "Energy Savings at Home" and "Substitution of old private cars with new high efficient" programs |
| Spain | - | Best | Energy efficiency measures | Aid Program for the Energy Renovation of Existing Buildings, the Efficient vehicle incentive program, the Aid Program for municipal public lighting, the Aid Program for SME and large companies of the industrial sector and the Aid Program for transport |
| Austria | Federal | Best | Measurement and monitoring procedures | Wide range of bottom-up and top-down methods |
| FYR of Macedonia | Centralized | Best | Measurement and monitoring procedures | Development of 20 different bottom-up methodologies |
| Slovenia | Centralized | Good | Measurement and monitoring procedures | Development of 29 different bottom-up methodologies |
| Croatia | Centralized | Best | Measurement and monitoring procedures | Development of 20 different bottom-up methodologies |
| Spain | - | Best | Measurement and monitoring procedures | Development of specialized bottom-up monitoring approaches for each measure |
| Slovakia | Decentralized | Best | Measurement and monitoring procedures | Development of specialized bottom-up monitoring methodologies |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|---------------------------------------|--|
| Denmark | Decentralized | Good | Measurement and monitoring procedures | Calculation either by standard values, by a specific inventory of the saving following the activity or by the effect of a specific market impact |
| France | Regionalized | Good | Measurement and monitoring procedures | Development of specialized bottom-up monitoring approaches for each measure |
| Greece | Centralized | Good | Measurement and monitoring procedures | Development of specialized bottom-up monitoring approaches for each measure |
| Austria | Federal | Best | Data collection procedures | Role of regional and national funding agencies and provided data from energy suppliers subject to the energy efficiency obligation scheme and federal bodies |
| France | Regionalized | Good | Data collection procedures | Provided data from White Certificate Scheme and the Emmy registry |
| Spain | - | Best | Data collection procedures | Data from national databases, databases on regional level and registries from paid subsidies |
| Poland | Regionalized | Best | Data collection procedures | Utilization of national databases |
| Greece | Centralized | Good | Data collection procedures | Data from Operational Programs and the Registry of Energy Performance Certificates |
| FYR of Macedonia | Centralized | Best | Data collection procedures | Combination of different sources such as provided data from public building owners and energy audits and statistical data, surveys and analyses |
| Croatia | Centralized | Best | Data collection procedures | Data from paid subsidies |
| Slovakia | Decentralized | Best | Data collection procedures | The main data sources comprise ITMS, INFOREG and SLOVSEFF |
| Denmark | Decentralized | Good | Data collection procedures | Each involved party have to report to the Danish Energy Agency specific data |
| Lithuania | Centralized | Good | Data collection procedures | The main data sources consist of the national statistical office and various national databases |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|----------------------------|---|
| Latvia | Centralized | Good | Data collection procedures | The main data sources consist of data from paid subsidies as well as national statistical data and other national information sources |
| Austria | Federal | Best | Verification procedures | Combination of plausibility checks and in depth sample checks of statistically significant proportions of projects |
| France | Regionalized | Good | Verification procedures | Through Emmy account in the corresponding registry |
| Sweden | Decentralized | Best | Verification procedures | Through MURE database |
| Slovenia | Centralized | Good | Verification procedures | Sample checks of statistically significant proportions of projects |
| FYR of Macedonia | Centralized | Best | Verification procedures | Through specialized reporting procedure |
| Denmark | Decentralized | Good | Verification procedures | Independent sample of the involved grid- and distribution companies |
| Spain | - | Best | Verification procedures | Check of the aid granted by means of sampling, including the control of the energy performance certificates, the invoices and the relative bank documents |
| Croatia | Centralized | Best | Verification procedures | Through algorithms in SMIV tool |
| Lithuania | Centralized | Good | Verification procedures | Random checks of the reports on the energy savings submitted by beneficiaries or administrators of the measures |
| Greece | Centralized | Good | Verification procedures | Conduction of random inspections to a representative sample of the interventions and establishment of specialized units in the Operational Programs |
| Austria | Federal | Best | Reporting obligations | Reporting on annual basis according to specialized communication flow among the involved parties |
| Poland | Regionalized | Best | Reporting obligations | Reporting on annual basis through the establishment of a central registry |
| France | Regionalized | Good | Reporting obligations | The reporting period depends on each measure |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|-----------------------|--|
| Denmark | Decentralized | Good | Reporting obligations | Utilization of specialized templates |
| Latvia | Centralized | Good | Reporting obligations | Utilization of specialized templates |
| Slovakia | Decentralized | Best | Reporting obligations | Utilization of specialized templates |
| Austria | Federal | Best | Administrative costs | 4-6 full-time equivalent per year |
| Denmark | Decentralized | Good | Administrative costs | 9.3% of the total cost of the energy savings for electricity grid companies and 12.7% for district heating companies |
| France | Regionalized | Good | Administrative costs | For the white certificates scheme about 15 people are required |
| Austria | Federal | Best | Integrated tools | Central online database by the Federal Computing Centre (BRZ) |
| Croatia | Centralized | Best | Integrated tools | SMIV tool |
| FYR of Macedonia | Centralized | Best | Integrated tools | ExCITE tool |
| Slovakia | Decentralized | Best | Integrated tools | ITMS, INFOREG and energy performance certificate database |
| Greece | Centralized | Good | Integrated tools | Energy performance certificate database |
| France | Regionalized | Good | Integrated tools | SceGES® tool and Emmy registry |

Table 8: Database of good and best practices in the coordination mechanisms.

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|---------------------------------|--|
| Austria | Federal | Good | Institutional and legal setting | The legal responsibility lies at national and regional level |
| Germany | Federal | Best | Institutional and legal setting | The legal responsibility is shared between federal government and the federal states |
| Austria | Federal | Good | Allocation of responsibilities | More than one ministries have the legal responsibility with clearly defined responsibilities |
| Croatia | Centralized | Best | Allocation of responsibilities | More than one ministries have the legal responsibility with clearly defined responsibilities |
| Romania | Centralized | Good | Allocation of responsibilities | More than one ministries have the legal responsibility with clearly defined responsibilities |
| FYR of Macedonia | Centralized | Good | Allocation of responsibilities | One ministry has the legal responsibility with clearly defined responsibilities |
| Latvia | Centralized | Best | Allocation of responsibilities | One ministry has the legal responsibility with clearly defined responsibilities |
| Lithuania | Centralized | Best | Allocation of responsibilities | One ministry has the legal responsibility with clearly defined responsibilities |
| France | Regionalized | Best | Allocation of responsibilities | More than one ministries have the legal responsibility with clearly defined responsibilities |
| Slovakia | Decentralized | Best | Allocation of responsibilities | More than one ministries have the legal responsibility with clearly defined responsibilities |
| France | Regionalized | Best | Coordination bodies | CNEN |
| France | Regionalized | Best | Coordination bodies | The nationwide network of local energy advice centers called Espace Info Energie or EIE |
| France | Regionalized | Best | Coordination bodies | A Strategic Committee comprising representatives from the Environment and Energy Ministry and national associations of |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-----------------|----------------------|-----------------------|---|---|
| | | | | municipalities, departments and regions (AMF, ARF, ADF) |
| France | Regionalized | Best | Coordination bodies | Coordination Committee from national associations (of Local Energy Agencies, Environmental NGOs, etc.) |
| France | Regionalized | Best | Coordination bodies | CNTE |
| Italy | Regionalized | Best | Coordination bodies | Conferenza Stato Regioni |
| Slovakia | Decentralized | Best | Coordination bodies | Permanent Interministerial Commission for the Preparation of Energy Efficiency Action Plans (NEEAP WG) |
| Sweden | Decentralized | Good | Coordination bodies | ENIG |
| Sweden | Decentralized | Good | Coordination bodies | BEBO |
| Sweden | Decentralized | Good | Coordination bodies | BELOK |
| Sweden | Decentralized | Good | Coordination bodies | HYLOK |
| Latvia | Centralized | Best | Coordination bodies | Regional energy agencies (Riga Energy Agency, Zemgale Regional Energy Agency (Zemgales reģionālā enerģētikas aģentūra, ZREA) and LALRG) |
| Austria | Federal | Good | Involvement of regional and local authorities | Creation of task forces, strategic coordination groups and similar settings |
| Austria | Federal | Good | Involvement of regional and local authorities | 15a agreement |
| Croatia | Centralized | Best | Involvement of regional and local authorities | National INFO WEB site and preparation of three-year energy efficiency plans from local authorities |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-------------------------|----------------------|-----------------------|---|--|
| Slovakia | Decentralized | Best | Involvement of regional and local authorities | Permanent Interministerial Commission for the Preparation of Energy Efficiency Action Plans (NEEAP WG) |
| Slovenia | Centralized | Good | Involvement of regional and local authorities | Adoption of a local energy concept (LEC) every ten years and the appointment of energy manager to municipalities |
| Croatia | Centralized | Best | Involvement of regional and local authorities | Role of the regional energy agencies and the regional development agencies |
| Romania | Centralized | Good | Involvement of regional and local authorities | Preparation of an energy efficiency master-plan from local authorities |
| Sweden | Decentralized | Good | Involvement of regional and local authorities | Swedish Energy Agency's program for a Sustainable Municipality and the role of The Swedish Energy Agency |
| FYR of Macedonia | Centralized | Good | Involvement of regional and local authorities | Submission of annual reports and programs with action plans by the local authorities to the Energy Agency |
| Germany | Federal | Best | Involvement of regional and local authorities | Role of Bundesrat, associations of local level representatives and the annual working group of the responsible government officials of federal and federal state level (Bund-Länder-Arbeitskreis Energieeffizienz) |
| Austria | Federal | Good | Other coordination fora and energy networks | Nationwide cooperation forum on climate and energy between the provinces and the Austrian Energy Agency |
| Austria | Federal | Good | Other coordination fora and energy networks | Austrian Social Partnership |
| Austria | Federal | Good | Other coordination fora and energy networks | European Energy Award® |
| Germany | Federal | Best | Other coordination fora and energy networks | Inter-ministerial working group (Interministerielle Arbeitsgruppe, IMA) |
| Germany | Federal | Best | Other coordination fora and energy networks | Informal coordination mechanisms and platforms in combination with research institutes, which are tasked to deliver an evaluation or impact assessment for a given |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|-----------------|----------------------|-----------------------|--|--|
| | | | | sector/measure to start the concentration on a quantitative basis in terms of energy, environmental, economic and societal impacts |
| Germany | Federal | Best | Other coordination fora and energy networks | Stakeholder consultations and stakeholder debates are organized, assembling representatives from industry, NGOs, consumer associations and representatives of civil society |
| Germany | Federal | Best | Other coordination fora and energy networks | Many regional strategies and programs were established and discussed in a similar stakeholder setting |
| Latvia | Centralized | Best | Other coordination fora and energy networks | Ministry of Economics' Advisory Boards |
| Sweden | Decentralized | Good | Other coordination fora and energy networks | Administrative boards have been commissioned by the government to cooperate with other regional and local actors in order to produce regional strategies for climate and energy policies |
| Slovakia | Decentralized | Best | Other coordination fora and energy networks | SIEA as a member of the platform supporting municipalities in activities related to Covenant of Mayors, while specific workshops are organized to this targeted audience |
| UK | Regionalized | Best | Other coordination fora and energy networks | Role of universities and Higher Education Funding Council for England (HEFCE) |
| Croatia | Centralized | Best | Legal and economic instruments for involving local and regional authorities' | Provision of financial incentives such as the Eco fund |
| Slovenia | Centralized | Good | Legal and economic instruments for involving local and regional authorities' | Provision of financial incentives from Eco fund, while ministries and big energy distributors also give loans to legal entities – companies and the public sector |
| Sweden | Decentralized | Good | Legal and economic instruments for involving | Financing energy and climate advisors in 290 municipalities and 14 regional energy offices |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|------------------|----------------------|-----------------------|--|---|
| | | | local and regional authorities' | support the implementation of energy efficiency interventions at local and regional level (290 municipalities and 20 county councils developing a capacity building network and subsidizing energy efficiency projects in front-runner municipalities (37 selected municipalities)) |
| Slovakia | Decentralized | Best | Legal and economic instruments for involving local and regional authorities' | Provision of financial incentives from EU investment and structural funds as well as through provision of information and guidance (conferences, consultancy of SIEA to municipalities) |
| Lithuania | Centralized | Best | Legal and economic instruments for involving local and regional authorities' | Provision of financial incentives from State budget, ES Structural and Cohesion Funds and local EE Funds |
| France | Regionalized | Best | Legal and economic instruments for involving local and regional authorities' | Subsidies schemes targeting, among others, local authorities, and the energy efficiency obligation scheme facilitating the implementation of energy efficiency measures in the end-use sector including local authorities |
| Latvia | Centralized | Best | Legal and economic instruments for involving local and regional authorities' | Provision of financial incentives from available EU Funds, and national budget Green Investment schemes |
| France | Regionalized | Best | Capacity building | Hired shared energy experts |
| France | Regionalized | Best | Capacity building | Some initiatives of cities network are also implemented in cooperation with the French energy agency ADEME |
| France | Regionalized | Best | Capacity building | Resources centers by the ADEME regarding local energy and climate plans, GHG assessment, Cit'ergie® process or the "Climat Pratic" tool |

| Country | Governance structure | Best vs Good practice | Element | Brief description |
|----------------|----------------------|-----------------------|--|--|
| Germany | Federal | Best | Policies redesign and access on data and information | Authorities interact to safeguard access to data and information informally and on ad hoc basis |
| Latvia | Centralized | Best | Policies redesign and access on data and information | Re-design of the measures' content in order to increase their effectiveness within EU Funds 2007-2013 programming period |
| Latvia | Centralized | Best | Policies redesign and access on data and information | The Regional Energy Agencies (Riga city Energy Agency, Zemgale region Energy Agency) are active providers of information relevant for energy efficient renovation of multi-apartment buildings |