



Ex-Post Urban Impact Assessment

Energy Performance of Buildings Directive

Workshop based on ESPON TIA Quick Scan tool

In close association with



List of authors of the report

- **Martijn de Bruijn**, European Commission, DG REGIO
- **Slaven Klobučar**, European Committee of the Regions
- **Erich Dallhammer**, ÖIR - Österreichisches Institut für Raumplanung
- **Bernd Schuh**, ÖIR - Österreichisches Institut für Raumplanung

Institutions and organisations involved in the urban impact assessment of the Energy Performance of Buildings Directive

- European Commission, DG REGIO
- European Commission, DG ENER
- European Committee of the Regions
- ESPON - European Territorial Observation Network
- CEMR - Council of European Municipalities and Regions
- EUROCITIES

Experts from the cities taking part in the UIA

- **Ulrike Leidinger**, City of Aachen
- **Maria-Theresia Erat**, City of Berlin
- **Maaïke Kaiser**, City of Delft
- **Andrius Baranauskas**, City of Kaunas
- **Alenka Loose**, City of Ljubljana
- **Thomas Werner**, City of Munster
- **Ina Bērziņa - Veita**, City of Salaspils
- **Suvi Holm**, City of Tampere
- **Inge Van de Klundert**, City of Utrecht
- **Egle Randyte**, City of Vilnius

Cities contributing to the questionnaire

- City of Aachen, Germany
- City of Berlin, Germany
- City of Delft, the Netherlands
- City of Kaunas, Latvia
- City of Ljubljana, Slovenia
- City of Munster, Germany
- City of Salaspils, Latvia
- City of Tampere, Finland
- City of Utrecht, the Netherlands
- City of Vilnius, Lithuania
- City of Aarhus, Denmark
- City of Cork, Ireland






Disclaimer

This report was produced by the European Commission in cooperation with the European Committee of the Regions and the European Territorial Observation Network – ESPON, and in close association with EUROCITIES and CEMR. This report serves for information purposes only. The effects observed in the analysis might not necessarily be a result of the directive itself but a result of national implementation as well. This report and the maps represent the views and experiences of the cities participating in the urban impact assessment.

Acronyms and legend

CEMR	Council of European Municipalities and Regions
CoR	European Committee of the Regions
C	Central Europe
DG ENER	European Commission – Directorate for Energy
DG REGIO	European Commission – Directorate for Regional Policy
DG JRC	European Commission – Joint Research Center
EP	European Parliament
ESPO	European Territorial Observation Network
EUROCITIES	EUROCITIES Association
E	Eastern Europe
IPCC	Intergovernmental Panel on Climate Change
LRA	Local and Regional Authority
MS	Member State(s)
RES	Renewable Energy System
NUTS	Nomenclature des zones territoriales statistiques Common classification of territorial units for statistical purposes
N	Northern Europe
NE	North-East Europe
NZEB	Nearly zero-energy buildings
S	Southern Europe
OiR	Österreichisches Institut für Raumplanung (ÖIR)
UIA	Urban Impact Assessment
W	Western Europe

Effects of the directives – colour code

	Positive effects
	Minor positive effects
	Neutral
	Minor negative effects
	Negative effects

Legend – direction of effects

	Increase
	Decrease

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1 Introduction

The 2010 Energy Performance of Buildings Directive is the EU's main legislation when it comes to reducing the energy consumption of buildings. Under the Energy Performance of Buildings Directive:

- energy performance certificates are to be included in all advertisements for the sale or rental of buildings;
- EU countries must establish inspection schemes for heating and air conditioning systems or put in place measures with equivalent effect;
- all new buildings must be nearly zero energy buildings by 31 December 2020 (public buildings by 31 December 2018);
- EU countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls, etc.);
- EU countries have to draw up lists of national financial measures to improve the energy efficiency of buildings.

The Energy Performance of Buildings Directive is currently being evaluated by the European Commission and the urban impact assessment was timed to fit in with the schedule of DG ENER. The results of this report will feed into the stakeholder consultation process, and potentially in the evaluation of the directive. The urban impact assessment consisted of the following steps:

Selection of the cities

The cities were proposed by the European Committee of the Regions, EUROCITIES and CEMR and pre-selected by ESPON to fit the representative sample of 21 cities. This sample represented different types of city such as EU capital cities, cities from second tier metro regions, cities from smaller metro regions and cities from different European countries. The final selection was made by the European Commission. The complete list of cities proposed can be found in Annex 4.

Questionnaire

The questionnaire prepared by DG ENER was sent to the chosen cities in advance of the workshop in order to obtain more detailed information on the implementation of the directive and to prepare the workshop. The results are summarised in Chapter 3 and the narrative responses are integrated into the general report, Chapters 4, 5, 6 and 7.

Urban impact assessment expert workshop

The workshop was held on 11 November and brought together 10 experts from the chosen cities, representing a rather balanced representation of EU cities (invited vs attending; N (1/3); NE (3/3); E (0/1); S (1/3); W (2/6) and C (3/4). The workshop was organised around interactive discussions where experts discussed their views on the effects of the directive at local and regional levels.

Two moderators from the OIR, provided by ESPON, prepared and guided the workshop and ESPON TIA tool test. The urban impact assessment was carried out to determine the environmental, social, governance and economic effects of the implementation of the directive. During their discussions the experts drafted a cause and effects chart, outlining expected effects. Following the discussion about the effects of the directive, experts discussed policy proposals that would reflect some of the difficulties observed in the implementation of the directive.

2 Methodology: ESPON Quick Scan

2.1. The conceptual model: how does policy influence the development of regions?

In the first part of the workshop a conceptual model was prepared on the basis of the urban experts' opinions, with the objective of identifying potential territorial impacts of the directive in the fields of economy, society, environment and governance.

In an interactive discussion, the participants drew a systemic picture linking the regulations of the Energy Performance of Buildings Directive to potential effects in the fields of environment, society, economy and governance. They identified potential linkages and feed-back-loops between different effects. The main results of the discussion were:

Society

- There was concern that higher energy efficiency standards for buildings might increase building costs and, consequently, rents. It might be difficult to develop social housing at a price that was affordable for poorer sections of the population. This might reduce investment in social housing. Consequently, the number of people threatened by the risk of poverty might increase. On the other hand, highly energy efficient renovations of the housing stock might result in the displacement of tenants or owners and a change in existing social structures and neighbourhoods.
- The directive did not take into account cultural habits: with regard to the use of buildings, for instance, indoor temperature or ventilation of rooms differed depending on people's social status and cultural habits.

Economy

- More activities to increase building efficiency should increase demand for craftsmen especially in sub-construction work. Consequently the number of employed people should increase. However, in some regions it was difficult to find adequately skilled craftsmen. Further qualification would be needed in those cases.
- The directive would contribute to increased innovation in the sub-construction work sector only if there was an innovative climate. Otherwise the effects on innovation would be minor.
- It would be difficult to increase energy efficiency by thermal insulation in historic neighbourhoods. Thermal insulation would change the townscape of neighbourhoods and reduce the existing variety in terms of the facades of buildings, which was in direct conflict with policies on protecting cultural heritage.

Environment

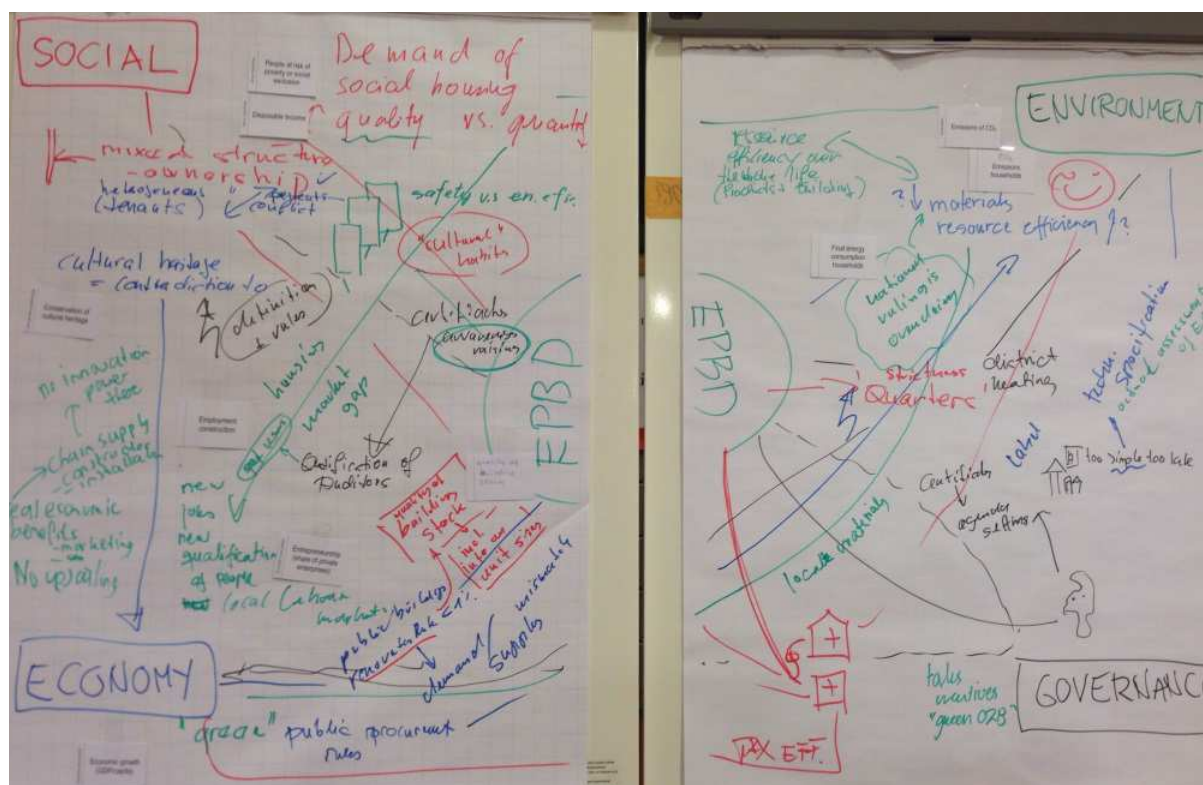
- When carrying out renovations it was important to take into account the life-cycle of the buildings and resources used for renovating.
- Depending on the level of energy efficiency of connected buildings and the fuel used, district heating could either be environmentally-friendly and efficient or economically inefficient, i.e. because of low energy demand for a costly infrastructure. Cities should make their decision on district heating based on a cost-benefit analysis.

- The directive did result in higher renovation rates and better energy efficiency in most of the participating cities.

Governance

- The effects of the directive depended largely on the way the directive had been transposed into national legislation. The participants considered the energy certification of buildings to have had limited benefits in terms of increasing their energy efficiency.
- The participants considered the energy certification of buildings to have had limited benefits in terms of increasing their energy efficiency in metropolitan regions or areas with a tense housing market situation.
- As the definition of the Nearly Zero Energy Building Standard in Article 2 of the EPBD was intended for new buildings, it might not always fit existing buildings, especially in densely developed regions. Optional approaches, like neighbourhood-related measures, might support an increase in renovation rates.

Figure 1: Workshop findings: conceptual model



Source: Urban impact assessment expert workshop: Energy Performance of Buildings Directive (2010/31/EU), Brussels 11 November 2015

The next step was to select indicators that could describe the identified effects. The following indicators available at NUTS3 level were selected:

- CO₂ emissions in households
- CO₂ emissions – in general
- Final energy consumption

- Economic growth (GDP/capita)
- Entrepreneurship (share of private enterprises)
- Employment in construction
- Employment in the energy sector
- Disposable income of households
- Number of people at risk of poverty or social exclusion

Additionally, several other indicators, which would have been worth taking into account when displaying the effects of the Energy Performance of Buildings Directive, were discussed. Unfortunately, many of these indicators are not available at NUTS 3 level; more specifically data concerning the energy consumption of buildings, the quantity (floor space) and quality of buildings in a city and the numbers of buildings that were part of the cultural heritage. Some of these data were available only at national level.

2.1 Which types of region are affected?

Urban impact assessments (UIA) aim to analyse the impact of an EU policy on urban regions. Thus, the analysis of effects concentrated on the metro regions, which are NUTS level 3 approximations of the functional urban areas (city and commuting zones) of 250 thousand or more inhabitants.

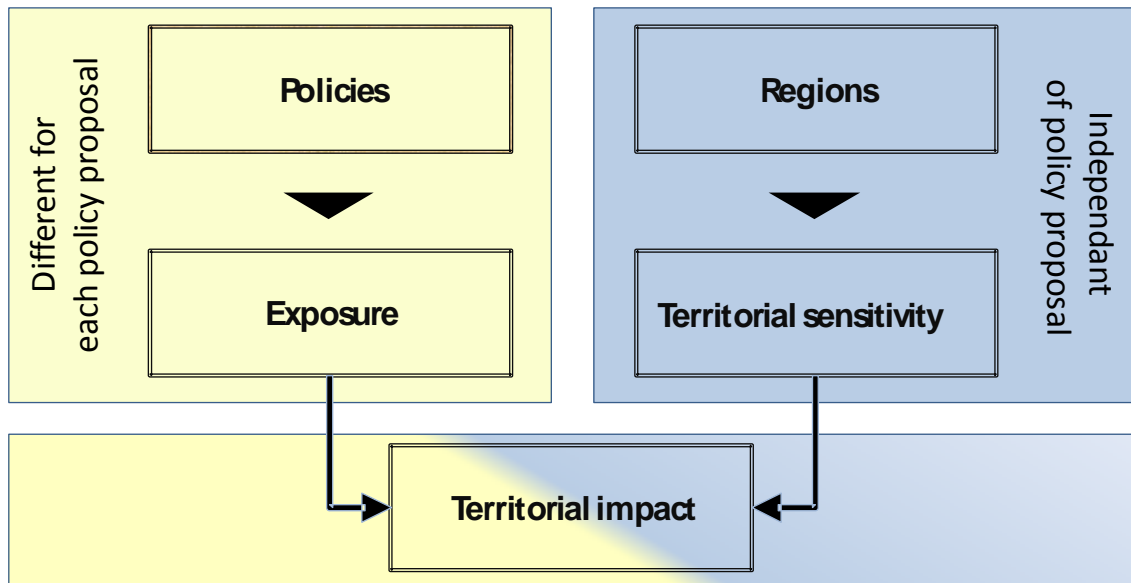
The boundaries of a functional urban area do not necessarily coincide with those of NUTS level 3 regions. Therefore, NUTS level 3 regions in which at least 50% of the regional population lives inside a given functional urban area were selected as the components of the metro region related to that functional urban area. In some cases, the NUTS level 3 approximation of the functional urban area is very good. In others cases, the metro region may be larger or smaller than the functional urban area. Each functional urban area is represented by at least one NUTS level 3 region, even if that NUTS level 3 region has less than 50% of its population inside the functional urban area.¹ However, this analysis was challenging due to the data availability issues.

2.2 How is "regional impact" calculated? Combining regional sensitivity and expert judgement

The ESPON TIA Quick check is based on the vulnerability concept developed by the Intergovernmental Panel on Climate Change (IPCC). In this case, the effects deriving from a particular policy measure (exposure) are combined with the characteristics of a region (territorial sensitivity) to produce potential territorial impacts (cf. following figure):

¹ http://ec.europa.eu/eurostat/statistics-explained/index.php/Territorial_typologies_for_European_cities_and_metropolitan_regions

Figure 2: Exposure x territorial sensitivity = territorial impact



Source: OIR, 2015.

As the figure shows, territorial impact (which is visualised in the following set of maps) depicts a combination of so-called regional sensitivity and the exposure caused by the implementation of the directive. Regional sensitivity describes the baseline situation of the region according to its ability to cope with external effects. It is a characteristic of a region that can be described by different indicators and it can be described independently of the directive analysed.

The exposure describes the intensity of the effect caused by the directive on a specific indicator. It is the effect of the implementation of the directive. Exposure illustrates the experts' judgement, i.e. the main findings of the expert discussion at the TIA workshop. Combining expert judgement with the given sensitivity of region within the selected exposure fields the TIA quick check shows the territorial impact for the selected types of region.

2.3 Mapping the impact

The result of the urban impact assessment is presented in maps. The displayed impact combines the expert judgement on the exposure with the territorial sensitivity of a region, described by a territorial indicator on NUTS3. Whereas expert judgement is a qualitative judgement (strong advantageous effect on territorial welfare / weak advantageous effect / no effect / weak disadvantageous effect / strong disadvantageous effect), the sensitivity is a quantitative indicator. (The detailed description is provided in the annex.).

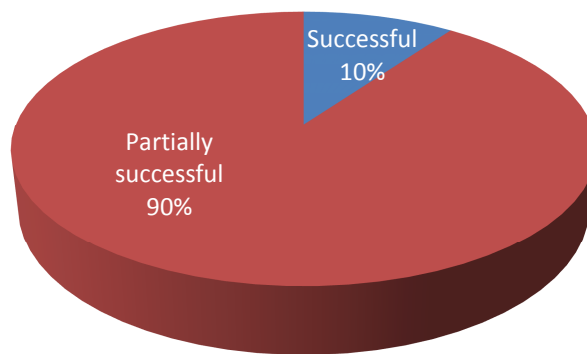
As the urban impact assessment focuses on metro regions, the impact of the Directive is just highlighted in regions belonging to this type. All other regions are coloured grey.

3 Results of the questionnaire

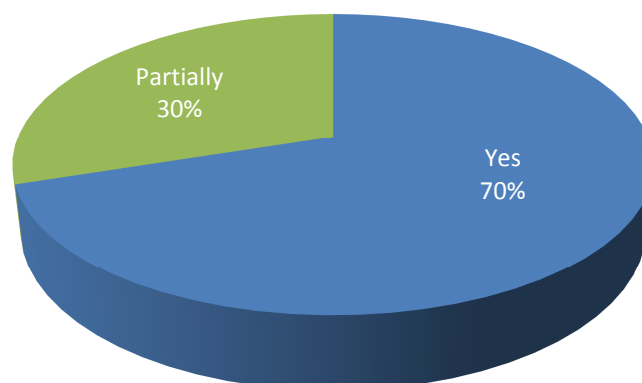
In the period from 30 June 2015 to 31 October 2015, the European Commission carried out a public consultation on the evaluation of the Energy Performance of Buildings Directive. The objective of this consultation was to consult stakeholders on the review of the directive and evaluate whether the directive had met its aims. The public consultation launched the review of the directive, which is due by the end of 2016 as required under Article 19 of the directive.

DG ENER drafted a questionnaire with some of the key questions posed in the public consultation. The aim of this questionnaire was to prepare the urban impact assessment workshop that took place on 11 November 2015. The narrative contributions are incorporated within Chapters 4, 5, 6 and 7. This section summarises the findings of the 12 contributions received (from Aachen, Berlin, Delft, Kaunas, Ljubljana, Munster, Salaspils, Tampere, Utrecht, Vilnius, Aarhus and Cork).

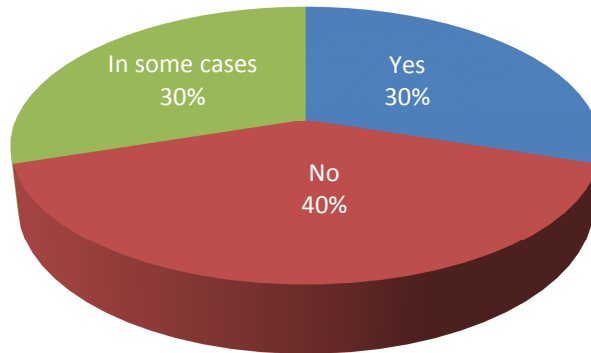
How successful has the EPBD been in achieving its goals from the perspective of your city administration?



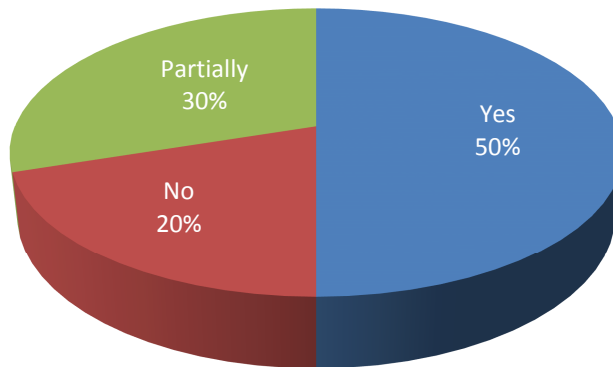
Has it helped improve energy efficiency in buildings in your city?



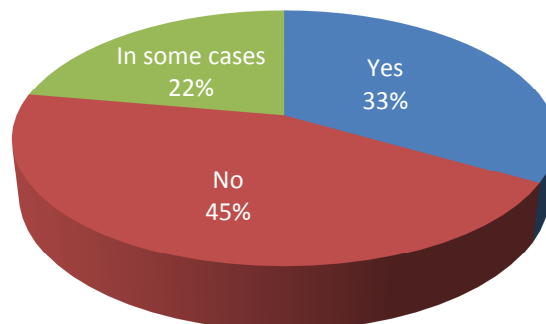
Are there areas where the EPBD worked better than other areas (for example city centre vs suburbs)?



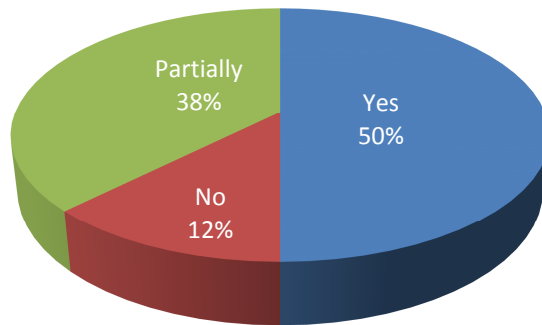
Have building energy renovation rates increased in your city since 2010? Why? What were the triggers?



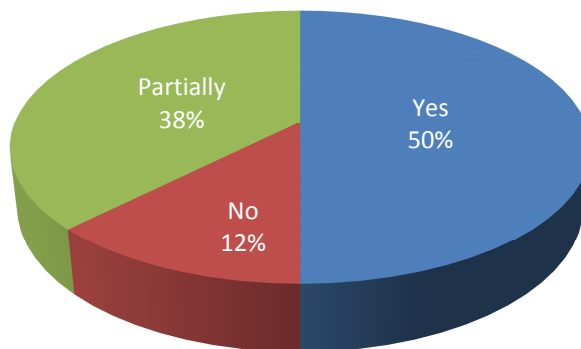
Are there any separate (new) obligations set at city and district level missing from the EPBD that would help increase energy efficiency and use of renewable energy in buildings?



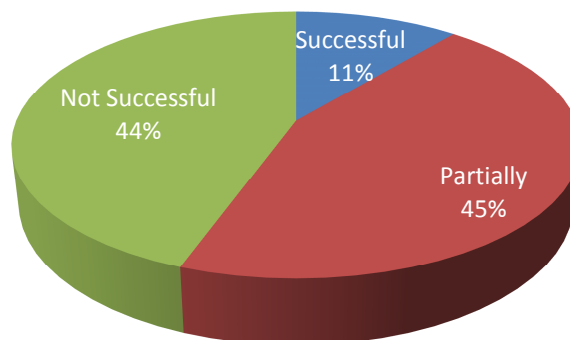
Do the EPBD and its definition of NZEB reflect the requirements that could derive from the energy systems of nearly zero-emissions districts and cities?



In your view, has the EPBD contributed sufficiently to accelerating investment in improving the energy performance of the building stock in your city?



How successful has the inclusion of Energy Performance Certificates in the EPBD been, and have they contributed to trigger improvements in energy performance of buildings?

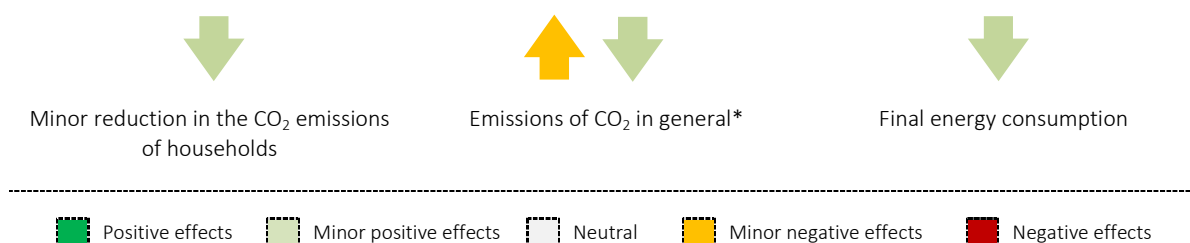


4 Environmental impact on metro regions

! The maps depicting the effects on indicators can be found in the annex of this report.

Environmental impact on the metro regions

* Two different scenarios. Further explained in the text



4.1. The potential territorial impact on CO₂ emissions of households

Expert judgement on the indicator CO₂ emissions of households:

- weak advantageous effect

The experts concluded that as a result of the implementation of this directive, CO₂ emissions originating from households should have dropped moderately, having a weak advantageous effect on the environment. Due to the slow rates of renovation, a more substantial drop in the CO₂ emissions was not observed.

The experts also pointed to the importance of education (especially of tenants) after investment had taken place, e.g. in a near zero energy house windows should stay closed at all times because ventilation was taken care of differently. The experts also pointed to the importance of cultural or historical habits in the energy efficiency of buildings. Habits needed to change if people were to benefit fully from the investments, e.g. in eastern Europe the habit of tenants in centrally-heated housing blocks was to open the windows if the heating was too high.

When taking into account the sensitivity of the metro regions, the positive effects on the CO₂ emissions in households was minor.

4.2. The potential territorial impact on CO₂ emissions

Expert judgements on the CO₂ emissions indicator:

- weak advantageous effect (first scenario)
- weak disadvantageous effect (second scenario)

The experts discussed the potential effects of the directive on overall CO₂ emissions in the metro regions. As the implementation of the directive varied widely from one Member State (MS) to another, so did the effects of the directive on CO₂ emissions.

Generally, the experts agreed that CO₂ emissions from heating buildings should have decreased. The scale of the reduction depended on buildings' existing energy efficiency levels. Overall, the experts would expect weak advantageous effects.

However, experts cautioned that the entire life-cycle of energy efficient products should be taken into account when implementing energy efficient policies. They questioned whether a life-cycle analysis of

building insulation could result in an opposite effect. Locally-produced products would certainly contribute more to CO₂ reduction than products imported from other parts of the world. The slow pace of building renovation, owing mostly to insufficient financing and a lack of incentive would also prevent the advantageous effect from being stronger.

To clarify this, the experts proposed two different scenarios: **first scenario** assumed that the positive effects on CO₂ emissions were higher and there was a weak *advantageous effect*. In the **second scenario** it was assumed that in line with the life-cycle debate there was a weak disadvantageous effect.

The analysis showed that approximately 2% of metro regions might experience a high impact on CO₂ emissions. Most of these regions were situated in Italy (Rome, Latina, Pescara, Florence, Turin, Novara), others were in Germany (Kelheim, Regensburg Landkreis) and in the Netherlands (Flevoland). Two thirds of the metro regions would face a moderate impact, 30% a minor impact. (This geographical distribution of effects was independent of whether there was a positive or negative impact.)

4.3. The potential territorial impact on final energy consumption

Expert judgement on the final energy consumption indicator:

- weak advantageous effect

As it was expected that the directive would have achieved its goal of increasing the energy efficiency of buildings, the experts expected a weak advantageous effect on final energy consumption. Combining exposure with the sensitivity of the urban areas, the TIA showed that for more than 99% of the metro regions the overall positive effects were minor. Just one metro region (Madrid) 0.2% would secure a high positive impact on CO₂ emissions. Although better insulation would lead to a reduction in energy use, the slow renovation rate and the need for changes in attitude would keep the advantageous effect mostly weak.

4.4. Other environmental effects

The experts emphasised that had the directive been efficiently implemented, a stronger increase in resource efficiency and a decrease in the use of raw materials might have been observed, which together would have a stronger positive effect on the environment.

Some of the experts believed that the energy performance certificate was not implemented in an efficient way, with certain Member States not listing suggestions on which investments to make in order to increase the energy efficiency of the building concerned. In other Member States the certificate was based on theoretical performance that was far removed from reality. If the energy performance certificates had been more detailed and more specific they could have resulted in higher renovation rates, as private owners often did not have the knowledge on how to proceed and insulate their buildings more effectively. The experts emphasised that it was not enough to look just at the energy efficiency of buildings but that the entire life-cycle of buildings and resources needed to be taken into account.

Experts estimated that the effects of the directive might have been more substantial had there also been requirements for city districts (neighbourhoods) and not just for individual buildings. This would have enabled more cost-efficient investments to be made in the buildings where the biggest gains

were possible, e.g. the orientation of certain buildings towards sunlight is much more favourable than for others.

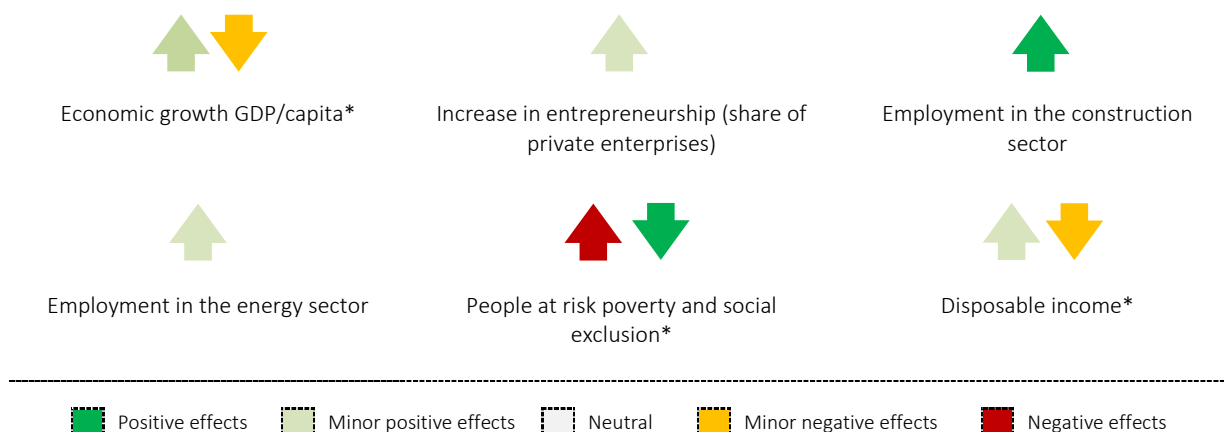
The experts agreed that the directive had had a positive effect on renovation rates in most of the cities consulted, resulting in better energy efficiency in private and public buildings. Without the directive and the support of the European Union, the current levels of renovation would not be as high; however they also agreed that more could be done to increase renovation rates.

5 Economic and social effects on metro regions

! The maps depicting the effects on indicators can be found in the annex of this report.

Economic and social effects on urban areas

* Two different scenarios. Further explained in the text



5.1. The potential territorial impact on economic growth (GDP/capita)

Expert judgement on the economic growth (GDP/capita) indicator:

- weak advantageous effect (first scenario)
- weak disadvantageous effect (second scenario)

As the directive required certain renovations to be carried out, the experts suggested that this should have triggered a weak advantageous effect (**First scenario**) on economic growth (GDP per capita) in the metro regions, generating new jobs notably in the construction sector.

However, there were some concerns that jobs in the fossil fuel energy sector may have been lost due to a lower demand for fossil fuels and this could have led to a weak disadvantageous effect on economic growth (**Second scenario**).

The analysis showed that 12% of metropolitan regions might face a high impact on economic growth. Most of these metropolitan regions were situated in eastern Europe, especially in Poland, Hungary, Croatia, Romania and Bulgaria and parts of East Germany. Other regions with a presumably high impact were located in the south (e.g. Caserta, Catania, the Setúbal Peninsula) and in the UK (e.g. Northumberland, south Nottinghamshire, and Greater Manchester North). 80% of metropolitan regions experienced moderate impact.

5.2. The potential territorial impact on entrepreneurship (share of private enterprises)

Expert judgement on the entrepreneurship indicator (share of private enterprises):

- weak advantageous effect

The implementation of the directive was expected to have resulted in a weak advantageous effect on entrepreneurship in the metro regions in general. When applying the sensitivity of EU's metro regions to this indicator, the results showed different effects on metro regions, from minor impacts to high positive impacts.

The experts saw a positive effect on entrepreneurship owing to the additional demand for enterprises in the construction sector and the sub-construction sector needed to increase the energy efficiency of existing buildings. As this work could not be done under existing industrial standards, additional enterprises in the crafts sector should have emerged.

The analysis showed that 6% of metropolitan regions might experience a high impact with regard to entrepreneurship. More specifically, metropolitan regions in Denmark (e.g. North Jutland), north-eastern France (e.g. Pas-de-Calais, Moselle) and a few regions in Germany (e.g. Wolfsburg, Göttingen) and eastern Europe (e.g. Northern Estonia, Borsod-Abaúj-Zemplén) would experience a high positive impact on entrepreneurship.

5.3. The potential territorial impact on employment in construction

Expert judgement on the employment in construction indicator:

- strong advantageous effect

The experts noted that the links to the local economy had not been sufficiently explored. If done properly, it could have resulted in strong positive effects on the economy. What this directive did bring was the creation of certain new types of job, in particular jobs in the construction sector. One expert mentioned, however, that they had observed a lack of innovation among local entrepreneurs, resulting in the municipality doing a large share of the renovations itself.

The analysis showed that about 16% of metropolitan regions might experience a very high and 79% a high positive impact on employment in the construction sector.

5.4. The potential territorial impact on employment in the energy sector

Expert judgement on the employment in the energy sector indicator:

- weak advantageous effect

The experts considered that the directive should have had weak advantageous effects on employment in the energy sector, as energy experts were needed to carry implementation through.

Combining the expert judgement with the sensitivity score resulted in two metro regions in France (Herauld, Seine-Maritime) achieving a high positive impact. 31% of metro regions would experience a moderate positive impact.

It is important to note that some jobs might have been lost, notably in the energy industry linked to the use of fossil fuels. Nevertheless, the experts believed that new and highly qualified jobs had been created.

5.5. The potential territorial impact on disposable income of households

Expert judgement on the disposable income of households' indicator:

- weak disadvantageous effect (first scenario)
- weak advantageous effect (second scenario)

Effects on disposable income could be observed from two different perspectives. Cases where renovations of private houses had to be financed entirely or largely by private owners could result in a weak disadvantageous effect on disposable income in general (**First scenario**), resulting in strongly

negative effects in some Member States' metro regions, notably those in Bulgaria and Romania. Where the cost of upgrading the energy efficiency of buildings was directly financed by the tenants of buildings, housing costs would increase and consequently the disposable income of households would decrease.

On the other hand, if the renovations were carried out with public sector support or by means of appropriate tax incentives, the directive might have resulted in weak advantageous effects (**Second scenario**) with a strong positive impact on the same countries. Savings in energy consumption would mean that disposable income would grow. The conclusion regarding this indicator was that the impacts on disposable income depended largely on national implementation, tax incentives and support from national and local public administrations, which varied from Member State to Member State.

The analysis showed that 2% of metropolitan regions might experience a high impact on the disposable income of households. All these metropolitan regions were situated in Bulgaria and Romania. As this geographical distribution of the effects was independent of whether there was a positive or negative impact, it was to be noted that for the metropolitan regions of Bulgaria and Romania in particular it was essential to avoid negative effects on household income.

5.6. The potential territorial impact on the number of people at risk of poverty or social exclusion

[Expert judgement on the number of people at risk of poverty or social exclusion indicator:](#)

- [strong disadvantageous effect \(first scenario\)](#)
- [strong advantageous effect \(second scenario\)](#)

Similarly to the indicator on disposable income, the indicator for the number of people at risk of poverty or social inclusion could be observed from two different perspectives linked to national implementation.

The **first scenario** presented the effects of the directive when renovation was financed by private individuals, resulting in strong and very strong negative effects across the European Union. When the costs of upgrading the energy efficiency of buildings were transferred directly to the tenants, housing costs increased and the disposable income of households' decreased. Poorer populations in particular were at risk of not being able to afford the costs and consequently the number of people at risk of poverty or social exclusion could increase.

In the **second scenario**, buildings were renovated by means of tax incentives, public financing and other measures, easing the financial burden on private owners. The increase in the energy efficiency of buildings would reduce heating costs and consequently increase the disposable income of households. This could result in a reduction in the number of people at risk of poverty or social exclusion.

The experts emphasised that for some of the buildings, notably in eastern Europe, renovations for energy efficiency would not be ideal as these buildings were in such a poor state that it would be better to build new buildings instead. On a similar note, the experts pointed to the problem that often only energy efficiency measures were financed, while renovations linked to the structure of buildings were not. These latter investments were sometimes more urgent.

Experts also explained that there was often a tension between quality and quantity, especially concerning social housing. With a limited budget either a limited number of houses could be made

very energy efficient (e.g. from E to B), or a large number of houses could be made a bit more energy efficient (e.g. from E to D). Important social issues urged for the latter solution.

The analysis showed that 14% of metropolitan regions could face a very high and 85% a high impact on the number of people at risk of poverty or social exclusion. As this indicator showed the highest percentages of very high or high impact in comparison with all other relevant indicators, the experts deemed this effect to be one of the most important ones to be taken into account.

Metropolitan regions with a potential very high impact were located in the east of Europe, especially in Poland, Romania and Bulgaria and East Germany (e.g. Białystok, Lubelski, Iasi, Galati, Bad Doberan, Brachim) and the south of Europe (e.g. Taranto, Palermo, Cordoba, Murcia, Alicante). Others were located in the UK (e.g. Northumberland, Warwickshire).

As this geographical distribution of effects did not depend on whether the impacts were positive or negative, it had to be noted that especially for metropolitan regions in the east of Europe and the UK the effects on people at risk of poverty or social exclusion had to be taken into account.

6 Governance effects on metro regions

One of the main problems observed resulted from a poorly implemented directive in some of the Member States; in several cases it was transposed too late and was not sufficiently ambitious. In certain cases national legislation prevented cities from carrying out the energy renovation of city-owned housing stock. Some national tax incentives even worked against the directive, e.g. "punishing" tax payers for their energy performance investments with higher taxes because of the increased value of their houses.

According to the experts, energy performance certificates did not sufficiently influence the housing market because in many cities the energy costs of a building were marginal in relation to house or rental prices. The energy performance certificate did to some extent raise homeowners' awareness of the need for better insulation and energy efficiency in their homes; however more could have been done.

In some Member States national legislation had changed several times in recent years and this had created confusion among the citizens and even the experts had difficulties following. At the same time companies were marketing a lot of energy efficient and RES technologies for consumers. It was challenging for a non-expert to make the right decisions.

Ownership of buildings was an important issue when carrying out renovations. Certain buildings had a mixed ownership structure, both private and public, making an agreement on renovation difficult, often delaying the reconstruction of those buildings.

On the other hand, the owners of the buildings who rented out their apartments and did not live in them themselves had little interest in renovating as it would have a negative financial impact on them, yet a very positive one on their tenants. However, it was not only private owners who did not have any interest in energy efficient renovation. For many politicians investment in energy efficient reconstruction was not a priority as many of them did not see the imminent economic or political benefits. The experts agreed that the best local policies were long-term ones, backed by politicians and the public administration.

7 Issues that could not be reflected by indicators

During the discussion about the conceptual model several issues were raised by the experts that could not be fed directly into the ESPON TIA quick check. The following issues were discussed:

- **Cultural heritage**

Buildings considered to be part of cultural heritage posed a big problem for renovation as in principle their facades could not be altered, meaning that the only option was to insulate the buildings from the inside. This came with its own challenges and greater costs. Many of the public buildings were part of cultural heritage and this led to a conflict between protecting cultural heritage and energy efficiency policies.

- **Cultural differences**

The directive did not take into account cultural differences in the way inhabitants tended to heat their houses. Inhabitants of eastern European regions used to central district heating were often used to having higher temperatures in their houses in winter than some northern or southern European regions. This could be tackled through promotional campaigns aimed at those countries and regions specifically.

There were several external constraints that could reduce the positive effects of the directive:

- **Public procurement**

The rules of public procurement sometimes conflicted with energy efficiency policies. Often public procurement rules required the cheapest option to be chosen. This was often not the best option in terms of quality, leading to poor quality of insulation work for instance.

- **Justification of investments**

Justification for the building investment (public buildings) was based nowadays on a cost-benefit analysis, but the renovation programmes needed to be executed faster in order to accelerate the energy performance of the building stock sufficiently.

The suggestions of experts on improving implementation of the directive:

- More needed to be done on raising awareness among citizens, public servants and politicians in order to achieve the most from this directive.
- More collaboration and sharing of best practice were needed between cities, and at regional, national and EU levels. At the same time it was important to develop a common information base with other stakeholders, financing institutions, equipment manufacturers, research and educational organisations and media.
- The directive should have been transposed better in some Member States.

Financing the renovation:

- In some cases sufficient funds were available in the form of cheap loans, the legal restrictions on the use of these loans forced cities to prioritise which buildings to renovate and construction work to do each year, slowing down investment rates.
- EU funding was very challenging for local and regional authorities because of the red tape. While it was still advantageous to receive EU funding, the bureaucratic procedures kept the authorities from further exploring EU support, resulting in slower reconstruction rates than might have been possible. The experts agreed that the bureaucratic procedures and the extensive documentation required needed to be reduced in order to be more accessible.
- There was a lack of own resources that were needed for EU projects, this issue needed to be addressed by EU and national governments.

Annex 1 – Urban impact assessment workshop agenda

Urban impact assessment expert workshop

Energy Performance of Buildings Directive (2010/31/EU)

European Committee of the Regions, Rue Belliard 101, Brussels, Room JDE 51

11 November 2015

10.30 a.m. Welcome and introduction

- Welcome speeches by **Mikel Landabaso**, Director of Inclusive Growth, Urban and Territorial Development and Northern Europe, DG REGIO, European Commission, and **Thomas Wobben**, Director of the Directorate C – Legislative Works, European Committee of the Regions
- Statements by **Michael Klinkenberg**, EURO CITIES Policy Advisor and **Dr Angelika Poth-Mögele**, Executive Director for European Affairs, Council of European Municipalities and Regions (CEMR)
- Short introduction of the experts

10.50 a.m. Introduction to the directive

- Implementation of the directive and updates on the evaluation process
Vasco Ferreira, DG ENER, European Commission
- Results of the questionnaire
Slaven Klobučar, European Committee of the Regions
- Data and methods for EU-wide energy-related indicators – the LUISA approach
Carlo Lavalle, DG JRC, European Commission

11.30 a.m. Introduction to the ESPON Quick Scan TIA tool Bernd Schuh and Erich Dallhammer, OïR GmbH

11.40 a.m. Interactive discussion on the implementation of the directive Dealing with cause/effect chains

12:30 p.m. Buffet lunch

2 p.m. Interactive discussion on the implementation of the directive Defining the types of region affected and estimating the intensity of regional exposure

3.30 p.m. Coffee break

4 p.m. Presentation of the results of the discussion, plausibility and quality check

5 p.m. Policy recommendations

5:30 p.m. End of the workshop

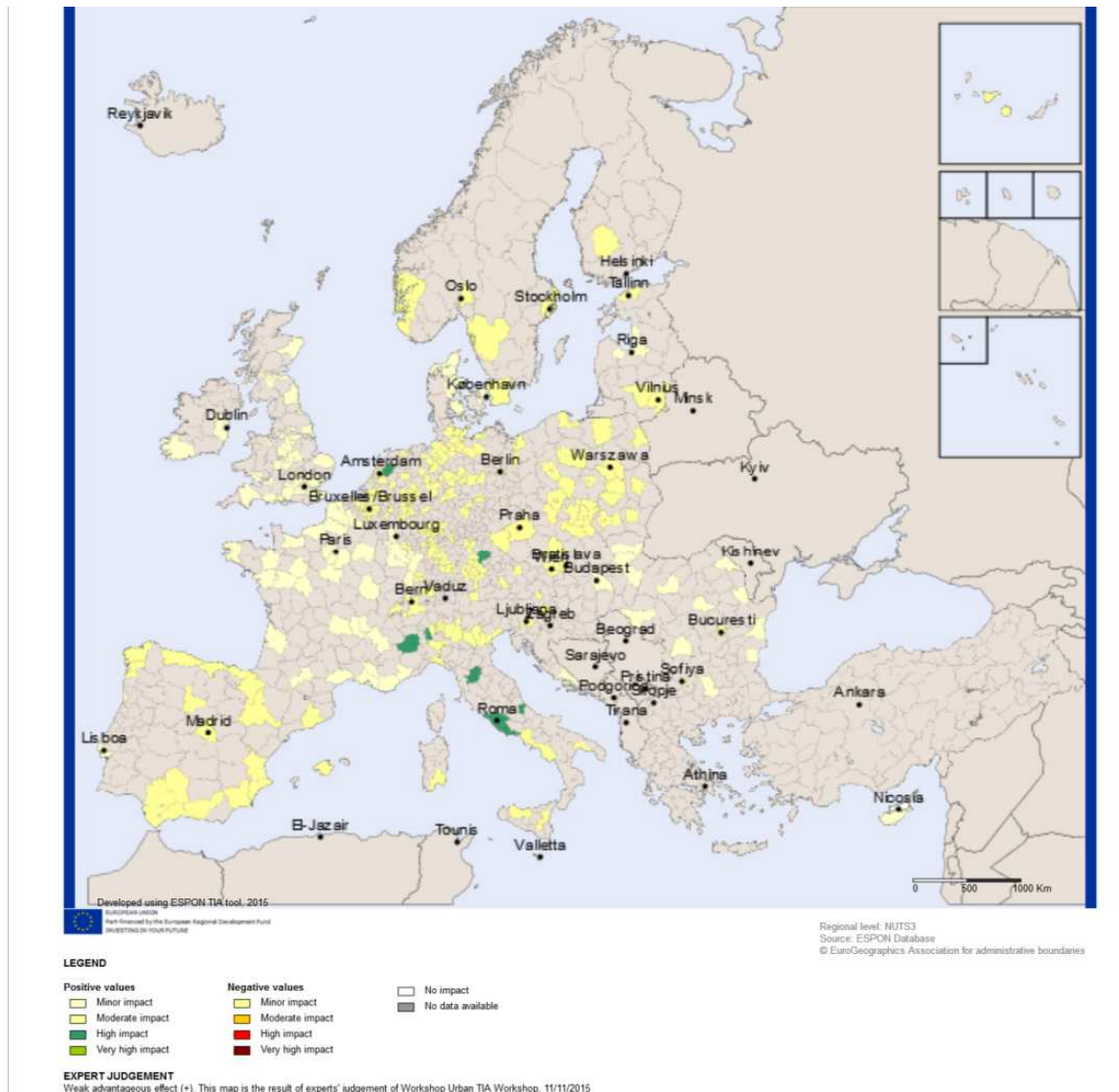
Annex 2 – Maps resulting from the ESPON Quick Scan tool

Source of the maps: Urban impact assessment expert workshop: Energy Performance of Buildings Directive (2010/31/EU), Brussels, 11 November 2015

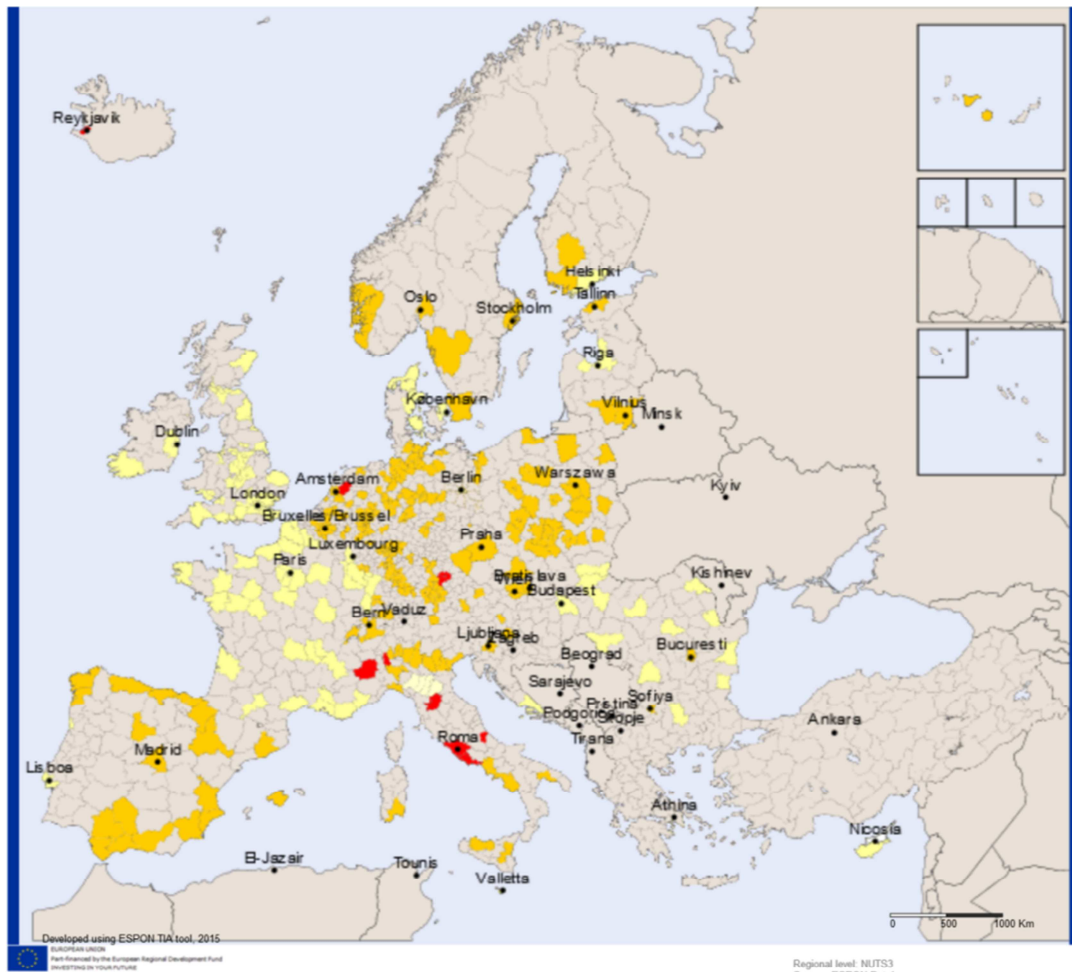
Map 1: 4.1. Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Household CO₂ emissions, Page 12



Map 2: 4.2. Scenario 1: Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) CO₂ emissions – judgement: weak advantageous exposure, page 12



Map 2: 4.2. Scenario 2: Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) CO₂ emissions - judgement: weak disadvantageous exposure, page 12, 13



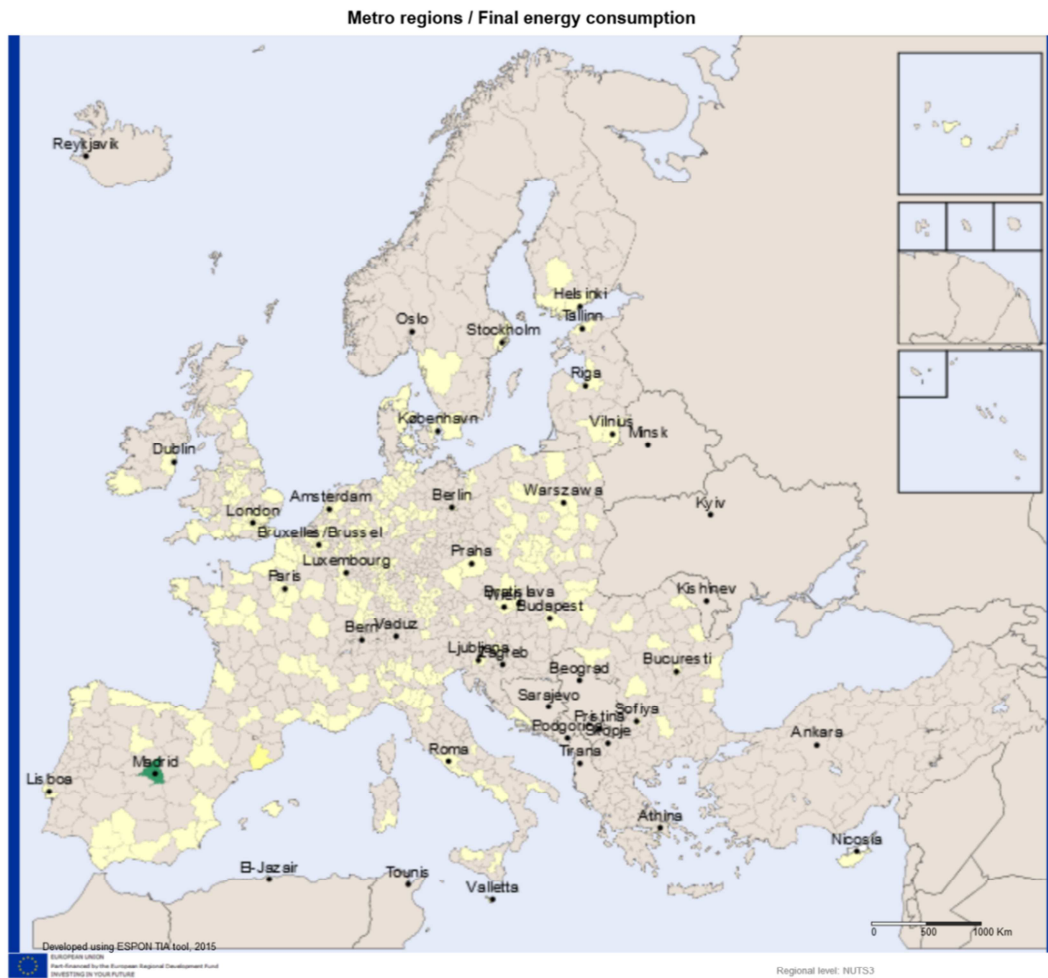
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- | | | | |
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| <input type="checkbox"/> Minor impact | <input type="checkbox"/> Moderate impact | <input type="checkbox"/> Minor impact | <input type="checkbox"/> No data available |
| <input type="checkbox"/> High impact | <input type="checkbox"/> Very high impact | <input type="checkbox"/> Moderate impact | |
| <input type="checkbox"/> Very high impact | | <input type="checkbox"/> High impact | |
| | | <input type="checkbox"/> Very high impact | |

EXPERT JUDGEMENT

Weak disadvantageous effect (-). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 4: 4.3. Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU)
Final energy consumption, page 13

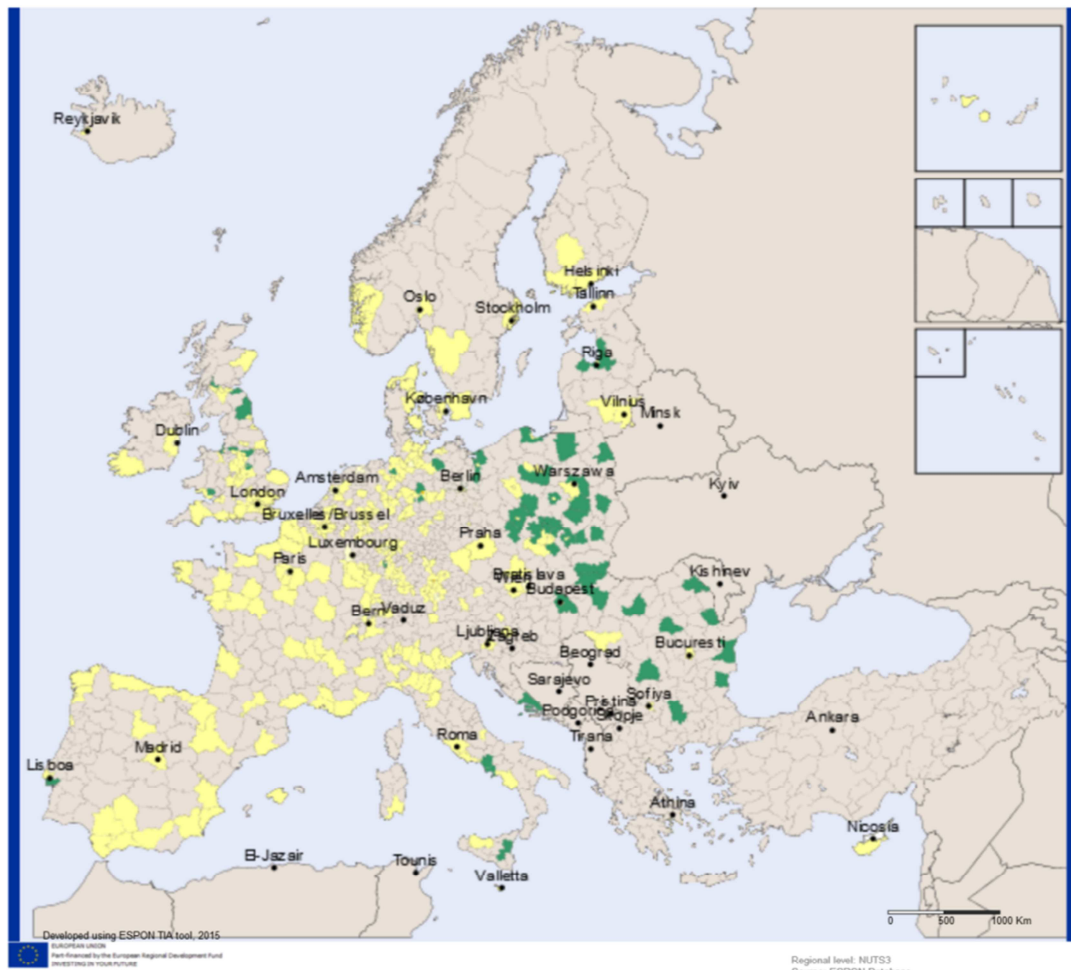


LEGEND

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<input type="checkbox"/> Very high impact	<input type="checkbox"/> Very high impact	

EXPERT JUDGEMENT
Weak advantageous effect (+). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 1: 5.1. Scenario 1: Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) - Economic growth (GDP/capita) - judgement: weak advantageous exposure, page 15



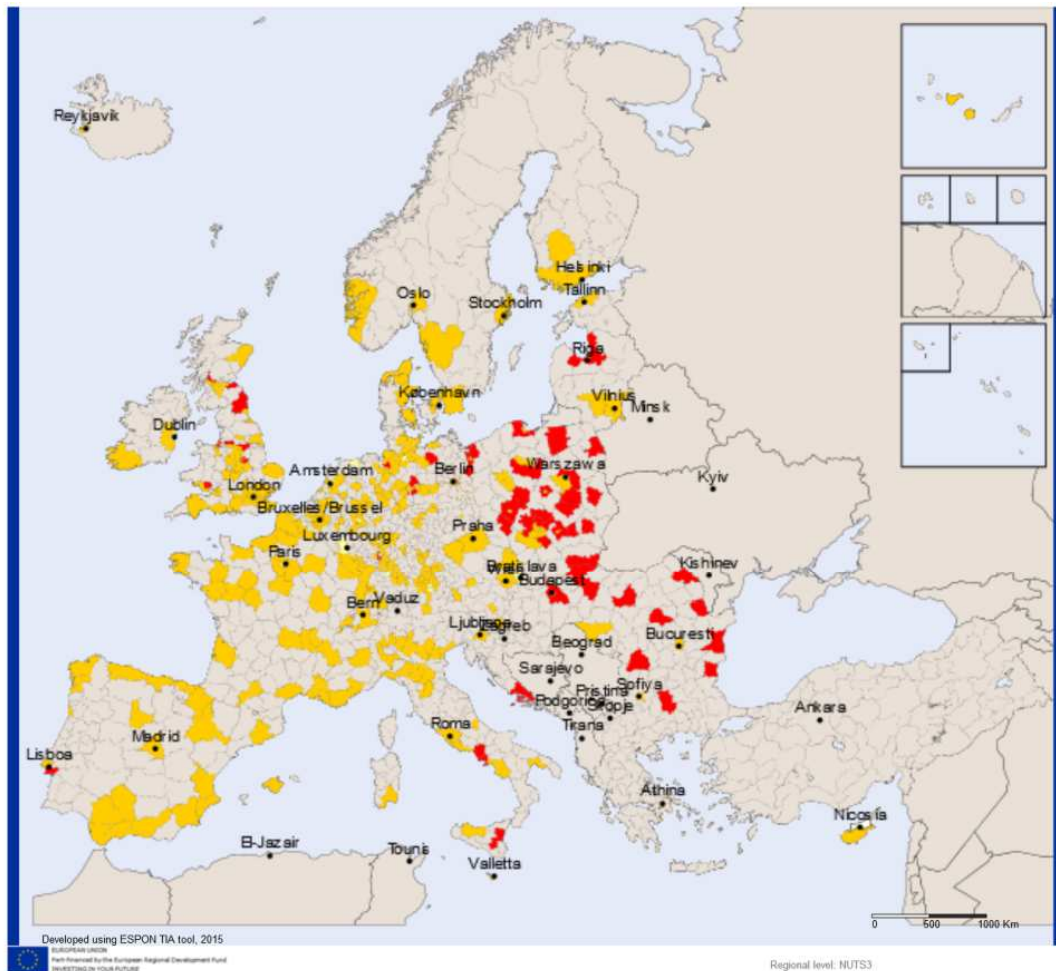
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Very high impact		Minor impact	Moderate impact	

EXPERT JUDGEMENT

Weak advantageous effect (+). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 6: 5.1. Scenario 2: Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Economic growth (GDP/capita) - judgement: weak disadvantageous exposure, Page 15



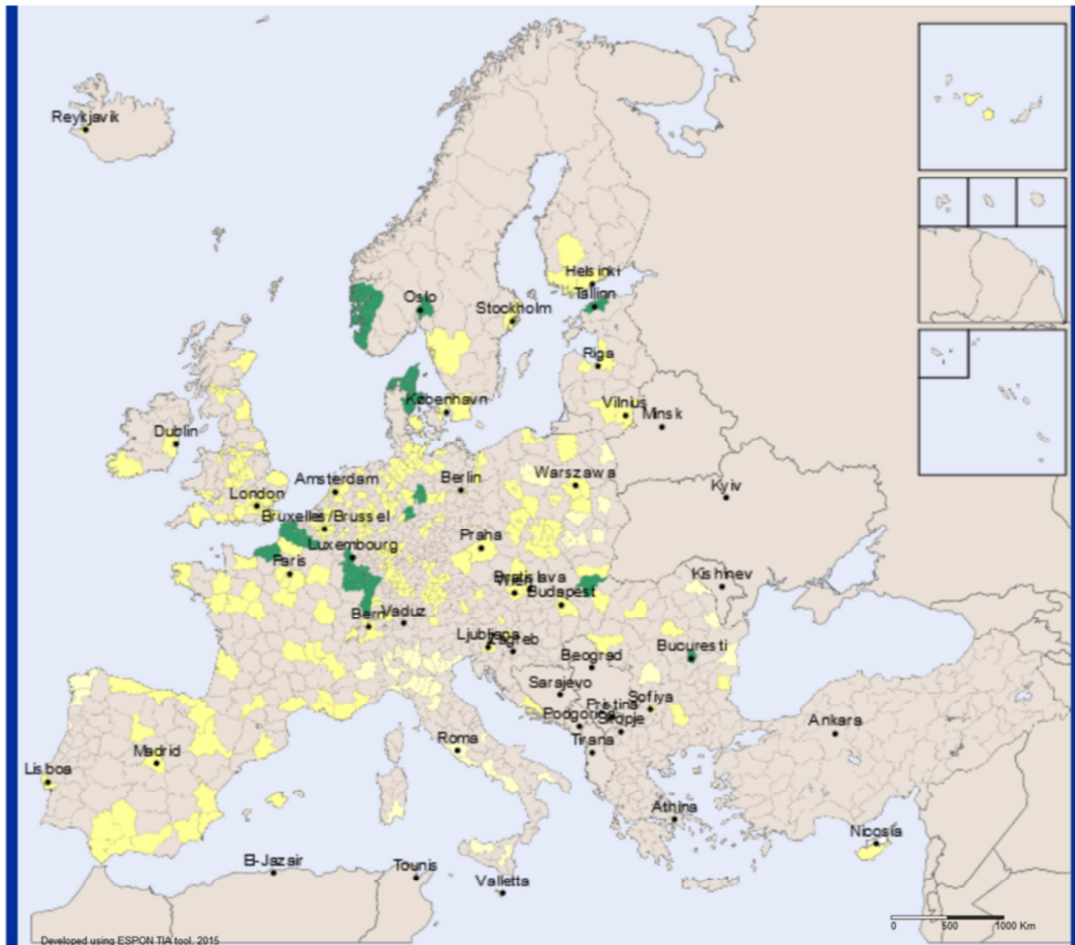
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Positive values	Negative values	□ No impact
□ Minor impact	□ Minor impact	■ No data available
□ Moderate impact	□ Moderate impact	
□ High impact	□ High impact	
□ Very high impact	□ Very high impact	

EXPERT JUDGEMENT

Weak disadvantageous effect (-). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 7: 5.2. Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Entrepreneurship (share of private enterprises), page 15



Developed using ESPON TIA tool, 2015

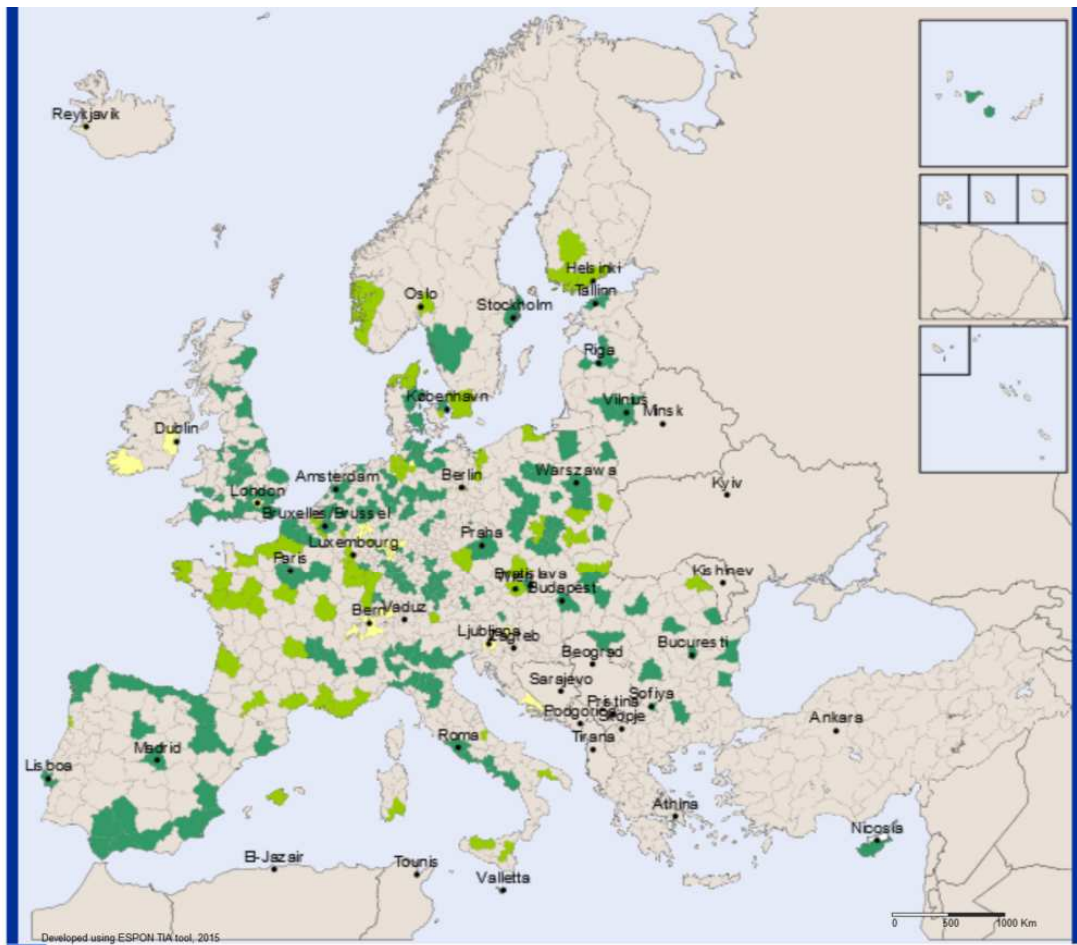
EUROPEAN UNION
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Regional level: NUTS3
Source: ESPON Database
© EuroGeographics Association for administrative boundaries

Positive values		Negative values		No impact	
	Minor impact		Minor impact		No impact
	Moderate impact		Moderate impact		No data available
	High impact		High impact		
	Very high impact		Very high impact		

EXPERT JUDGEMENT
Weak advantageous effect (+). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 8: 5.3. Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Employment in construction, page 16



Developed using ESPON TIA tool, 2015.
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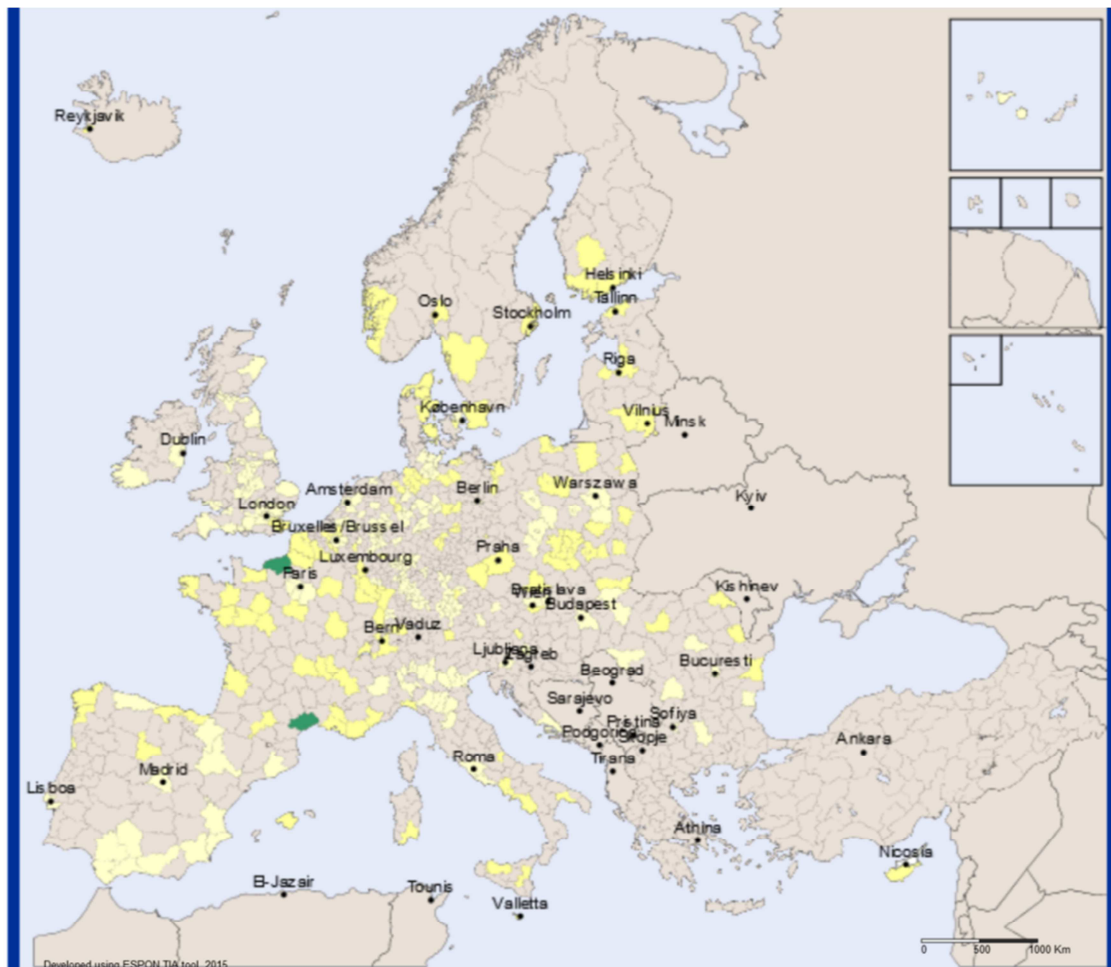
Regional level: NUTS3
 Source: ESPON Database
 © EuroGeographics Association for administrative boundaries

LEGEND

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EXPERT JUDGEMENT
 Strong advantageous effect (++) This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 9: 5.4. Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Employment in energy sector, page 16



Developed using ESPON-TIA tool, 2015
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Regional level: NUTS3
 Source: ESPON Database
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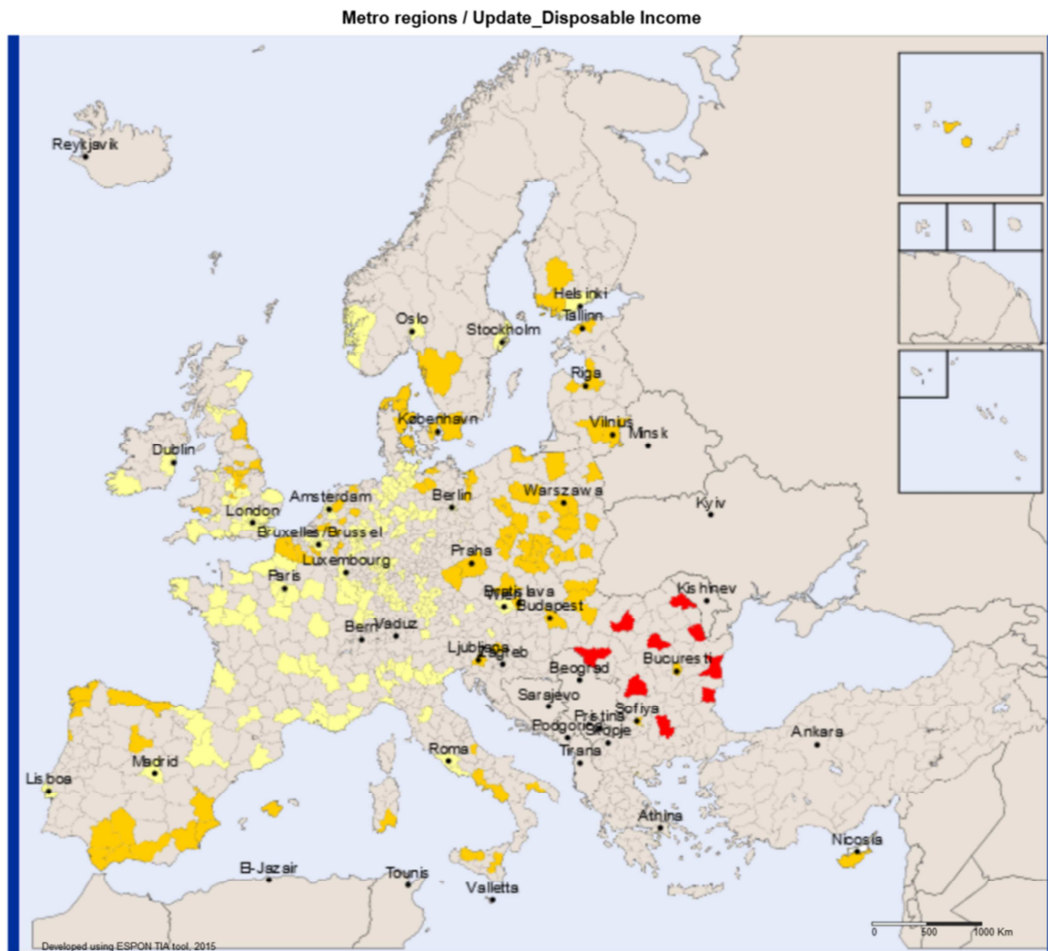
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	Moderate impact		Moderate impact	
	High impact		High impact	
	Very high impact		Very high impact	

EXPERT JUDGEMENT

Weak advantageous effect (+). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 10: 5.5. Scenario 1 - Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Disposable income - judgement: weak disadvantageous exposure, page 16, 17



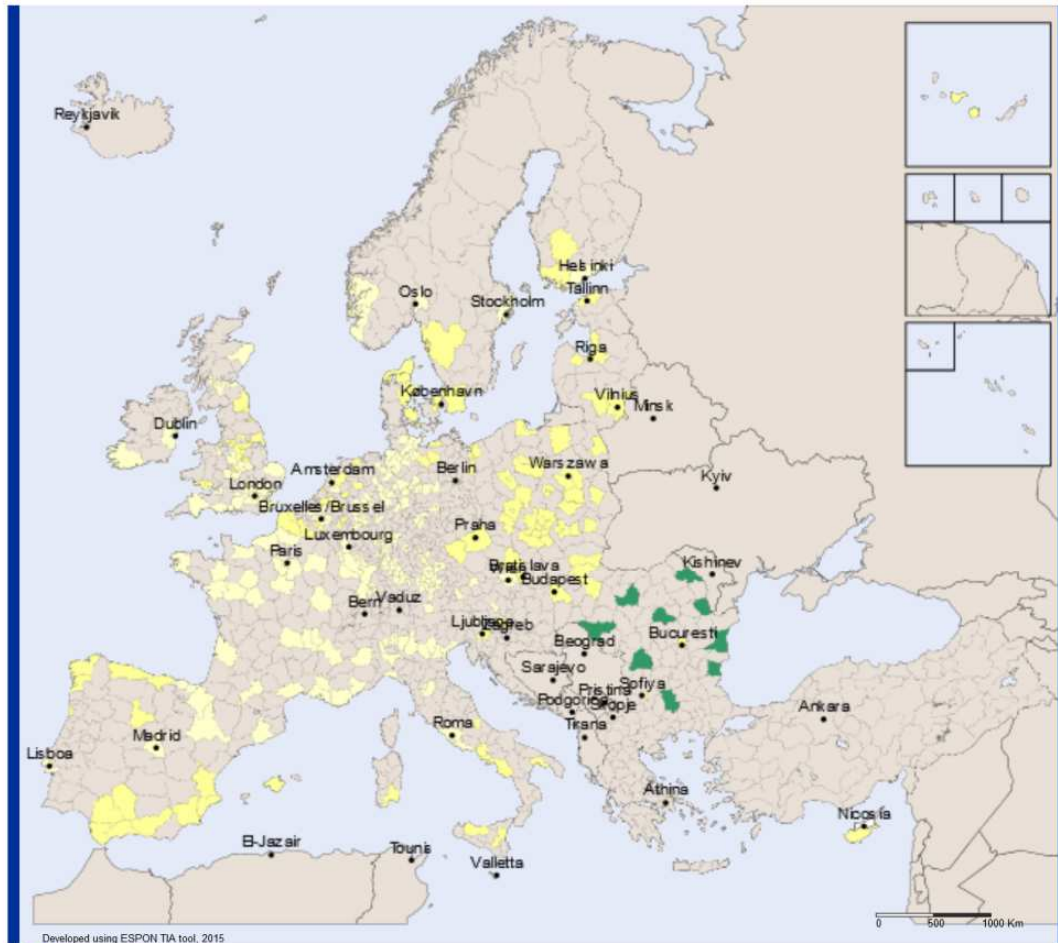
Regional level: NUTS3
 Source: ESPON Database
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LEGEND

Positive values	Negative values	No impact
Minor impact	Minor impact	No data available
Moderate impact	Moderate impact	
High impact	High impact	
Very high impact	Very high impact	

EXPERT JUDGEMENT
 Weak disadvantageous effect (-). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 11: 5.5. Scenario 2 - Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) Disposable income – - judgement: weak advantageous exposure, page 16, 17



Developed using ESPON TIA tool, 2015
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Regional level: NUTS3
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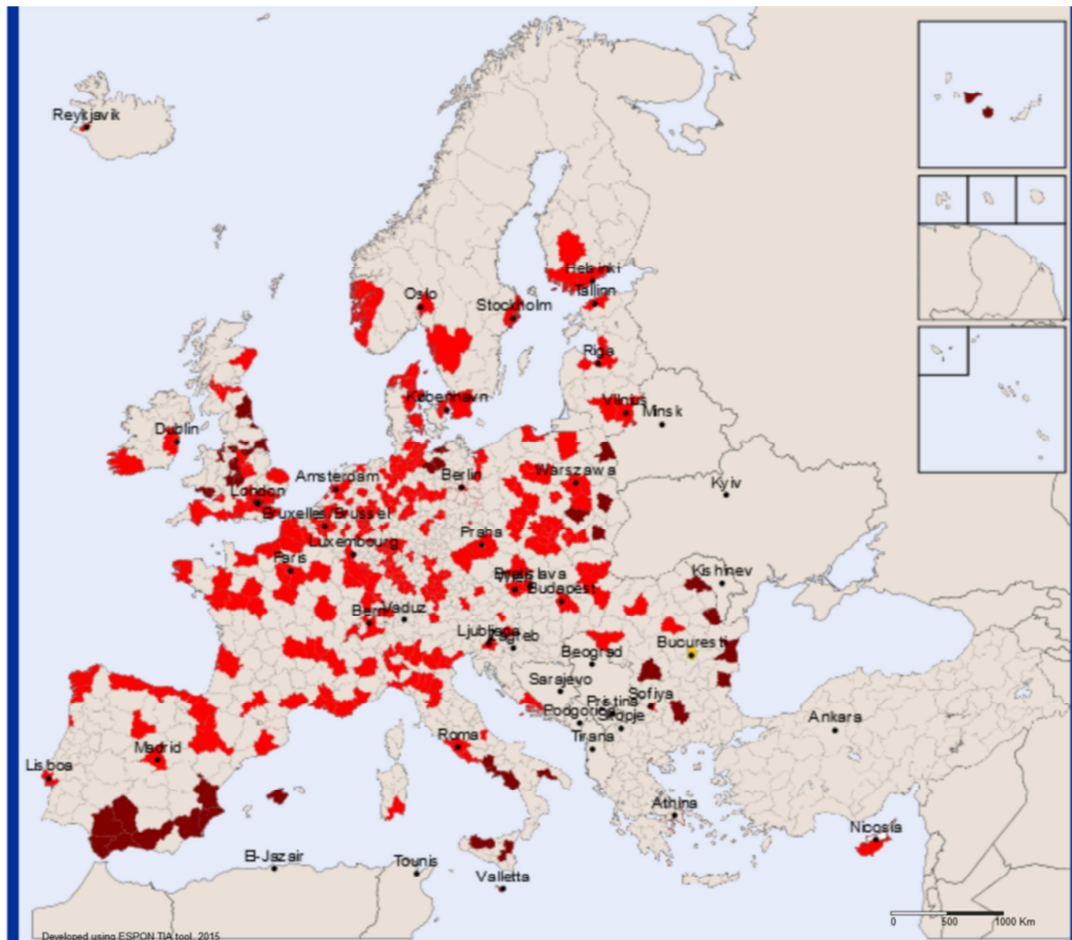
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□ Moderate impact	□ Moderate impact	
□ High impact	□ High impact	
□ Very high impact	□ Very high impact	

EXPERT JUDGEMENT

Weak advantageous effect (+). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 12: 5.6. Scenario 1 - Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) - People at risk of poverty or social exclusion - judgement: strong disadvantageous exposure, page 17



Developed using ESPON TIA tool, 2015.

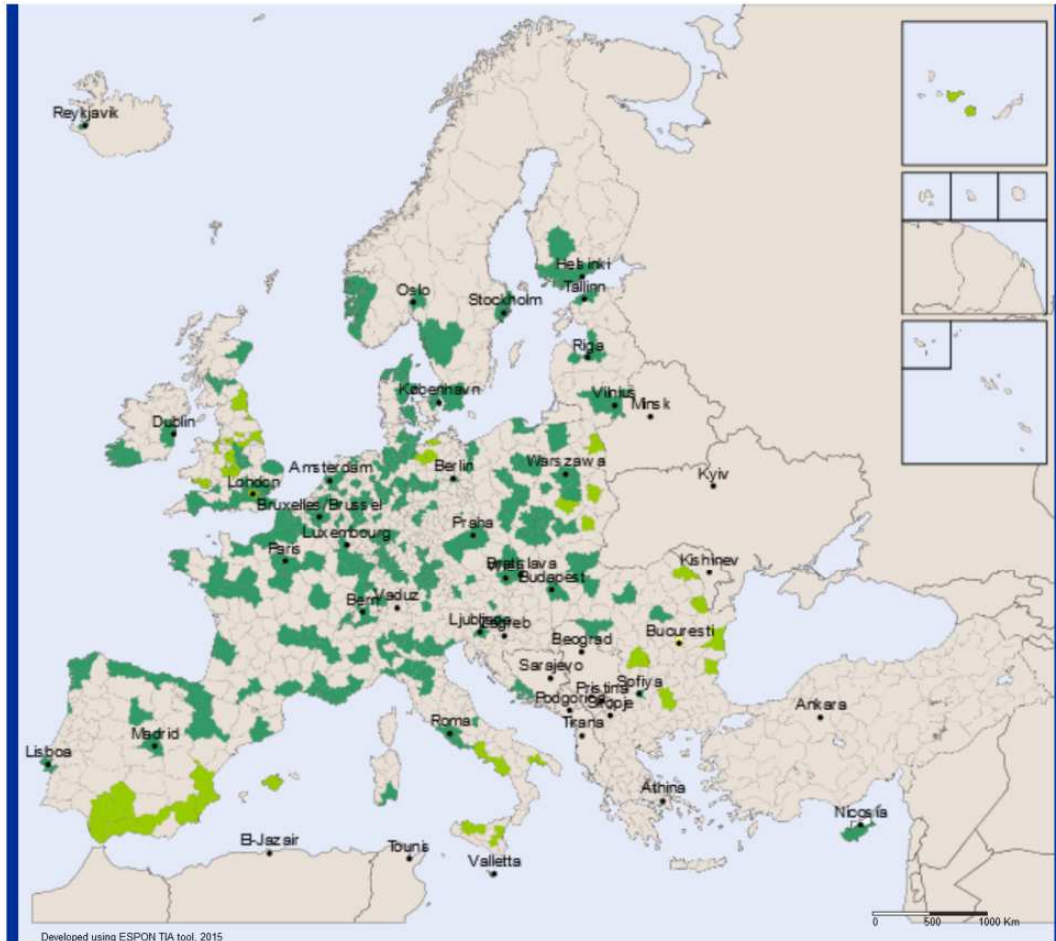
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LEGEND		
Positive values	Negative values	No impact
Minor impact	Minor impact	No data available
Moderate impact	Moderate impact	
High impact	High impact	
Very high impact	Very high impact	

EXPERT JUDGEMENT
Strong disadvantageous effect (-). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Map 13: 5.6. Scenario 2 - Metro regions affected by the Energy Performance of Buildings Directive (2010/31/EU) - Number of people at risk of poverty or social exclusion – - judgement: strong advantageous exposure, page 17



LEGEND

Positive values	Negative values	□ No impact
□ Minor impact	□ Minor impact	■ No data available
□ Moderate impact	□ Moderate impact	
□ High impact	□ High impact	
□ Very high impact	□ Very high impact	

EXPERT JUDGEMENT

Strong advantageous effect (++). This map is the result of experts' judgement of Workshop Urban TIA Workshop, 11/11/2015

Regional level: NUTS3
Source: ESPON Database
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Annex 3 – Description of the indicators used and regional sensitivity

Following the interactive discussion among experts, the following indicators were selected and introduced into the ESPON Quick Scan model;

1. CO₂ emissions from households

Definition of sensitivity	Regions showing greater residential CO₂ emissions per capita are expected to be more sensitive to directives aimed at reducing energy consumption in buildings
Description	Residential CO ₂ emissions per capita
Source	DG ENER, EUROSTAT; ÖIR calculation
Reference year	2012
Original Indicator Spatial Reference	NUTSO
Missing data	DE80

2 CO₂ emissions – In general

Definition of sensitivity	Regions showing greater density of vehicle fleet and employment in industry per capita were expected to be more sensitive to directives aimed at reducing CO₂ emissions
Description	CO ₂ emissions were largely dependent on vehicle emissions and emissions from industry. Therefore, the combination of vehicle concentration and employment in industry was used as a proxy for CO ₂ emissions
Source	EUROSTAT; ÖIR calculation
Reference year	2011
Original Indicator Spatial Reference	NUTS2, 2010
Missing data	DED4, DED5, FR91-94, 94, ITH5, ITI3, FI1B, FI1C, UKD6-7

3. Final energy consumption

Definition of sensitivity	Regions showing greater final energy consumption in households per capita are expected to be more sensitive to directives aimed at reducing energy consumption in buildings
Description	Final energy consumption in households per capita
Source	DG ENER, EUROSTAT; ÖIR calculation
Reference year	2013
Original Indicator Spatial Reference	NUTS0
Missing data	DE80

4. Economic growth (GDP/capita)

Definition of sensitivity	Regions with lower GDP per capita were expected to benefit more from directives aimed at GDP growth increase and that inadvertently harmed economic growth. Sensitivity was thus inversely proportional to the level of GDP per capita
Description	Gross domestic product (GDP) at current market prices; Purchasing Power Standard per inhabitant
Source	EUROSTAT
Reference year	2011
Original Indicator Spatial Reference	NUTS3, 2010

5. Entrepreneurship (share of private enterprises)

Definition of sensitivity	Regions showing lower levels of self-employment were expected to benefit more from actions aiming at its promotion, or that inhibited it unintentionally. Sensitivity was thus inversely proportional to the share of self-employment
Description	Share of self-employed persons among employed persons was used as a proxy for entrepreneurship
Source	EUROSTAT
Reference year	2012
Original Indicator Spatial Reference	NUTS2, 2010

6. Employment in construction

Definition of sensitivity	Regions with a higher share of employment in construction are expected to be more sensitive to directives aimed at reducing energy consumption in buildings
Description	Share of employment in construction (NACE Rev2 F) on total employment
Source	EUROSTAT Structural Business Statistics
Reference year	2013
Original Indicator	NUTS2, 2006
Spatial Reference	DE40, DED4, DED5, EL122, Croatia, Ireland, Slovenia, UK

7. Employment in the energy sector

Definition of sensitivity	Regions with a higher share of employment in the energy sector are expected to be more sensitive to directives aimed at reducing energy consumption in buildings
Description	Share of employment in electricity, gas, steam and air conditioning supply (NACE Rev2 D) on total employment
Source	EUROSTAT Structural Business Statistics
Reference year	2013
Original Indicator	NUTS2, 2006
Spatial Reference	
Missing data	DE40, DED4, DED5, EL122, Croatia, Ireland, UK, Slovenia

8. Disposable income of households

Definition of sensitivity	Regions with lower disposable income per capita were expected to benefit more from directives raising disposable income and be more harmed by potential decreases. Sensitivity was thus inversely proportional to the level of disposable income per capita in PPS
Description	Disposable income per capita in purchasing power standard based on final consumption per inhabitant
Source	EUROSTAT
Reference year	2010
Original Indicator	NUTS2, 2010
Spatial Reference	

Missing data	FR91, FR92, FR93, FR94: 2008, CY, LU: 2009; no data for DED4, DED5; Croatia; ITH5; ITI3; Malta;
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9. Number of people at risk of poverty or social exclusion

Definition of sensitivity	Regions that displayed a higher at-risk-of-poverty rate were likely to experience more acute poverty. Sensitivity towards directives influencing poverty was directly proportional to the at-risk-of-poverty rate
Description	At-risk-of-poverty rate as a percentage of total population
Source	EUROSTAT
Reference year	2012
Original Indicator Spatial Reference	NUTS2/NUTS1 2010
Missing data	Only NUTS1: BE (2011), EL (2010), HR (2012), HU (2012), PL (2012), UK (2009), CY, LV, LT, LU, MT (2012); Only NUTS0:HR, IS; NUTS2: IE, SE11: 2011 DE, NL: 2010; FR: 2009; PT: 2005; no data: DED4, DED5; French Overseas Departments;

Definition of additional indicators

During the TIA quick check it is possible to identify additional fields of exposure which are affected by the policy proposal and which are not provided by the tool as standard. Whereas the exposure caused by the policy proposal could be judged by the experts during the workshop, a valid indicator for describing the sensitivity of regions needs to be defined in advance. The TIA quick check offers the possibility to upload new indicators. It provides a template, where for each NUTS 3 regions the values of the indicator can be filled in.

For the new indicator it has to be defined, whether the exposure field needs to be evaluated as being either harmful ('cost') or favourable ('benefit') for the regions welfare. Then the tool will automatically transform the experts rating into numbers for further calculation (= normalisation).

Normalisation of indicators

The normalisation follows a linear procedure. Normalised values range from 0.75 up to 1.25. Basically, normalized sensitivity indicators represent coefficients that can increase (if greater than 1) or decrease (if lower than 1) each policy proposal's impact on a specific field. In case of the pilot on urban impact assessment, only data for NUTS 3 regions of the type "metro-regions" (regional typology of DG Regio) was added to the tool and therefore the normalization had to be adapted to this sample.

Methodology for normalisation of regional sensitivity values

Source: ESPON TIA Quick Check Moderator's Guide and Methodological Background

For this step the following definitions are needed:

X_{norm_i} the normalized value of the sensitivity indicator for impact field i

X_i the original value of the sensitivity indicator for impact field i

X_{min_i} the minimum original value of the sensitivity indicator for impact field i

X_{max_i} the maximum original value of the sensitivity indicator for impact field i

Then, normalization follows this formula:

$$X_{norm_i} = 0,75 + ((1.25 - 0.75) * ((X_i - X_{min_i}) / (X_{max_i} - X_{min_i})))$$

Annex 4 – Selection of cities participating in the UIA

Statistics on the cities proposed and selected

version: 22 October 2015

Countries	proposed no.	selected no.	metro type	proposed no.	selected no.	
AT	2	1	1	15	6	40%
BE	3	1	2	24	9	38%
BG	0	0	3	4	3	75%
CH	0	0	-	15	2	13%
CY	0	0	Total	58	20	
CZ	2	0				
DE	6	3				
DK	1	1				
EE	1	0	location	proposed no.	selected no.	
EL	1	0	N	6	3	50%
ES	2	0	NE	10	3	30%
FI	1	1	E	4	1	25%
FR	1	0	S	8	3	38%
HR	0	0	W	20	6	30%
HU	0	0	C	10	4	40%
IE	2	1	Total	58	20	
IS	0	0				
IT	1	1	Institution	proposed no.	selected no.	
LI	0	0	Eurocities	23	8	35%
LT	5	2	CEMR	13	6	46%
LU	0	0	CoR	22	6	27%
LV	4	1	Total	58	20	
MK	0	0				
MT	0	0				
NL	5	2				
NO	1	0				
PL	3	1				
PT	2	1				
RO	1	0				
SE	3	1				
SI	2	1				
SK	0	0				
TR	0	0				
UK	9	2				
Total	58	20				

Source: ESPON, November 2015

Cities proposed and cities selected

version: 22 October 2015

Proposed by	Priorit	Selecte	Cities	Country	NUTS3	additional NUTS3	metro ty	locatio
[name]	[1 2]	[yes no]	[name]	[code]	[code 2010]	[codes from SGPTD]	[1 2 3]	[NESWC]
CEMR	1	yes	Aachen	DE	DEA2D	-	3	C
Eurocities	2	yes	Aarhus	DK	DK042	-	2	N
CoR	1	yes	Berlin	DE	DE300	DE404 DE405 DE406 DI	1	C
Eurocities	1	yes	Birmingham	UK	UKG31	UKG36 UKG37 UKG32 I	2	W
CoR	1	yes	Cork	IE	IE025	-	2	W
CoR	1	yes	Delft	NL	NL333	-	-	W
Eurocities	1	yes	Gothenburg	SE	SE232	-	2	N
CoR	1	yes	Kaunas	LT	LT002	-	2	NE
CoR	2	yes	Leuven (Brussels)	BE	BE100	BE231 BE241 BE242 BE	1	W
CEMR	1	yes	Linz	AT	AT312	AT313	2	C
Eurocities	1	yes	Ljubljana	SI	SI021	-	1	S
CEMR	1	yes	Münster	DE	DEA35	DEA33	3	C
Eurocities	1	yes	Porto	PT	PT114	-	2	S
CEMR	1	yes	Salaspils (Riga)	LV	LV006	LV007	1	NE
Eurocities	2	yes	Sunderland	UK	UKC23	-	3	W
CEMR	1	yes	Tampere	FI	FI197	-	2	N
CoR	1	yes	Torino	IT	ITC11	-	2	S
Eurocities	1	yes	Utrecht	NL	NL310	-	-	W
CEMR	1	yes	Vilnius	LT	LT00A	-	1	NE
Eurocities	2	yes	Warsaw	PL	PL127	PL129 PL12A	1	E
CoR	2	no	Aoste (Isere)	FR	FR714	-	2	W
Eurocities	2	no	Antwerp	BE	BE211	-	2	W
CoR	2	no	Athens	EL	EL300	-	1	S
Eurocities	2	no	Berlin	DE	DE300	DE405 DE406 DE408 DI	1	C
CoR	1	no	Birmingham	UK	UKG31	UKG32 UKG36 UKG37 I	2	W
Eurocities	2	no	Bristol	UK	UKK11	UKK12	2	W
Eurocities	2	no	Cardiff	UK	UKL22	UKL15 UKL16	2	W
CEMR	1	no	City of Vaxjo	SE	SE212	-	-	N
Eurocities	2	no	Cologne	DE	DEA23	DEA24 DEA27 DEA2B	2	C
CoR	2	no	Dublin	IE	IE021	IE022	1	W
Eurocities	1	no	Edinburgh	UK	UKM25	UKM23 UKM28	2	W
CEMR	2	no	Highland	UK	UKM61	-	-	W
CoR	1	no	Hradec Králové	CZ	CZ052	CZ053	2	C
CoR	2	no	Kladno (Praha)	CZ	CZ010	CZ020	1	C
CEMR	1	no	Klaipeda	LT	LT003	-	2	NE
CEMR	1	no	Kuldiga (Kurzeme)	LV	LV003	-	-	NE
CEMR	1	no	Liepaja (Kurzeme)	LV	LV003	-	-	NE
CoR	2	no	Lisbon	PT	PT171	PT172	1	S
CoR	2	no	Łubianka	PL	PL613	-	-	E
Eurocities	1	no	Malaga	ES	ES617	-	-	S
Eurocities	2	no	Malmö	SE	SE224	-	2	N
Eurocities	2	no	Manchester	UK	UKD31	UKD32	2	W
CoR	2	no	Mechelen	BE	BE212	-	-	W
Eurocities	1	no	Nuremberg	DE	DE254	DE252 DE253 DE255 DI	2	C
CoR	2	no	Opsterland	NL	NL123	-	-	W
Eurocities	2	no	Oslo	NO	NO011	NO012	1	N
CoR	2	no	Rakvere	EE	EE006	-	-	NE
CEMR	1	no	Resita (Caras-Severin)	RO	RO422	-	-	E
Eurocities	1	no	Riga	LV	LV006	LV007	1	NE
Eurocities	2	no	Rotterdam	NL	NL339	-	2	W
CoR	1	no	Santander	ES	ES130	-	3	S
CoR	2	no	Schiedam (Rotterdam)	NL	NL339	-	2	W
CEMR	2	no	Shetland Islands	UK	UKM66	-	-	W
CoR	2	no	Silale	LT	LT007	-	-	NE
CoR	2	no	Slovenska Bistrica (Maril)	SI	SI012	-	2	S
CoR	2	no	Torun	PL	PL613	-	-	E
Eurocities	2	no	Vienna	AT	AT130	AT112 AT125 AT126 A'	1	C
Eurocities	2	no	Vilnius	LT	LT00A	-	1	NE

Source: ESPON, November 2015