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STEER PROJECT
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 Theme Energy

D2.4 Guidelines for monitoring impacts

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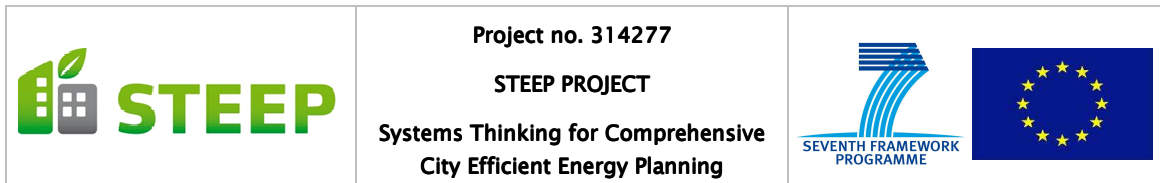
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PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
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CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. PURPOSE OF DELIVERABLE

The purpose of this deliverable is to provide a set of high-level guidelines which can be followed by any city or organisation wishing to monitor the success of a given intervention, specifically in the area of energy efficiency. This document must be considered alongside deliverable 2.3 ‘Guidelines for prioritising Interventions’, as a tool for the monitoring processes outlined below.

This document will revisit the modelling concepts that have been described in D2.1, and in particular, the notion of ‘process performance’ that has also been articulated in D2.3. The guidelines here will explain how to adopt a tripartite approach to monitoring interventions, combining the systems modelling approach, quantifiable KPIs and the use of data visualisation.

Throughout the document, examples from each of the three cities participating in STEEP (San Sebastián, Florence and Bristol) will be provided and will conclude by offering some ‘lessons learned’ regarding our experiences of monitoring interventions.

It is important to make clear, that this document explains how to monitor the effects and impact of interventions, rather than just the intervention itself. In the context of energy planning, the successful contribution of interventions toward a city’s strategic objectives (such as reduced carbon emissions) is what is crucial

2. MONITORING PROGRESS USING A ‘SYSTEMS THINKING’ APPROACH: ESTABLISHING A BASELINE

Consistent with the STEEP ‘systems thinking’ methodology, the primary method of monitoring the successful implementation of interventions is via a series of modelling workshops; specifically, the monitoring of the sub-processes identified therein and the performance rating that is given via what is known as the ‘Italian Flag’ notation. As explained in the Deliverable 2.3 this process is followed in Model Building Workshops by the attendees themselves, and we can consider these outcomes as a baseline against which to monitor chosen interventions.

In systems modelling workshops, stakeholders are required to disaggregate an overall objective into the sub-processes which are necessary to achieve this. The performance of these sub-processes is then rated by the individuals via the following process:

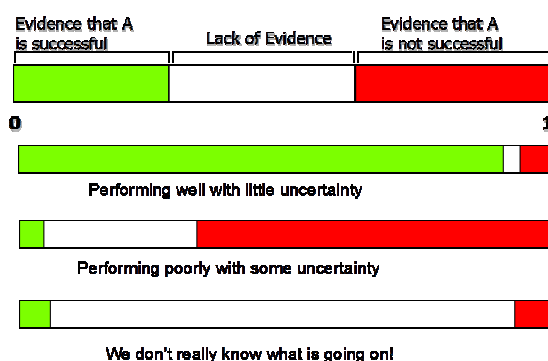


Figure 1. Explanation of ‘Italian Flag notation’ process performance – University of Bristol

The first step in monitoring interventions therefore, is utilization of the ‘Italian Flag’ performance assessment in stakeholder work-shops, to establish a baseline against which to assess future performance of interventions.

As the modelling is a dynamic and iterative rather than static process, the amount of green/red/white should alter following the implementation of the interventions and subsequent workshops to review the model. A preliminary form of monitoring is therefore the review of sub-processes and alteration of the levels of red, white and green. This provides a useful ‘visualization’ of how an intervention has made an impact upon the overall process.

It is also important to note that whilst this assessment is often a subjective judgment regarding ‘qualitative’ aspects, there will be certain processes which are quantifiable and to which specific numerical targets can be attached. For example, the following process model (taken from the second modelling session in Bristol) provided sufficient

detail to be able to generate ‘quantifiable options’ for the sub-process of ‘developing travel plans’:

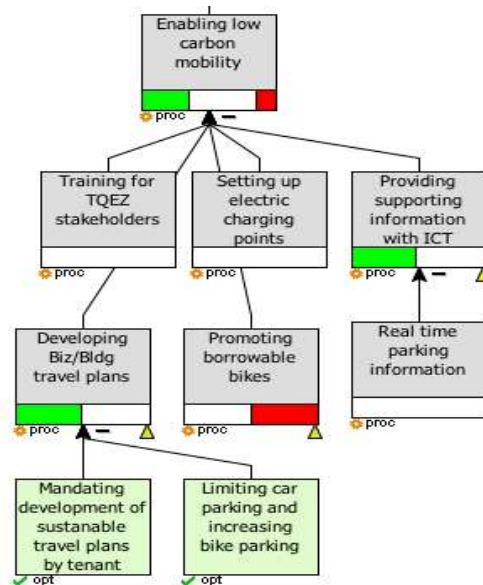
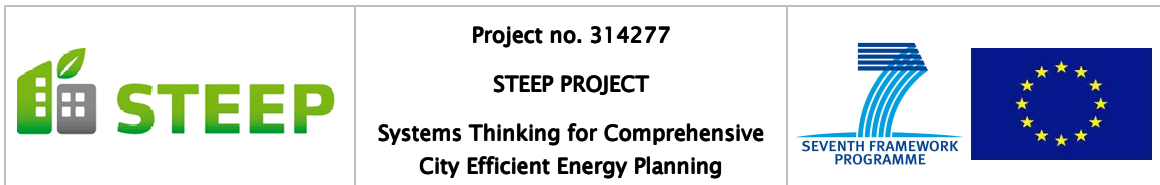


Figure 2. Example of quantifiable sub-process taken from Bristol workshop

By identifying the quantifiable solutions, (in this case ‘limiting car parking’), stakeholders involved in the workshop are able to provide a baseline performance rating. In this instance, specific figures regarding the number of parking spaces or number of cycle racks will set a quantifiable standard by which to rate the success of a process. The notations included in the hierarchical structure will reflect the ongoing progress of that specific aspect and the effect of the interventions taken, i.e. the amounts of green red and white will alter over time.

With this in mind (and when employing this form of monitoring), consideration must also be given to how often the model will be ‘revisited’ by those stakeholders that initially determined this baseline. With ‘quantifiable’ measures, monitoring using this technique is straightforward as anyone can identify progress once a baseline has been set, by referring back to the original amounts. This is not the case however for qualitative standards which are largely subjective and based upon the views of those specific individual who determined the baseline.

We recommend therefore that an essentially part of the monitoring process under the STEEP methodology, is ensuring that regular review meetings are held with the same group of stakeholders at regular intervals after the models have been developed. The number and frequency with which these review sessions are conducted should reflect the timescales attached to a particular intervention.



The initial performance of a particular sub-process can be reviewed by a number of individuals/ organizations in order to provide a wider variety of opinions and views and achieve greater objectivity. The issue with this however, is that in order to generate 'trend' data and form a consistent approach to performance, the same individuals must also be present during review sessions.

3. ESTABLISHING KEY PERFORMANCE INDICATORS (KPIs)

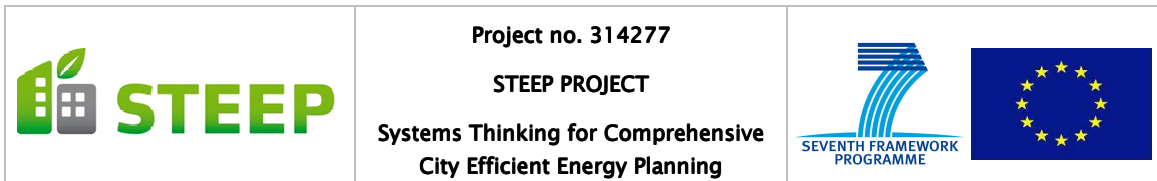
Key Performance Indicators (KPIs) are a set of quantifiable measures that are used to evaluate the success of a particular activity. These kinds of indicators have been largely used in projects to compare targets against initial objectives. Key performance indicators have been used in the monitoring phase of STEEP to measure both the improvement of the overall systems model, and to measure the improvement in each of the individual sub-processes that make up this model.

For all types of intervention, it is necessary to define specific indicators that will be used to evaluate their impact. For example, in the case of the STEEP masterplanning for Bristol's Temple Quarter Enterprise Zone, the overall objective was defined as the achievement of an operationally low-carbon district. In this instance, indicators would focus on measuring the carbon emissions related to the different components of the district. These components would include (but not be limited to) energy consumption of the buildings, transport emissions, industry and emissions related to the entire life cycle of the infrastructures involved. In this case the main key performance indicator would be the Global Warming Potential (GWP) in Kg equivalents of CO₂.

Depending on the scope of the objectives, the type of indicators selected will also need to be different. For example, where the main objective of the process is to obtain or 'design a low carbon district', the key performance indicators would relate to energy consumption e.g. *Primary Energy Consumed (KWh) in the operation phase*. In contrast, if we alter the objective to 'obtaining a low 'carbon life-cycle' energy district, the selected indicators for the monitoring phase will also change. In this instance, the indicator should be specific enough to measure not only the energy consumed and generated in the operation but should also consider indirect energy consumption in other stages of the life cycle of the materials used within the district. For example:

– *Primary Energy Consumption (MJ PE)*: This indicator would consider the embodied energy (the energy needed for raw material extraction, manufacturing, transport and the end of life management of each of the components used) of the infrastructure and components of the district as well as the primary energy needed for the operation of the district. Different types of intervention will require different targets and it is impossible to prescribe which indicators cities should use to monitor progress. Typically however, in the area of energy planning, targets are set using one or many of the following:

- % reduction in greenhouse gas emissions of district/city
- Reduction in energy consumption per m² of each building type (efficiency measures)



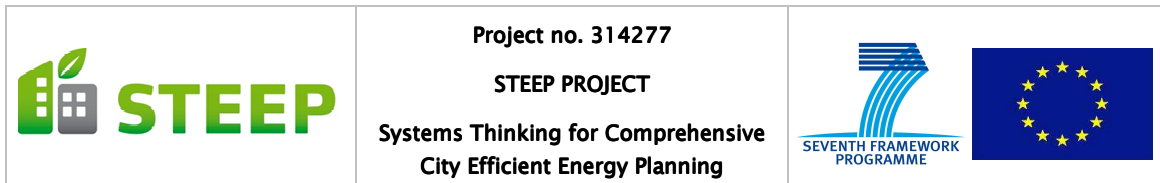
- Overall reduction in energy consumption in the district/city (sum of efficiency gains and renewable energy supply)
- m2 of new high performing eco-buildings constructed (with signed certificate)
- m2 of refurbished high performing eco-buildings (with signed certificate)
- MW of new renewable electricity generators installed (with signed certificate).
- MW of new renewable heat / cooling installed (with signed certificate).
- % increase in renewable electricity consumption of district/city
- % increase of renewable heat / cooling of district/city
- Quantitative data on RES and RUE policy implementation by local authority administrations in the community
- Quantitative data on householders with changed attitudes towards RES and RUE
- N° of companies involved in providing new solutions in the action plan
- Number and % reduction in Vehicle Kilometers of Travel (VKmT) per capita and by mode

Most of the indicators described here focus on the monitoring of the environmental impact of the interventions, which are necessarily quantitative. Within the STEEP methodology however, it is important to consider the qualitative aspects that need to be considered to achieve the overall objective. As a result of the stakeholder workshops in Bristol for example, there were a number of interventions identified that relate to the *behavioral* and *organizational* changes that need to be made to achieve the final objective.

The fact is that different type of indicators will be defined for each different type of process. For example it can be accepted that all the technological processes will use a certain type of key performance indicators, but other non-technological and general processes will use other indicators that will probably be very different in comparison.

In this sense and in order to overcome this difficulty, two main forms of monitoring could be proposed; the first would focus on the measurement of the improvement obtained due to the implementation of the interventions, interventions that are in more cases technological and with a direct impact. In this case the Key Performance Indicators can be used as explained before and the cumulative improvement measured for all these processes would be the result of the direct impact or improvement achieved by the plan.

But apart from the described traditional monitoring and in order to quantify the total impact of the plan, the influence of the other type of processes can also be considered, these processes that are necessary but that have an indirect and hardly measurable



impact. This is precisely the second part of the work of the monitoring. As said before these type of processes will have other type of key performance indicators with other units. For example for the process *“ensuring the buy-in of the different departments of the city council of the necessity of a carbon neutral district”* some possible indicators could be related to the amount of people of each department that agree with this initiative and after the implementation of the plan the evolution of this buy-in can be measured. These types of processes are necessary and valuable but these indicators cannot be directly added to other indicators used in other processes like the amount of CO₂ emissions avoided. That is why another method can be used to consider in the same time the impact of both types of processes, a method that is able to sum the impact monitored by the KPIs for the processes with direct and indirect impact.

Therefore, in some of the processes that are considered as initiatives to be implemented, specific key performance indicators can be defined and related to the color code of the Italian flag in a way that the improvement measured by the indicators can be translated in a change of the proportion of the colors (the performance improvement) of the process.

Different methods can be used to relate the key performance indicators to the Italian flag. One of the options could be implemented for example following the next general steps;

- The first step would be to relate the initial values of the key performance indicators to the initial values of the Italian flag. This would be done directly considering that the initial values of the Italian flag for each process are available after the model building workshops and that the initial values of the baseline situation can be directly calculated/measured by the different KPIs.
- The next step would be focused on defining the ideal values of both measurement methods, i.e. the ideal values for the KPIs for this specific process and the ideal value of the Italian flag for this specific process that would be completely green. Therefore, the ideal value of the KPIs of each process needs to be defined considering the specific objectives for this process, i.e. the final situation of this process that would be needed in order to ensure the consecution of the main objective of the top-level process.
- Finally, once that those two values have been defined the relation between the improvement in the KPIs and the change of the color code can be achieved using the relative improvement obtained in each of them.

4. USING DATA VISUALISATION

In the same way that data visualisation can help in the prioritisation of interventions, so too can it help in the monitoring process once these interventions have been made.

As outlined in deliverable D2.3, the STEEP project partners have developed an interactive engagement platform where datasets can be visualised using a 'geographical' mapping site. This provides an ideal opportunity to map data regarding the various KPIs identified above. For example, heat load and energy consumption of specific buildings on a given site can be mapped:

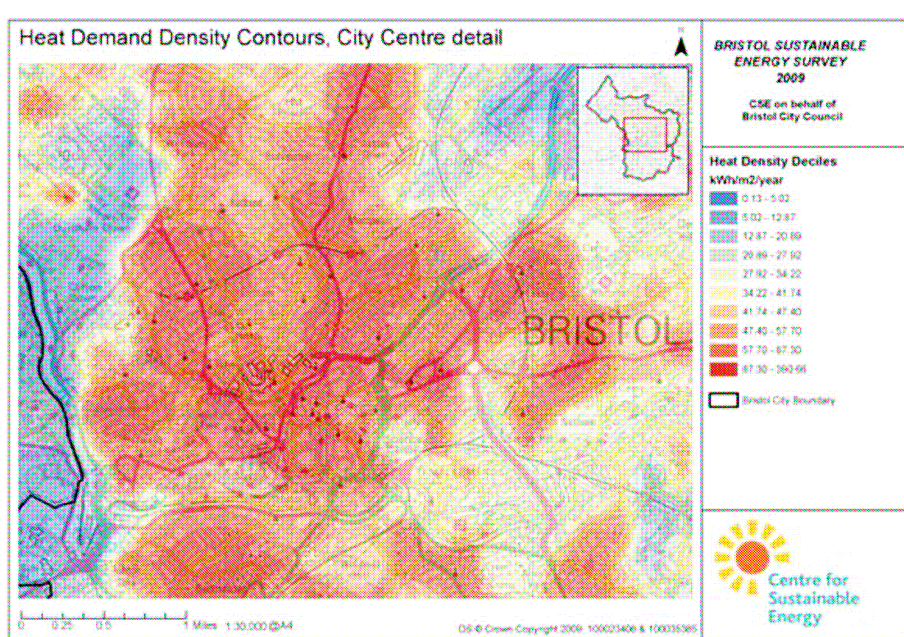
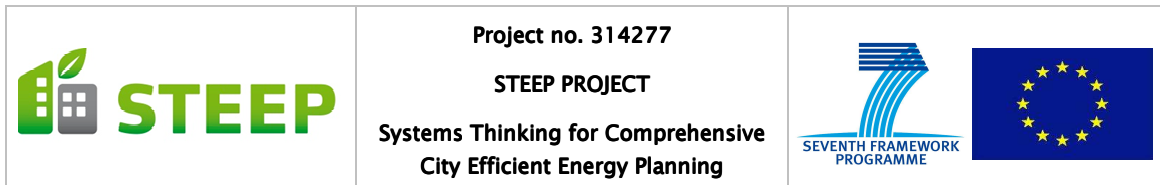


Figure 3. Heat and energy load for Bristol City centre – Sustainable energy survey

Visualisation of data in this sense not only provides a sound basis upon which to make judgements regarding appropriate interventions, it also provides an effective way of monitoring the progress of these.



5. EXPERT ASSURANCE

Another obvious method of monitoring progress of interventions is the use of an expert or ‘peer-review’ process. This process can be both a very simple method such as engaging with a variety of experts regarding the interventions which have been prioritised, or a large-scale review process using various city-level and European-level discussion fora.

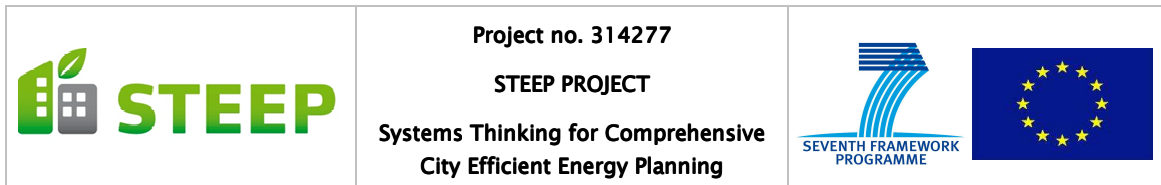
For example, as part of the STEEP project, the project methodology was shared on both the European Research Knowledge centre and the Smart City Stakeholder platform websites. Both of these represent a European-level dissemination platform, whereby interested cities and organisations can feed-back regarding project results. As such, it represents another way in which experts in the areas of energy, ICT and transport can monitor the effectiveness of the interventions suggested as part of the project.

6. STAKEHOLDER COLLABORATION AND PEER REVIEW

Intrinsic to the STEEP methodology is the notion of open-source data sharing and online collaboration. As previously mentioned, an online collaboration platform has been developed as part of the STEEP project website, whereby project stakeholders can access relevant GIS maps and provide feedback about the progress of the various interventions.

Full details of the platform can be found in deliverable D2.2, but there are three main ways in which the platform can be used to monitor interventions:

- i. The data that is shared on the platform can be utilised by third parties and other stakeholders to model scenarios based upon the effect of various interventions. For example, the ‘heat map’ above can be used to specify locations for potential district heating and/or cooling solutions. Published data can also be used by developers to build applications.
- ii. The platform is also designed to be an online communication tool whereby interested parties can discuss the data being presented and potential solutions. Feedback via this method will not only stimulate debate regarding potential solutions, but inter-alia provides assessment of the progress of implemented interventions.



- iii. Published data can also be used by developers to build ‘applications’ and potential providers of interventions can also use the platform to identify solutions which may be unknown to participants.

The STEEP project has used its collaboration platform in exactly this way, to combine the workshops defined in D2.1 alongside an open-source approach to data sharing to provide the maximum level of *transparency* for developing and monitoring interventions.

7. CONCLUSIONS

Taken together, a combination of ‘traditional’ monitoring techniques such as the establishment of KPIs and use of data with the STEEP systems’ modelling process provides an effective method for monitoring interventions. By definition, interventions will be context-specific and largely dependent upon the priorities of the organization who takes ownership of these. The techniques outlined here are not intended to provide an exhaustive approach but have been found to be an effective way of measuring and maintaining the progress of energy efficiency measures within the context of STEEP.

The various different methods for monitoring interventions above, each has positive and negative aspects and should be applied dependent upon the particular situation. What is important to reiterate is that both the interventions themselves and the methods used to monitor them should also focus on qualitative aspects such as behavioral and organizational change. Exploration of the barriers and issues that are encountered in any given problem situation, can provide a firm basis upon which to monitor success of interventions. The STEEP ‘systems thinking’ approach, which specifically focuses on stakeholder engagement is therefore more effective in monitoring interventions, as it consistently and continuously allows relevant parties to explore and re-design solutions; rather than the traditional or ‘standard’ approach which sets a static base-line against which the success of interventions is judged.