

## Theme 2: Common challenge in resource efficiency improvement

Energy efficiency and technology improvements on their own will not achieve the Low Carbon Societies (LCS) goals. Thus, resource efficiency and a circular economy are keys to a low carbon society. Resource efficiency improvement potential has been analysed from the industrial and territorial management perspectives. Exploring synergies between LCS and the larger area of sustainable development and green economy, highlighting co-benefits and trade-offs, is of utmost importance to pave the way to a more equitable and largely participated low carbon transition.

■ S. La Motta, M. Peronaci

### Background

The transition towards Low Carbon Societies must consider resource and energy efficiency as one of the main pillars to be successful: such a transition cannot be achieved by only reducing energy consumption and developing innovative solutions to improve energy systems.

Similarly, this transition will be very difficult –or even impossible– to achieve if any mitigation and adaptation action to respond to climate change is not seen in the general context of sustainable economic development.

In addition to that, if such components – the use of energy and natural resources, the need for mitigation and adaptation actions to respond to the challenges of climate change– are treated as a whole in a sustainable and equitable economic development perspective, this will create the necessary general consensus so that the population behavior could be modified accordingly.

Therefore also the efficiency of resources has become a priority for environmental and economic reasons as well.

Three are priority components to be considered when promoting strategies and policies to face resource efficiency improvement:

■ Contact person: Sergio La Motta  
sergio.lamotta@enea.it



- reduction of the natural resources used;
- improvement in the different sectorial uses of them;
- reuse and recovery of raw materials.

This can be achieved through a transition from a linear economy model to a circular economy model, in line with the strategies towards a green economy model.

Even though those issues must be analyzed holistically, a more schematic approach leads to consider two different sectors: the industrial one and the territorial one.

## Key findings

Three sets of key findings are identified. The following is a list of key findings, related to the main issues discussed in this section:

- The past great transformation has contributed to substantial economic development but also to substantial increase in resource intensity. A new transformation to a more sustainable social and economic system must be sought.
- A wide range of economically attractive low carbon measures are available and they could lead to significant reductions in energy use and carbon emissions. At the same time, transition to a circular urban economy cannot be realized within the current economic paradigm. A new transformation with a shift of main drivers is required.
- Building circular economy can synergize low carbon transition and resource efficiency improvement but there is no immediate solution to realize it. It is important to build momentum through implementing economically attractive low carbon saving options and encouraging transdisciplinary science to engender actual transformation.

The issues below are more specifically related to the industrial sector:

- Resource efficiency and circular economy are a key to low carbon societies.
- Energy efficiency and technologies improvements are not enough to achieve the goals for the LCS.
- Actual improvement for transition towards LCS can come from challenging and breakthrough modifications of the today's model of production and consumption.
- Strategies tailored to systems for the production of basic materials and materials in general.

The following issues are more specifically related to the territorial management:

- At city scale, it is difficult to transpose solutions from one city to another: local characteristics are very important (e.g. cultural heritage and tourism in Rome are a huge constraint), and lead to different policy opportunities, and GHG measurement choices (the choice of GHG accounting scope depends on the characteristics of cities).
- Bottom-up vs. top-down approach in urban climate policies design.
- There is the need to build pragmatic databases and tools, to harmonise protocols, and ease the accounting.
- There is the need for a combination of technical and social innovation.
- Are existing GHG reduction initiatives and policies sufficient enough, if generalized, to reduce GHG emissions? Or will we need new strategies?
- Changing behaviours and lifestyles.

- More consistency shall be given in transition processes between time (short, medium, long terms) and spatial scales (from individual to global level).

The past great transformations (e.g. industrial transition, mobility transition) have contributed to economic development but also to a substantial increase in resource intensity. Therefore, a new transformation to more sustainable social and economic system is now needed, with a shift of three drivers: from centralized control mechanism to distributed panarchy based on guidance and facilitation, from fossil fuels and exhaustible resources to renewable resources, and from linear system to circular system. The current sustainable development policies/targets focus on decreasing negative impacts and improving efficiency; instead, emerging alternatives are likely to create a radical shift to low-carbon and resource efficient society.

Both bottom-up social innovation and new kind of top-down mechanism are necessary to realize transformation. It is also important to prepare a phase-out strategy from fossil fuel and exhaustible-resource-based system.

With regard to resource efficiency improvement in the industrial sector, there is the need for new technologies, new management and business models, but also new tools with low-tech components, such as the industrial symbiosis, training of new, high-level professional skills, dissemination of BAT, etc. New updated control policies and legislations are also needed.

As to resource efficiency improvement in the territories management, the territorial component is also important as cities consume 75% of natural resource and 67-76% of energy, and urban population is rapidly increasing, particularly in developing countries. Even though the spatial definition of “Urban territories” varies from Country to Country, it is recognised that these areas are very complex systems, since almost all human activities are developed within them. The main sectors to be considered are: the environment, resource management (waste cycle, water cycle, etc.), economy, energy, logistics, mobility, social and cultural aspects, buildings. In addition, some other horizontal sectors must be considered as well, as the role of ICT, training, and public awareness.

The main actors involved in implementing any strategy/policy to manage such areas are central and local public Authorities, private industrial and tertiary sectors, public and private research institutions/bodies, financial institutions, citizens.

Another key factor in resource efficiency improvement is urban mining, i.e. the process of reclaiming compounds and elements from products, buildings and waste used in our cities; innovative technologies in this context must be implemented to recover primary/secondary materials as well.

This brings us to consider how important is, in an LCS strategy, the eco-innovation of systems, technologies and methodologies; in the light of this, it must be treated in a holistic “smart areas” perspective.

## Way forward

Exploring and reinforcing synergies between low carbon society goals and resource efficiency improvement in both the industrial territorial management perspectives can accelerate the dynamics involved in a Low Carbon transition. There is large scope for

the research community in exploring the opportunities that will arise in combining LCS together with the more general area of sustainable development and green economy, highlighting co-benefits and trade-offs.

There are several main strategies/actions that must be improved to facilitate a Low Carbon transition. Synthetically these are:

- The transition from a linear to a circular economic model must be sped up within over the short-medium term with appropriate strategies, innovative technologies, and methodologies and legislations.
- There is the need to invest financial resources to promote a local circular economy, also by implementing economically attractive carbon saving options; new carbon pricing strategies must be thought.
- There is the need to invest more on the human capital, promoting research and networks on innovation technologies and methodologies as well as creating new professional skills able to manage complex systems through a holistic approach.
- Sustainability cannot be achieved by simply improving efficiency: it requires a new transformation. For this purpose, transdisciplinary science must be promoted to create new realities, identify breakthrough points, mobilize and empower alternatives and disempower regimes in order to realize transformation.
- Enhance resource efficiency and circular economy with both B2C and B2B approaches.
- Boosting circular economy at the urban level, in connection with industries, through the systematic valorisation of urban mines with the actual involvement of each stakeholder along the value chain.
- Foster co-operation among all the stakeholders/actors potentially involved (central, local authorities/decision-makers, industries, public and private research institutions/bodies, financial institutions, citizens).
- Tailor any developed strategy/policy/action plan to the actual situation of each urban area being considered.
- Carry out ex-ante, ex-post analyses of each strategy/policy/action plan adopted, and eventually modify/adjust them.

**Sergio La Motta, Marcello Peronaci**

Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)