

# A green blueprint for a sustainable industrial policy

Guido Nelissen

## 1. Introduction

Our economies are embarking on a long phase of technological and industrial transition towards a decoupling of economic growth from environmental degradation and the use of fossil energy and exhaustible raw materials. The debt-fuelled and resource-wasting growth model has clearly proved to be unsustainable. The steep price increases in raw materials at every upturn of the economic cycle – in fact, market reactions to the growing awareness of long-term scarcities – societal demand for sustainable development and the challenge of climate change all show that the production and consumption modes of the twentieth century have reached their limits and that we have to move at full speed to a more sustainable growth model in which economic growth is decoupled from resource use. As industry is key in this transformation and industrial policy is the main instrument for shaping it actively, this chapter tries to define pathways to a low-carbon economy and to explore how industrial policy can be a catalyst in this process and how the traditional tools of industrial policy should be adapted in order to transform companies and sectors into more sustainable structures.

Section 1 provides an overview of the structural challenges industry is facing. This is followed by a description of the way industrial policy thinking has evolved over the years and how the EU has tried to redefine industrial policy within the framework of the open European market. Finally, we try to describe how the toolbox for industrial policy should be adapted and complemented in order to do justice to the urgent need to move to more sustainable modes of production and consumption.

## 2. The challenge of structural change

A strong manufacturing base is essential for sustained economic growth and stability in Europe. Furthermore a strong growth- and innovation-focused industrial policy is essential to European companies, workers and consumers in the context of economic instability and the challenges of sustainable development. Despite intense processes of de-industrialisation, industry still plays a major role in Europe's economy:

- Industry still represents a quarter of European GNP and employment (construction and energy included).
- Its productivity grew by 47 per cent over the period 1995–2007 against overall productivity growth of less than 20 per cent;
- Industry has managed to increase resource productivity (ratio GNP/material input) by 2.9 per cent per year (Wuppertal Institute 2007).
- Three-quarters of European exports are made up of industrial goods. Exports of goods increased by 4.7 per cent a year over the period 2000–2008, substantially faster than industrial production.
- Industry is a driver for the development of all kinds of services: each job in industry creates at least one extra job in business-related services (business-related services already provide 37 per cent of all private employment).
- Industry accounts for 80 per cent of all private R&D. Although many technologies support sustainable development, they still have to be transformed into affordable products and solutions to promote their uptake and diffusion.
- Last but not least, industry contributes to the (technological) solution of many social problems (environment, mobility, health care, better quality of life, attaining sustainable development objectives).

However, European industry is currently under pressure from a broad range of mutually reinforcing ('mega')-challenges:

- *New international division of labour*, characterised by fast-growing and emerging economies (BRIC), adds a new dimension to globalisation. These economies no longer only specialise in cheap labour but are gradually moving up the value chain. For example, China is catching up quickly in the new emerging green markets. It produces half of the global turnover in solar panels. Five years ago there was no Chinese company in the global top-ten producers of windmills. Today, this list already contains four Chinese producers.

- The *increasing speed of technological development and technology diffusion*, with the increasing presence of emerging economies in 'high-tech' sectors (supported by rapid advances in information and communication technologies). As a result, specialisation in high value-added products and production provides less and less of a shield against competition.
- The evolution towards a (global) *knowledge society*. As a consequence, innovation and research are taking over from physical capital and manual work as the driving force of growth and competitiveness.
- Population *ageing* raises specific challenges: new products and services to support the elderly, the challenge of active and healthy ageing, the increase in the average retirement age, the employability of older workers, skills shortages and so on.
- The emergence of a whole range of *enabling technologies*, such as biotechnology, nano-technologies and new materials that may bring about major changes in the organisation of production and new activities and create the basis for new industries, as well as transform existing ones.
- Rapidly falling communication and coordination costs have removed the need to perform manufacturing stages near to each other, thus facilitating the geographical dispersion of different production activities related to the same product. This is reflected in the *offshoring/relocation* of labour-intensive (and low-skilled) production stages and driven by the advances in digital technologies and virtually zero telecommunication costs. Global competition is no longer over products but over spatially unpacked production processes.
- Closely related to the previous point is the emergence of tightly interlinked – and geographically ever more dispersed – *value chains*. Previously integrated industrial operations have been split up into highly complex, smaller manufacturing and service packages which are globally redistributed. As a result, industrial sectors can no longer be treated as homogeneous, independent and national. Value chains are increasingly complex and intertwined, vertically segmented and cut across traditional sector-based categories and geographical boundaries. This has a number of consequences:
  - The increasing importance of networks of suppliers and innovation partners and the need for companies to move to strategic positions inside these supply chains.

- Company performance is increasingly dependent on the performance of upstream activities (not only for production operations but also for previously internal service functions).
- The growing importance of targeted policies directed towards specific elements within value chains or towards strengthening linkages and creating synergies within value chains. National industrial policy will be more and more oriented towards the support and development of these value chains, and strengthening of the position of home-companies inside these globalised company networks, rather than on general sectoral policies.
- The emergence of global value chains is facilitating the rapid integration of developing countries and former Communist countries into the global economy by the transfer of capital, technology and knowledge.
- The blurring of borders between industry and services, the so-called '*tertiarisation*' of industry (a term that reflects reality better than 'de-industrialisation'), is rendering traditional statistical classifications obsolete as tools for policy-making (since these make a clear difference between industry and services). A substantial component of the rising share of services in economic activity is attributable to the 'outsourcing' to specialised service providers of services activities previously undertaken within industry. Firms even switch from being manufacturers to re-inventing themselves as service providers. This may take the form of a total reorientation of business or be part of an unbundling of production processes (associated with processes of fragmentation, offshoring, vertical specialisation or splitting-up of the value chain) through which firms disinvest themselves of manufacturing production processes. Finally, many industries derive a significant part of their added value from the delivery of services that accompany the goods that they provide. Consequently, instead of addressing the issue of de-industrialisation, industrial policy has to adequately capture the close interlinkages between industry and services.
- A 20 per cent decline in industrial production (and a 10 per cent decline in employment) as a result of the *persistent financial crisis*, which meant the failure of the paradigm of financial market self-regulation. Since 2008, industry has been suffering from the most severe crisis in living memory. It should be clear that the financial sector must serve the real economy and not vice versa. Therefore, re-regulation and proper supervision are urgently needed to ensure

that financial markets promote rather than endanger the growth of the real economy (ETUC 2010). The financial crisis has also added to worries about the growth potential of the (Western) European economies as pre-crisis economic growth was apparently sustained only by debt-fuelled bubbles (the dotcom bubble burst in 2001 and the subprime bubble in 2008).

- *Climate change* and the *depletion of scarce resources* (with a surge in market prices as a result) are compelling industry to move towards low-carbon and resource-efficient production and products. Most analyses of the financial crisis overlook the fact that, prior to the subprime crisis in the United States, oil prices doubled while food prices rose by two-thirds (sparking public unrest in poorer nations).

The need to address the long list of structural challenges that industry is facing is at the heart of the rediscovery of industrial policy, mainly since the turn of the century when the bursting of the dotcom bubble acted as a kind of wake-up call to politicians (Gazier et al. 2010).

### 3. Industrial policy: an 'adaptable' concept

According to Pelkmans (2006: 2), 'There is a great deal of confusion about what industrial policy is, only surpassed by the confusion about what *European* industrial policy might be.'

Although industrial policy has for many decades been a controversial concept, a clear rationale for industrial policy does exist in economic theory. There is a broad consensus over the fact that state intervention has to correct for *market failures*, market barriers and externalities that hinder the emergence of well-functioning markets and the efficient allocation of scarce resources. Monopolies are a clear example of market failure. However, market failures also arise from the fact that individual firms do not have the capacity to invest in the public infrastructure (roads, schools, R&D) that they need in order to function properly.

*Market barriers* exist because of information gaps – for example, about the market potential for new products and the costs of new activities – and coordination problems (setting-up a new activity requires the creation of a new supply chain, which is beyond the capacity of an individual firm; standards have to be established in order to define products/markets). To lift market barriers or to correct for market failures, it is clear that

industrial policies are needed to regulate markets, to provide public infrastructure, to correct for information asymmetries and to support R&D, start-ups or projects with a long payback period (Aiginger and Sieber 2006).

Finally, *externalities* are costs and benefits that are not transmitted through prices. Pollution is the best known example of an external cost; exploiting someone else's invention can be considered a positive externality. Governments have to correct for these externalities by regulations and 'internalise' these costs and benefits, for example, by imposing taxes and subsidies, introducing intellectual property rights or requiring that polluters repair damages.

Although economic theory does not provide a generally accepted definition of industrial policy, we could say that industrial policy refers to all micro- and meso-economic instruments with a structural impact on companies – that is, that influence strategic decision-making – and on the regulatory framework in which they operate.

This definition does not mean that industrial policy is a static concept. On the contrary, industrial policy has evolved over the years from a very broad to a very narrow interpretation (Budzinski and Schmidt 2006). Although industrial policy lies at the origin of the European Union – European integration started in 1952 with the creation of the European Coal and Steel Community – its importance waned during the 1980s and 1990s. During this period, European decision-making was mainly directed towards:

- Restoring macroeconomic equilibrium in the EU (inflation, public deficits, monetary stability).
- The creation of a monetary union.
- The creation of a single market with free movement of capital, services and persons. Competition policy was central in the construction of the common market and industrial policy was considered incompatible with active national industrial policies (oriented towards providing state aid to companies and supporting the national industrial base, for example, by creating 'national champions'). National industrial policy was considered to be at odds with the creation of open markets, which required the dismantling of national barriers, subsidies and direct intervention.
- The belief that services and the 'new', ICT-based economy would take over wealth creation from industry, which would disappear

anyway in the long term, because of deindustrialisation. Industry and industrial policy were written off as belonging to the past. The contribution of industry to society was no longer valued at its true worth.

Furthermore, radical neoliberalism achieved dominance, aimed at eradicating state intervention in general and asserting that the best form of industrial policy was no industrial policy at all: it claimed that free markets and free competition are the best tools for modernising industry, remaining competitive and, finally, promoting economic growth.

On top of all this there were the bad experiences with the interventionist industrial policy of the post-war era: keeping afloat ‘sunset’ (or ‘chimney’) industries, which had to restructure and slim down anyway, was detrimental to public finances and did not contribute to their survival in the long term (Ecorys 2010).

To some extent, industrial policy became a dirty word and a concept belonging to the past, connected with industrial lobbying, state ownership and generally pouring money down the drain. Talking about industrial policy also became old-fashioned because it was seen to be in contradiction with the dynamics of free markets. As a result, traditional interventionist industrial policies were gradually phased out.

All this resulted in a clear tendency to limit the role of national industrial policy while an equivalent at European level did not yet exist. The toolkit for industrial policy shrank drastically. Subsidies to keep ailing companies and sectors artificially afloat, to support ‘national champions’ and to protect domestic markets, together with strategies of import substitution and public equity in strategic companies were no longer reconcilable with the rules of the Single Market. National interventionist industrial policies – the last wave of nationalisations in Europe occurred in 1982 under the presidency of François Mitterand in France – had to give way to the creation of favourable framework conditions in which companies can thrive. Industrial policy turned out to consist of policies for supporting entrepreneurs.

But faced with the bursting of the internet bubble in 2001 (which meant the collapse of the so-called ‘new’ economy) and the resulting continuous economic slowdown, many voices have been raised calling for a contemporary and more appropriate industrial policy dealing with the

important structural challenges that industry must face in the face of globalisation and the challenge of sustainable development.

Starting in 2001, the European Commission has issued six communications on industrial policy. This led to a gradual rediscovery of industrial policy in Europe and clearly showed renewed commitment on the part of the Commission – after two decades of silence – to protect and strengthen Europe's industrial base and to tackle the deep structural changes that confront industry. It resulted in a clear recognition of the role of industry as a motor for social, ecological and economic progress.

The wave of Communications on industrial policy must also be seen as new attempts to reconcile industrial policy with the requirements of the internal market and the challenges of worldwide competition. Over the years, a new and broader understanding of industrial policy has emerged. Across ideological boundaries there is now a broad consensus: industrial policy must be considered a policy process in support of strategic collaboration between the private and the public sector based mainly on soft tools – since 'hard' instruments, such as price controls, buy-national campaigns or non-tariff barriers are irreconcilable with the general policy frameworks of the EU – and which also includes environmental objectives and policies (sustainable development), energy objectives and policies (the European climate plan) and social objectives and policies (training, the social management of change, skill gaps and corporate social responsibility). The result is a modernised toolbox for industrial policy.

## **4. The updated industrial policies of the EU**

### 4.1 The building blocks of industrial policy

#### **Concept of industrial policy**

According to Pelkmans (2006), industrial policy tools in an open market economy can be interpreted in terms of four building blocks:

- (i) *Policies that affect industry* (but are not necessarily intended to meet industrial policy objectives). This concerns industrial policies not directed towards industry, but having a major impact on industrial strategies: macroeconomic policy (monetary and fiscal poli-

cies), income distribution and taxation, wage policies, industrial relations, land-use policies, price controls, general environmental policies, sustainable development, regional policy and energy security (for example, promotion of renewable energies).

- (ii) *Policies aimed at creating the right framework conditions.* This level concerns the basic conditions needed to enable companies to thrive: establishment of companies, efficient public services, liberalisation of services, regional economic policies, competition policies (state aid, subsidies), creation of an internal market, corporate taxation, company finance, environmental policy with direct economic impact, transport and logistics, energy supply for industry, development of skills and human capital, social management of restructuring
- (iii) *Horizontal industrial policies* concern general instruments to actively support industry: research and development, innovation, standardisation, promotion of entrepreneurship, promotion of risk capital, public procurement, trade policies, industrial infrastructure (industrial parks, incubation centres, re-development of brownfield sites and so on), impact assessment of new legislation.
- (iv) *Sectoral (or vertical) policies* are often considered to be the more interventionist part of industrial policy:
  - Strategic roadmaps and action plans for specific sectors. In the recent past the EU has developed action plans (often resulting from high level panels) for almost all key industrial sectors.
  - Strategic roadmaps and action plans for value chains. Sectoral policies are more and more being directed to strengthen linkages and create synergies between the elements making up value chains.
  - Strategic roadmaps and action plans for new technologies (technology platforms,<sup>1</sup> joint technology initiatives – see below).
  - Cross-cutting policies: ICT, defence, key enabling technologies, energy efficiency, energy-intensive sectors, space and so on.
  - Creation of lead markets (see below).
  - Actions promoting low-carbon industry (which have a strong sectoral dimension).

---

**1.** Technology platforms bring together the entire array of companies and research centres involved in a given technology in order to produce synergies and mutual inspiration. Such platforms may be the origin of new standards, ideas and products. Some examples: ERTRAC (transport), smart grids, manufacturing, steel, solar thermal, sustainable chemistry, hydrogen, photo voltaic cells.

Overall, the differences between 'framework' and 'horizontal' policy measures can often seem fluid. Horizontal measures can evidently have a very strong sectoral dimension. Policy areas such as energy, environment or trade contain elements from almost all the categories mentioned above. But although the distinction between the different categories is not always self-evident in specific cases, the classification nevertheless offers a clear conceptual framework for the debate on industrial policy.

### **EU industrial policy at present**

When discussing contemporary industrial policy, it should be clear that the hard core of the European Union is the internal market, which has a very strong legal underpinning and powerful institutional backing. As a result, a number of industrial policy tools are no longer compatible with European competition rules:

- central planning;
- support for national champions;
- 'buy national' campaigns;
- soft loans and debt rescheduling;
- trade protectionism (quota/tariffs);
- abuse of anti-dumping procedures;
- barriers to takeovers by foreign companies;
- golden shares (owned by governments to block company decisions);
- public equity which does not respect internal market rules;
- investment subsidies and support for ailing companies when not in line with European rules.

Although these direct forms of public intervention are ruled out, there remains room for governments to exert direct influence on economic decision-making. Public ownership of companies is still possible but on condition that governments behave as a private investor. Public investment funds (mainly with private support) and public support for risk capital financing are still widespread. The establishment of public–private partnerships has become common in the development of infrastructure. Furthermore, the European Commission recently created some new frameworks for public intervention, such as the joint technology initiatives, the creation of lead markets or rules for green/innovative public procurement. Finally, Europe also has a significant tradition of major industrial projects, such as Airbus, Galileo, Eurocopter, Ulcoss, Iter and so on.

## 4.2 The 'new' European vision of industrial policy

A new vision of 'modern' industrial policy has emerged from the various Communications on industrial policy. The main building blocks of this new European approach are as follows:

- The *strong emphasis on the knowledge society* through strong support for R&D and innovation: the 3% Barcelona objective, the creation of a European Research Area, the strongly increased budget for the Seventh Framework Programme, the creation of a European Institute of Innovation and Technology, innovation action plans, access to risk capital for innovative SMEs and so on.
- The *rediscovery of sectoral policies*, using existing horizontal instruments in a sector-tailored way (the so-called 'matrix-approach').
- *Promoting information and communications technology (ICT)* as an important driver of productivity and growth.
- Tackling the *demand-side of industrial policy*. The need to create innovation-friendly markets was the key recommendation of the Aho Report (named after the former prime minister of Finland who chaired the proceedings) in 2006 on the creation of an innovative Europe. It has led to the development of policies oriented towards lowering barriers to bring new products to the market: market introduction of new products, more dynamic standardisation as a tool to define markets and products, innovative public procurement, regulations/incentives to promote the uptake of new products, creation of lead markets and so on.
- Integration of a social dimension:
  - Recognition that industrial change needs to be counterbalanced by social policies to accompany this change: creation of the Globalisation Adjustment Fund, promotion of corporate social responsibility, active labour market policies for redundant workers, structural funds in support of managing industrial change.
  - Promotion of intangible assets and human capital: tackling skills gaps, promotion of social innovation, knowledge diffusion, lifelong learning.
- New forms of public intervention:
  - Joint technology initiatives: large-scale public–private partnerships in support of applied and industry-based research in breakthrough technologies such as nano-electronics, clean air

- transport, fuel cells, embedded computer systems, development of concepts for 'factories of the future',<sup>2</sup> green cars and so on.
- Development of lead markets. Lead markets aim to create markets for a given technology in a targeted way by creating conditions to facilitate the transformation of innovation into commercial products and services and by setting technological and regulatory standards, implementing a labelling system and applying procurement measures in order to foster market-friendly framework conditions.
- Support for green/innovative public procurement: public procurement represents 16 per cent of EU GNP but 'green potential', whereby environmental criteria are taken into account in the weighting of bidders, has been only marginally exploited.
- *Integration of the dimension of sustainable development* with a view to disconnecting economic growth from environmental degradation. The main aspects of this sustainable industrial policy are:
  - The development of eco-industries and eco-technologies, for example, by means of the Eco-technologies Action Plan or the Strategic Energy Technologies Plan.
  - Support for eco-efficient production and clean technologies in traditional sectors (for example, the EU Eco-Management and Audit Scheme).
  - Implementation of the objectives of the European climate plan: promotion of renewable energy and energy efficiency.
  - Integration of a global dimension: global sectoral aspects, emission trading, carbon leakage and so on.
  - Access to raw materials: recycling, substitution, countering monopolies in extraction and trade, fair trade agreements, R&D with regard to renewable raw materials and strategic partnerships to ensure supply.
  - Product policy: eco-design<sup>3</sup> and integrated product policy.
- Improved governance:
  - Establishment of the Competitiveness Council as a main political body resulting from the merger in 2002 of the existing councils on the internal market, industry and research.

---

2. Factories of the future: development and integration of enabling technologies for adaptable machines and industrial processes in order to deliver smart, networked, high performance and sustainable production systems.

3. Eco-design refers to (energy-) performance criteria to be met by producers.

- Impact assessments.
- 'Better regulation' strategies (legislative and regulatory simplification).
- Improved use of the Open Method of Coordination.

The European Commission no longer shies away from industrial policy. There clearly is a renewed commitment on the part of the Commission to protect and strengthen Europe's industrial base and to take into account the specific needs and characteristics of individual sectors. The result is a clear recognition of the role of industry as an engine for social, ecological and economic progress. This revival of industrial policy is also the result of the failure of neoliberalism and market liberalisation to address the structural challenges confronting industry. The creation of the internal market did not contribute to growth and jobs as expected, nor was it able to prevent the burst of the dotcom bubble in 2001 or the financial crisis of 2008. It gradually became clear that a more balanced economic strategy was needed, leading to a new, broader – but also softer and less ideological – redefinition of industrial policy, closely linked to sustainable development and social policies.

After years of neglect, there is now a commitment to focus on the needs of industry again. The industrial policy debate has resumed and European industrial policy is now high on the European political agenda. The next step is to look at how industrial policy can turn the challenge of sustainable development into a lever for stimulating the economy and the creation of new jobs (European Metalworkers Federation 2009).

## **5. A green revolution?**

In a speech delivered on 1 October 2007, José Manuel Barroso, President of the European Commission, declared 'I think we are now standing on the brink of a Third Industrial Revolution: the Low-carbon Age. Like the previous industrial revolutions, this will be driven by technology and new forms of energy. It will also transform our societies.' And in his State of the Union speech of January 2010, US President Barack Obama stated: 'The nation that leads the clean energy economy will be the nation that leads the global economy. And America must be that nation.'

Are we at the dawn of a new industrial revolution? Climate change and the depletion of oil reserves and other natural resources are changing

the energy and resource landscape of our economies. Resource efficiency has become imperative for economic development. This will have far-reaching consequences and will lead to a radical transformation of industry and society. At the same time, such a transformation presents opportunities for technical, social and political innovation/progress. The question, then, is how industrial policy, as the main tool for shaping production, can steer and foster this development.

Any 'industrial revolution' should be perceived as a radical and abrupt – but also long-lasting – change at all levels of society. Due to fundamental technological innovations in energy, a new balance is developing between the economy and the institutional framework. These industrial revolutions have to be differentiated from the 'long waves' described by Kondratieff and Schumpeter, as they refer to comparatively shorter cyclical fluctuations of growth rates, which are linked to a broad spectrum of fundamental innovations and are not restricted to the energy sector.

A description of this third industrial revolution in comparison to the first and second ones can be found in Jänicke and Jacob (2009).

Table 1 shows that we are now on the verge of an exciting transformation of the economy, with the changes in the main energy source as the driver for a complete overhaul of the economic system. Such shifts in the fuel basis of industry have always affected all economic sectors and all levels of society. The move to renewable energy (linked to a strong emphasis on energy efficiency) will entail a deep economic transformation. It will oblige the current economic sectors to develop sustainable structures. The dominant production models of the future will be based on innovation and knowledge rather than on cheap resources. At the same time, sustainable consumption patterns will gradually become dominant on the demand side. This development will be supported by regulations and market-based instruments (taxes, subsidies, feed-in tariffs and so on). The enormous social and financial implications of this transformation require broad societal acceptance and broad mobilisation of society. It will lead to a new institutional framework.

The first industrial revolution required respect for property rights, free trade, creation of markets and increased labour productivity through a far-reaching division of labour. All this increased pressure for the rule of law and political participation, hence the creation of a liberal state (*the 'liberal' revolution*).

Table 1 Overview of industrial revolutions

	1st Industrial Revolution (1780)	2nd Industrial Revolution (1890)	3rd Industrial Revolution (1990)
Dominant technology and raw material	Steam engine, power loom, iron processing	Electricity, chemistry, combustion engine, assembly line	ICT, microelectronics, new materials, eco-industries
Dominant energy source	Coal	Coal, oil	Renewable energies, energy efficiency, the WVEW (worldwide electricity web)
Raw material	Steel	Plastics	Renewable raw materials, biotech, recycling
Transport/communication	Railway, telegraph	Car, plane, radio, TV	High-speed railways, internet, mobile telecommunication
Dominant factor	Labour	Capital	Knowledge
Society/state	Liberal state, freedom of trade, constitutional state, property rights	Welfare state, mass production, mass society, social partners, parliamentary democracy	Civil society, globalisation, global governance, environmental state, demography
Core countries	Great Britain, Belgium, Germany, France	United States, Japan, Germany	EU, United States? China? Japan?

Source: Jänicke and Jacob (2009).

The second industrial revolution meant the transition to mass production. Mass production is possible only when matched by mass consumption – and thus mass income, income distribution and social standards were key to creating the necessary purchasing power. In turn, this led to the creation of the welfare state, with a key role for the social partners (*the 'social' revolution*). Besides unleashing an impressive potential for innovation, the third (or green) industrial revolution will again lead to a redefinition of our societal systems and structures. Deep technological changes will result in the fall of old structures and the creation of new structures and will also enter the broader societal context through changes in social norms, cultural values and institutional structures (system innovation). Just as the transition from an agricultural to an industrial society had a huge impact on societal institutions and structures, the transition to a society based on sustainable systems will completely overhaul our societies and ways of living. But the transition to a new paradigm is a complex process, characterised by fundamental changes in the functioning of our societies. Although blueprints do not exist, there

will be a clear evolution to an 'environmental' state which will include sustainable functions (supporting sustainable production and consumption). The term '*sustainable welfare state*' has been introduced to describe it (the term was even used in the draft Communication on the EU 2020 Strategy). Today, we are probably in the preliminary phase of this third or green industrial revolution, in which basic innovations are being developed and prepared for the market. This phase is characterised by unexpectedly strong growth of renewables and new, low-carbon or eco-efficient technologies.

With the transition to an eco-efficient economy, economic growth and sustainable development will become mutually reinforcing processes. By combining climate change policies with the development of sustainable production and consumption structures, new jobs, markets and activities will underpin economic growth. A big difference with the previous industrial revolutions is that the greatest benefits from greening the economy are public rather than private (a reduction in environmental externalities). As a consequence, individual private demand will not be the main driver of sustainable development as private willingness to pay for green innovations will be low. Policies to support investments in public goods will be just as important. Simple market mechanisms based on individual consumer preferences will therefore not be able to deliver the transformation required and the state must play a strong regulatory role for a targeted and structured process of change. As industrial policy is the main tool shaping production sectors (the supply side) of our societies, integrating a sustainability dimension into industrial policy will be crucial to the emergence of more sustainable industrial structures and thus the stimulation of green growth. A well-conceived and sustainable industrial policy has the potential to solve the deep-seated dilemma of economic growth: on the one hand, economic growth is unsustainable because of its ecological impact, while on the other hand growth (and consumption) has to be high enough to offset the rise in labour productivity because otherwise employment will fall. The scope of traditional industrial policy should therefore be extended in order to integrate the challenges of sustainable development, eco-efficient production, renewable energy, energy efficiency, climate change, the protection of natural resources, sustainable transport systems and resource scarcity (German Ministry of the Environment 2007). It is already clear that the transformation of traditional policy instruments for industrial policy has started, but much remains to be done.

## 6. Toolbox for a sustainable industrial policy

As global economic growth runs up against the limits of what the planet can sustain and a resource- and carbon-constrained world, the decoupling of rising living standards from natural resource use and environmental impacts (not only by a reduction of resource use in relation to GNP, but also by an absolute reduction in resource use) becomes most urgent. To this end, industrial policy has to switch from a merely defensive to a much more pro-active approach to environmental issues, looking for synergies between economic growth and environmental protection; transforming ecological challenges into economic opportunities; creating a virtuous circle between the development of eco-technologies/innovations and new environmental regulations; and engaging industry in a learning process geared to more environmentally responsible activities. This requires a strong regulatory role for the state, the mainstreaming of the objective of sustainable transformation into all relevant policies and the extension of the array of industrial policy tools.

For these reasons, a sustainable industrial policy should shift away from the narrow focus on competitiveness by:

- developing a strategic approach that goes beyond enhancing framework conditions and promotes life-cycle thinking and the need to close the ecological loop;
- implementing broader, socially accepted goals to solve societal problems as a starting point;
- supporting the development and diffusion of more eco-efficient technologies;
- fostering the development of the markets for sustainable technologies and products;
- adjusting industry to these upcoming sustainable markets and technologies;
- preparing industry for the increasing scarcity of energy and other resources; and
- promoting sustainable industrialisation in other parts of the world.

We shall now look again at the four building blocks of industrial policy to see how they can be adapted to the needs of sustainable development.

## 6.1 Policies not specifically directed towards industry but which affect it

Such policies do not have the promotion of industry as their main objective, but nevertheless have a huge impact on industrial development.

The shifting of the focus of economic growth to the sustainability dimension will put these policies in the centre of any industrial policy strategy.

- The need to develop *long- and medium-term policy frameworks/roadmaps* able to mobilise society for sustainable development objectives, for example, the EU Climate Package, action plans on energy efficiency, the production/use of renewable energy, the promotion of sustainable transport systems or programmes to promote sustainable production and consumption. Also, flagship initiatives such as Sustainable Cities (large demonstration projects based on the integration of sustainable transport, sustainable housing, waste recycling and renewable energy at city level) help to promote the values of sustainable development. Broad policy frameworks are a condition of pro-active policymaking and timely anticipation of change. However, it is essential that these broad policy frameworks are able to mobilise industry by means of:
  - an integrated approach: policy coordination between industrial policy and sustainability strategies (inclusion of departments of the environment, research, energy and employment in the development of a sustainable industrial policy);
  - balancing such issues as climate change, energy and resources with economic growth, jobs and industrial development: at the same time, being mindful of conflicts while capitalising on synergies and opportunities.
- *Development of ambitious and intelligent environmental regulations* (prohibition, minimum requirements and threshold values). Properly designed environmental legislation may trigger innovation, support the market uptake of new products and technologies, create competitive advantages and contribute to job creation (for example, energy certification schemes and building requirements in the construction sector, CO<sub>2</sub> rules for cars, energy-efficiency rules for domestic appliances, waste prevention, take-back obligations and so on). But better links are needed between the development of regulations and eco-innovation policy and better coordination of

national approaches. Lead times should be long enough for industry to adapt, while at the same time norms should be strengthened gradually in relation to technological progress.

- Tools for the *internalisation of external costs* to promote the uptake of sustainable technologies and products and to ensure the optimal allocation of limited resources (*market-based instruments*):
  - Taxes (including the introduction of carbon taxes) which fix a price for pollution and then allow the market to determine the level of pollution. Environmentally-related taxes can be broadly broken down into two categories: ‘polluter pays’ and ‘user pays’.
  - Cap-and-trade systems: as opposed to taxes tradable permit schemes first establish an overall permitted level of pollution and then let the open market determine the price. Emissions trading is a key element for a sustainable industrial policy as it provides an important lever for investments in renewable energy sources or in energy saving. At the same time, emissions trading may not jeopardise the existence of energy-intensive industries inside Europe (steel, non-ferrous, chemicals) because of the significant risk of carbon leakage. For these sectors corrective measures will be needed: free permits, introduction of genuine carbon traceability, a border adjustment tax.
  - Subsidies.
  - Tax credits.
  - Green certificates that can be traded in order to meet a quota obligation.
  - Feed-in tariffs: distributors must pay a set price to promote the development and deployment of renewable energy.

Market-based instruments use the price mechanism as a lever to steer behaviour in order to create adequate demand for green products and services. They help prices to ‘tell the ecological truth’ and create incentives to ‘do better’ (in contrast to regulations or standards where there is no reason for further improvement once the required levels are reached). Rather than prescribing a certain technology, they leave room for the development of new technological solutions and therefore they are more flexible than regulations. Today, eco-taxes compose only 7 per cent of total tax revenue in the EU against 48 per cent for taxes on consumption and 45 per cent for taxes on labour. This clearly shows the need to scale-up eco-taxes while reducing the tax burden on labour.

## 6.2 Creating the right framework conditions

Framework conditions mainly concern the need for the structured and socially acceptable management of change on a broad social basis and with a high level of social acceptance. Most important in this respect is the principle of ‘just transition’ (TUC 2008). Energy policy and the creation of appropriate governance structures for a sustainable industrial policy are also relevant.

- *Need to address the social dimension.* Economic and technological transition has in the past always led to social and economic progress. The global transition to a low-carbon economy, too, can become an engine for development and job creation. However, transitions also trigger economic turbulence and social hardship. Previous industrial revolutions have shown that breakthrough technologies can be a threat to workers. A strong social dimension to industrial policies is thus needed to ensure social cohesion. The restructuring of traditional industrial sectors into sustainable structures needs broad social acceptance and should not negatively affect welfare or workers’ livelihoods (a ‘just transition’). It would thus be wrong to focus the green jobs discussion on job creation only. It is also about job transformation (many existing jobs – plumbers, electricians, construction workers, metal or chemical workers – will be redefined as profiles are greened; this means new skills, working methods, job profiles, employment structures) and job destruction (resulting from the move from private to public transport, the dematerialisation of production and the reduction of packaging materials, longer product durability; as a result of environmental regulations leading to rising costs and thus to substitution, relocation or reduced demand). Moreover, newly created green jobs are not necessarily decent jobs (UNEP, ILO, IOE and ITUC 2008) as it means often the transition of employment from traditional, well-organised sectors with high quality jobs to new sectors without union representation and poor labour conditions (electronics recycling in Africa and China, exploited workers in biofuels plantations, the poorly organised solar industry in eastern Germany). The principle of ‘just transition’ points to the fact that accommodation to economic change cannot be left to market forces but must be embedded in the long tradition of social dialogue and solidarity in Europe. Without fair distribution of the costs and benefits, good social protection and active labour market policies, the transition to a low-carbon economy risks un-

dermining social cohesion and its credibility with broad sections of the population (European Metalworkers Federation 2009). Therefore, a well-designed sustainable industrial policy should integrate:

- the development of a common analysis/understanding of employment and economic trends;
- early social and employment impact assessments;
- active labour market policies: redeployment of workers, increasing workers' employability, social dialogue to secure employment, redevelopment of the economic fabric at regional level, and organising job transition in a secure and dynamic way;
- tools for managing restructuring in a socially respectable way have to be developed: by definition, the shift to a green economy entails economic restructuring and measures will be required to ensure a 'just transition' for affected workers; in this respect there is a need to:
  - (i) establish a European framework and concrete initiatives for socially responsible anticipation and management, including a framework for transnational collective bargaining;
  - (ii) extend the scope of the European Globalisation Fund to restructuring resulting from the move to a low-carbon economy (to be financed by a proportion of the income from the auctioning of emission permits or the introduction of a financial transaction tax);
- Timely anticipation of new skill needs. New skill sets will emerge in new economic activities with much more focus on maintenance, repair, the provision of technical solutions, computer-based control and measuring. More generally, there is a need to develop the new generic skill of 'green competency capacity' – learning to think green and to promote workers' qualifications related to low-carbon technologies.
- Promotion of social innovation strategies in order to facilitate behavioural and organisational change (required by the deployment of sustainable technologies).
- Preservation of the future of energy-intensive industries in Europe and avoiding firms relocating away from countries that are taking the lead in greening their economies.
- The possible negative impact on lower income groups and the risk of reverse income distribution: unlike income taxes, environmental taxes are not proportional to income, while subsidised green investments are implemented mainly by relatively wealthy income groups.

- Consultation and active participation of trade unions and NGOs at all levels in the design and monitoring of climate change policies.
- *Access to energy.* A sustainable energy policy must guarantee appropriate prices and security of supply, support low-carbon production (by steadily increasing the share of renewables and promoting energy efficiency) and promote the upgrade of energy networks to incorporate 'smart' grids that facilitate the integration of renewables and improve security of supply. Reinventing our energy system on a low-carbon model is one of the most critical challenges of the twenty-first century. It will take decades (and enormous investment) to adapt energy sources and networks to the challenges of a low-carbon economy. Nevertheless, the European Roadmap on Low Carbon Energy Technologies (European Commission 2011b) has set ambitious targets for renewable energy: in 2020, 20 per cent of EU electricity should be produced by wind energy technologies and 15 per cent by solar energy, sustainable bio-energy should have a market share of 14 per cent, while the electricity grid should be able to integrate 35 per cent renewable energies.
- Development of appropriate *governance structures* which are able to balance issues such as climate change, energy and resources with economic growth, jobs and welfare. They should make it possible to capitalise on synergies and opportunities, while at the same time being mindful of potential conflicts:
  - Need for an integrated approach that will ensure coordination between industrial policy and sustainability strategies (that means the inclusion of policies regarding the environment, research, energy and employment in the development of industrial policy).
  - Better policy coordination and cooperation inside the EU and between the EU, the member states and the regions.
  - An effective and transparent monitoring system with the involvement of all stakeholders. This would require the capacity to develop indicators, collect data and analyse and interpret results to guide policy development. Development of tools, structures and skills for ecological accounting (for example, the Global Reporting Initiative) are urgently needed.
  - Support capacity-building, training and education to seize green economic opportunities. The shift towards a green economy will require the strengthening of government/company capacities to analyse challenges, identify opportunities, priori-

tise interventions, mobilise resources, implement supporting policies and assess progress.

### 6.3 Horizontal industrial policies

- Specific *research programmes for environmental technologies*, such as the Strategic Energy Technology plan (SET)<sup>4</sup> and the Environmental Technologies Action Plan (ETAP).<sup>5</sup> Environmental R&D is often complex because it usually involves various scientific and technical disciplines (European Commission 2009). Therefore, eco-innovation should be supported by the development of strategic roadmaps for new technologies/activities, while including all related institutional and societal dimensions (as the markets for these technologies also need to be developed).
- To achieve the transformation to sustainable industrial structures, it will be necessary to *shape the demand side* (moving away from the throwaway consumption culture) by means of educational instruments to change behaviour and better identification of resource- and energy-efficient products (by means of labels and information campaigns). There is often a lack of demand from consumers because of a lack of knowledge about costs and benefits throughout the life-cycle or underdeveloped distribution channels. Shaping the demand-side also requires the development of new demand-side policies:
  - activating the public sector as an innovation-driving demand factor: *green/innovative public procurement* (public procurement represents 16 per cent of EU GNP, but the green potential has only been marginally exploited);
  - fostering the emerging low-carbon markets by creating *lead markets* which aim to lower barriers to bringing new products and services to the market by means of regulation, public procurement, standardisation and supporting activities.
- Need for a *life-cycle oriented environmental product policy* (integrated product policy) in order to encourage producers to design

---

4. SET is the main European industry policy tool to support the implementation of European energy policy and climate objectives.

5. The Environmental Technology Action Plan was launched in 2004 as an instrument to coordinate all programmes that promote eco-innovation, including the promotion of uptake (creation of incentives, regulations and removing non-technological barriers).

products bearing in mind the environmental impact throughout the life-cycle. An integrated product policy goes beyond the production phase and aims to improve environmental performance at each stage of the life-cycle of a product (design, raw materials, assembly, distribution and disposal). An integrated product policy is based on tools such as eco-labels, eco-design, substance bans, voluntary agreements between producers and governments and the introduction of ecological footprint labels.

- Setting *dynamic standards and benchmarks* (performance-based or based on the specific characteristics of a product) provides a strong market pull for eco-efficient innovation, technological development and promoting sustainable consumption. Also, sectoral benchmarking agreements on best available technologies between governments and businesses and codes of conduct/guidelines – often developed by trade associations or NGOs – can be very successful. In this respect, a little public pressure is often needed via the threat of mandatory regulations, technical assistance or subsidies. Companies that participate in these agreements can also take advantage of improved relations with stakeholders, cost reductions or first-mover advantages. Probably the main challenge here is to move to more dynamic standards whereby the best performance in a product category serves as a standard to be achieved by other producers. The Japanese ‘top-runner’ approach in which after a certain amount of time the most efficient products in each category define the standards for all manufacturers, shows that ambitious and innovation-promoting regulation for the development of specific improvements is possible.
- Boosting resource efficiency by
  - developing clear indicators for measuring the increase in resource productivity and as a basis for setting standards;
  - dissemination of best available technologies, promotion of resource efficiency networks and materials efficiency agencies;
  - development of renewable resources and improving recycling.
- Developing ‘sustainable factories of the future’<sup>6</sup> based on:
  - Sustainable production processes fuelled by societal demand for sustainable development, which creates a strong business

---

6. Factories of the Future is also one of the European Joint Technology Initiatives, (large public–private partnerships) and aims to shape, promote and support intelligent, sustainable and high quality manufacturing.

case for green products. Going green strengthens the 'license to operate' for businesses. Therefore strategic decision-making in companies should integrate the sustainability dimension as it will contribute to the long-term survival of any company. It should be clear that in the long run the best performing companies will not be those with the cheapest inputs or largest scale, but those that have the capacity to improve and innovate continually, based for instance on foresight into environmental challenges and future changes in attitudes and consumption patterns.

- Development of sustainable business models with greater emphasis on dematerialisation, remanufacturing (reconditioning and refurbishing of industrial products), 'zero-waste' closed-loop systems (in which the by-products of one factory become the feedstock of another), durability, upgrading of products, maintenance and repair (an almost abandoned function) and extension of products with services in order to extend the life-cycle of products (selling solutions instead of products).
  - Wide adoption of best environmental management practices: corporate social responsibility, company sustainability reports (to complement the annual financial reports), introduction of ISO14000 (the standard for environmental performance) or EMAS (the European Eco-Management and Audit Scheme).<sup>7</sup>
  - Human-centred work organisation (promoting autonomous, creative and responsible employees) with a major role for social innovation.
  - Development of eco-industrial parks and establishment of CO<sub>2</sub> neutral factories as a basis for the effective implementation of closed-loop manufacturing.
- Introducing a *global approach* to the challenges of sustainable development: creating global markets for trade in sustainable products, inclusion of social and ecological clauses in free trade agreements, micro-credits for sustainable solutions, global diffusion of sustainable technologies, global sectoral agreements to reduce greenhouse gases and making use of the flexible mechanisms in the Kyoto Protocol (which allow the acquisition of carbon credits by supporting specific emissions reduction projects in third countries).

---

7. EMAS is a voluntary eco-management and audit scheme to optimise production processes, promote more resource efficiency and reduce environmental impacts.

- The scale of financing required for a green economy transition is large but can be mobilised by smart public policy and *innovative financing mechanisms*. The European roadmap for moving to a competitive low-carbon economy in 2050, aiming to reduce greenhouse emissions by 80 per cent, requires further annual investment of around 1.5 per cent of EU GDP (European Commission 2011b). As public finances will not be sufficient, appropriate policy frameworks are needed to help leverage private financing and improve access to finance. Credit availability is still not back to normal and financial markets remain risk averse. However, although upfront costs can be high and pay-back time long, many green investments pay for themselves because of the energy savings made. In this respect the development of ESCOs (energy service companies that support their customers in increasing their energy efficiency and are paid with a share of the achieved savings) deserves particular attention. Even so, further development of venture capital is needed in order to support the financing of start-ups, growing firms and R&D. Other innovative financing solutions, such as micro-credits, green investment funds, project bonds, green loans (with payback in relation to the energy savings resulting from the investment) and private–public partnerships should also be developed. Furthermore, the European Investment Bank and the European Bank for Reconstruction and Development should play a role in providing additional financing. Finally, re-regulating financial markets should tackle the focus on short-term profits and support long-term investment strategies (European Climate Foundation 2010).

## 6.4 Vertical industrial policy

- *Industrial Action Plans to support the development of eco-industries* (currently in the EU some 3.5 million employees or 1.5 per cent of the total are employed in waste management, waste water treatment, eco-construction, renewables and energy efficiency) and *eco-technologies*: identifying barriers to expansion, creating a friendly regulatory environment, providing financial resources and diffusing *eco-technologies* in traditional industries (European Commission 2010). Europe's global leadership in many environmental technologies should be supported. Moreover, renewable energies and energy efficiency are the new growth markets with a large potential for job creation, for example, in the green makeover of buildings or the

development of energy efficiency services (European Commission 2011a).

- *Developing roadmaps for the transformation and ecological modernisation of traditional sectors* (often the key sectors that acted as drivers of the previous industrial revolution) to decrease carbon intensity, to improve resource efficiency and to move to renewable resources. Long-term sectoral industrial strategies and policies are needed in line with the EU roadmap for a low-carbon economy by 2050. Traditional industrial sectors and their employees may find themselves called into question due to the challenges of environmentally sound sustainable development and the related rise in energy and raw material prices and more demanding standards. Jobs will be lost (Syndex et al. 2007) in the:
  - electronics sector as a result of the shift from hardware to software;
  - telecoms sector as wireless networks replace fixed networks;
  - car sector as the electrical engine replaces the internal combustion engine;
  - petrochemicals sector because of the phasing-out of fossil fuels;
  - metals sector as secondary production (based on recycled materials) replaces primary production (based on ores).

There is also green potential in every economic sector that needs to be developed (Green European Foundation 2009). The supply chains of new industries, such as wind and solar power, largely consist of very traditional sectors, creating new opportunities for these sectors. Energy efficiency provides plenty of new ways of creating value in the sector of electrical installations and maintenance. Also the steel sector is permanently re-inventing itself. Thirty per cent of steel products offered today did not exist 10 years ago: surface treatment alloys, lightweight steel solutions, special steels (for example, for windmills), sustainable steel construction (longer life-time of buildings and better energy performance while using less steel). The shift from primary to secondary production in the non-ferrous industry is impressive: recycled scrap already represents 40 to 60 per cent of the European production of non-ferrous metals. The French consultant Syndex sees 670,000 new jobs emerging in the European machinery sector by 2020 thanks to the deployment of environmental technologies (Syndex 2009).

- Developing a strategy for the development and market uptake of *key enabling technologies* such as nanotechnology, micro- and na-

noelectronics, advanced and renewable materials and biotechnology. These technologies are at the forefront of managing the shift to a low-carbon, knowledge-based economy. The contribution of ICTs to the objectives of sustainable development can hardly be underestimated. ICT's already represent 25 per cent of all private R&D. ICTs are key in energy management, eco-monitoring, the dematerialisation of products, developing soft infrastructure/social capital (eHealth, eGovernment, eEducation), solid state lighting and intelligent transport systems/logistics.

## **7. Concluding remarks**

The transition to a sustainable economy is a serious challenge for trade unions. As the transformation to green jobs happens on the shop floor, it should be a trade union concern at all levels. Green jobs, whether in traditional or new production, should also be decent jobs with good health and safety and good working conditions. Moreover, many other jobs will be transformed or replaced. Therefore, the transition to sustainable production must happen in a real social dialogue with trade unions.

Human resource policies, company finances and health and safety all belong to the longstanding core competencies of trade union representatives. However, other dimensions of sustainable development (energy and resource efficiency, corporate social responsibility, the ecological footprint of products and production processes, the cradle-to-cradle principle) are all new areas which require trade unions to build up new competencies and to extend the scope of their actions. Otherwise, they will not be able to rise to the challenge of sustainable development. Greening social relations will require capacity-building, designation and training of 'green reps', the extension of the scope of health and safety policies to sustainability issues, human-centred sustainable work organisation and the integration of innovation and sustainability-strategies into the information and consultation-rights/procedures. As there are 'shades of green' in every economic activity this concerns almost all trade union representatives in industry.

Banking on a low-carbon and sustainable economy has enormous potential to create new green jobs (in almost all sectors of the economy). Indeed, green investments tend to be more employment-intensive so the net direct employment impact of the green transition will be positive.

The new jobs will largely offset the job losses in the 'brown economy'. According to the European Commission, the objectives of the European climate plan – 20 per cent renewables and an increase in energy efficiency of 20 per cent in Europe by 2020 – have the potential to create four million new jobs, most of them local in nature (European Commission 2006).

The EU has established itself as a leader in the mitigation of climate change as well as in managing other global environmental issues (Europe currently accounts for about one-third of the world market in environmental goods). The EU should be eager to retain this role. Europe has the technological basis, the human capital, the political and institutional environment and the societal values to actively shape the transition to a sustainable economy. There is no doubt that an active industrial policy, able to tackle the radical transformation industry and society are undergoing, will contribute to maintaining and developing world class industrial activities within Europe and will at the same time deliver on its social and environmental objectives. It should provide industry with the capacity to improve and innovate continually, based on foresight concerning environmental challenges and future changes in attitudes and consumption patterns. There is now substantial evidence that the global economy still has untapped opportunities to produce wealth using less material and energy resources. Many of the tools needed to seize these opportunities are already available, but they need to be fine-tuned and applied on a larger scale, in a more dynamic and better integrated way, not to mention with greater urgency. Europe is on track towards an eco-efficient economy, but the journey has barely begun and the continued pursuit is likely to give rise to many more challenges and the need for active public intervention.

## Bibliography

- Aiginger, K. and S. Sieber (2006) The matrix approach to industrial policy, *International Review of Applied Economics*, Vol. 20, No. 5 (December): 573-601.
- Budzinski, O. and C. Schmidt (2006) *European industrial policy: economic foundations, concepts and consequences*. Marburg.
- Ecorys (2010) *Towards sustainable industrial competitiveness policy*, Issues papers to EU Ministers of Industry Council. Brussels: Ministre de l'Economie, des PME, du Commerce extérieur et des Technologies nouvelles du Gouvernement Wallon.
- European Climate Foundation (2010) *Roadmap 2050: A practical guide to a prosperous low-carbon Europe*.
- European Commission (2006) *Study on eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU*. Brussels: Ernst & Young.
- European Commission (2009) Investing in the development of low carbon technologies (SET-Plan), COM (2009), 519 final.
- European Commission (2010) The impact of climate change policies on the employment situation, DG Internal Policies, IP/A/EMPL/NT/2010-02.
- European Commission (2011a) *European Competitiveness Report 2011*. Brussels.
- European Commission (2011b), A Roadmap for moving to a competitive low carbon economy in 2050, COM(2011-112/4), Brussels.
- European Metalworkers Federation (2009) *Manifesto for more and better industrial jobs*. Brussels, January.
- ETUC (2010) *Climate change, the new industrial policies and ways out of the crisis*, Brussels.
- Gazier B., D. Paucard and F. Bruggeman (2010) *European restructuring toolbox*, European Commission, July.
- German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2007) *Elements of a European Ecological Industrial Policy*. Working Paper, June.
- Green European Foundation (2009) *The European green collar economy*. Paper 1/2009, Brussels.
- Jänicke, M. and J. Klaus (2009) *A third industrial revolution? Solutions to the crisis of resource-intensive growth*, Berlin. Available at: [http://www.polsoz.fu-berlin.de/polwiss/forschung/systeme/ffu/publikationen/2009/jaenicke\\_martin\\_jacob\\_klaus\\_2009/index.html](http://www.polsoz.fu-berlin.de/polwiss/forschung/systeme/ffu/publikationen/2009/jaenicke_martin_jacob_klaus_2009/index.html)

- Öko-Institut (2010) *Sustainable industrial policy for Europe: governing the green industrial revolution*. Brussels: Heinrich Böll Stiftung, Green European Foundation.
- Pelkmans, J. (2006) *European industrial policy*, Bruges European Economic Policy Briefings No. 15, July.
- Syndex, SDA, Wuppertal Institute and ISTAS (2007) *Climate change and employment: Impact on employment of climate change and CO2 emission reduction measures in the EU-25 to 2030*. Brussels: ETUC.
- Syndex (2009) *Climate disturbances, the new industrial policies and ways out of the crisis*, Brussels: ETUC
- TUC (2008) *A green and fair future. For a just transition to a low carbon economy*. London: Touchstone Pamphlet 3.
- UNEP, ILO, IOE, ITUC (2008) *Green jobs: towards decent work in a sustainable, low-carbon world*. Nairobi.
- Wuppertal Institute (2007) *The relation between resource productivity and competitiveness*.