

From Beast to Beauty? Ecological industry policy in North Rhine-Westphalia

Northrhine-Westphalia (NRW) is the largest land of the Federal Republic of Germany. Until the 1970ies the Ruhr-area with a population of about 12 million people and a strong coal, steel and chemical industry had been plagued with severe pollution. In the 1970ies environmental protection had emerged on the international and national policy agendas. The federal and regional government launched massive legislative and economic public interventions for cleaning-up rivers, soils and air. As a result, a highly competitive eco-industry emerged. The article outlines main features of eco-industries, the structural change of the Ruhr area and regional economic cluster policies in support of eco-industries in NRW. It draws conclusions for eco-industry policy developing from end-of-pipe towards integrated preventive approaches.

Ipar Renania-Westfalia (NRW) Alemaniako Errepublikako Federaleko estatu federal (land) handiena da. 1970eko hamarkadara arte, Rin-Ruhr eskualdeak, 12 milioi biztanle inguru eta kimika-, ikatz- eta al-tzairu-industria sendoa zituela, kutsadura-arazo larriak izan zituen. Hirurogeita hamarreko hamar-kadan, ingurumenaren babesa agertu zen nazioko eta nazioarteko agenda politikoetan. Gobernu federalek eta estatuko gobernuak hainbat lege eta ekonomia mailako hainbat esku-hartze abiarazi zituzten ibaiak, lurzoruak eta airea garbitzeko. Ondorioz, ekoindustria oso lehiakorra sortu zen. Artikulu honetan ekoindustrien ezaugarriak laburbildu dira, eta Ruhr eskualdearen egitura-aldaketa deskribatu da. Halaber, mesomailan oinarrituta eta energia-kudeaketaren eta hondakinen udal-kudeaketaren adibideak erabiltuta, Ipar Renania-Westfalian ekoindustriak laguntzen dituzten clusterren eskualdeko politika ekonomikoen indargune eta ahulguneak nabarmendu dira.

Renania del Norte-Westfalia (NRW) es el mayor estado federal (land) de la República Federal de Alemania. Hasta la década de 1970, la región del Rin-Ruhr, con una población de unos 12 millones de habitantes y una potente industria química, del carbón y del acero, se vio afectada por graves problemas de contaminación. En los años setenta, la protección medioambiental apareció en las agendas políticas nacionales e internacionales. Los gobiernos federales y el estatal lanzaron múltiples intervenciones legislativas y económicas para limpiar ríos, suelos y aire. Como resultado, surgió una ecoindustria muy competitiva. En este artículo, se resumen las características de las eco-industrias y se describe el cambio estructural de la región del Ruhr. Asimismo, centrándose en el mesonivel y empleando los ejemplos de la gestión energética y la gestión municipal de residuos, se destacan los puntos fuertes y los puntos débiles de las políticas económicas regionales de clústeres que apoyan las ecoindustrias en NRW.

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1. INTRODUCTION

In literature the Beauty and the Beast are contrasting characters. At first sight they are fascinating because they seem to have nothing in common, but what if

a beast turns into a beauty? Such a metamorphosis happened in the Ruhr area in North-Rhine Westphalia. The Ruhr area started as a heavily polluted, beastly industrial conglomerate and turned into a region with a strong eco-industry and many tourist attractions. For the year 2010 it has become the European Capital of Culture. Presently, the Ruhr area might not be a Beauty like in the fairy tales, but it has definitely become much more attractive and livable than some 50 years ago.

With a population of some 7.3 million people the Ruhr area is the largest urban agglomeration in Germany and the fourth largest in Europe after Moscow, London and Paris. The area consists of several large cities, such as Essen, Duisburg and Dortmund. Together with the cities of the Rhineland, like Cologne and Düsseldorf, the highly industrialized Rhine-Ruhr metropolitan area has a population of more than 12 million people.

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During their industrialization in the 19th and early 20th century the cities of the Ruhr area merged into a large complex with a vast industrial landscape. Since the 1960s the region has undergone a massive structural change affecting its economic, social, and natural environment.

Formerly known mainly for mining and heavy industry, the Ruhr area is now considered to be one of the world's most successfully restructured industrial regions and yet it remains rooted in its past, which can be studied along the so-called Industrial Heritage Trail. The ca. 400 km circular route around the Ruhr area connects 25 industrial sites, which make up the core network of the trail, including museums of technical and social history, panorama points and a series of typical workers' settlements. The Ruhr area has thus retained its characteristic regional identity while developing new economic development perspectives.

In the early 1960s living in the Ruhr-area was dangerous due to the heavy pollution of air, water and soil (Brüggemeier and Rommelspacher 1992). Ratios of leukemia, cancer, rickets and pathogenic changes of blood counts were above average. On some streets the smog reduced the range of sight at night to five to ten meters. During the winter smog of 1962 mortality rates rose significantly.

Today, heavy industrial pollution is considered to be a sign of backwardness and/or bad governance, but from the 19th century until the 1960s it was a symbol of power, industrial dynamics, modernity and wealth. Early witnesses of industrialization like Engels and Marx criticize the negative alteration of the environment, but like in most parts of the world it was seen in Germany as the inevitable price of progress.

Even when industrial processes obviously reduced the life span of workers (e.g. in coal mining) people endured it with a stiff upper lip and acceptance, which is today hardly comprehensible.

As the poet Friedrich Hölderlin wrote in his famous Patmos poem "But where danger is deliverance also grows". At a time when production increases drove pollution to intolerable levels, the Ruhr area became the cradle of modern environmental policy in Germany. In 1961 the former Federal Chancellor Willy Brand used during the federal electoral campaign the slogan and promise: "Blue skies above the Ruhr". It marked the beginning of a change of consciousness in industrial societies and a new broader concept of progress. Until then the traditional symbol of progress was smoking chimneys, but Brandt's slogan turned awareness away from the production plant towards a new emerging item on the political agenda: the human environment.

This shift of consciousness during the 1960s and 1970s came at a time when the Ruhr area had to face a crisis which resulted in a profound structural change of the economy of the federal state of North Rhine-Westphalia (NRW).

2. STRUCTURAL CHANGE IN NRW

North Rhine-Westphalia (NRW) is situated in the Western part of Germany sharing borders with Belgium and the Netherlands. It has over 18 million inhabitants and generates about a quarter of Germany's gross domestic product. In terms of population size and economic output the westernmost federal state of Germany (*land*) is comparable to Australia

and thus larger than most EU Member States. Due to the large scale of the region, conclusions might not only be relevant for regional policy but also for national industry policies.

1946 the British military government established the state North Rhine-Westphalia. Thus, there had been no grown historical development of a North Rhine-Westphalian regional identity before that time. In contrast, the regional identity of the Ruhr-area was relatively well preserved after World War II. This is still present today, although the Ruhr-area emerged only since the 19th century as a highly populated area, which is compared to other German regional identities a relatively recent. The high self-esteem of the Ruhr-area is well founded on its valuable natural resources (ores, water power, coal), which were the source of wealth and industrial as well as military power of the emerging German Reich. After two lost World Wars the Ruhr area's resources remained to be a secure physical foundation of Germany's economic growth and social stability.

During the beginning of the 1960s the economic competitiveness of the Ruhr coal sector declined, ten years later the crisis in Ruhr steel sector began. The substitution of labor by capital was the logical consequence. During the 1970ies the supply with labor increased compared to the supply with capital and natural resources. Today the original relations of the productive factors are reversed. The descendants of work force, which immigrated to the Ruhr area during the 19th and 20th century are facing in the former industrial quarters of NRW a supply of coal and steel which has run scarce or which can no longer be processed and sold economically on the world market.

The imbalance of human and natural resources makes it increasingly difficult to establish a new social equilibrium. A new wave of immigration made this even more difficult. During the second half of the 20th century the federal and regional government stimulated worker immigration, primarily from southern-Europe and Turkey. This was another factor which increased social instability in addition to the rapidly growing labor-productivity and the resulting pressure on the overall employment situation. Within 40 years the number of workers in the coal sector decreased from 450,000 to below 60,000, in the steel manufacturing sector from 230,000 to about 70,000. The average unemployment rate in the Ruhr-area has now reached levels of about one third above the national average.

In the face of a structural crisis, national and regional political decision-makers reacted by launching large structural adjustment programs, which had to overcome inertia and resilience from conservative social networks within the state, which wanted to retain the established industrial structures. The programs started with a time lag of about a decade at the end of the 1960s. Starting in 1968 billions of Euros (Deutschmarks at that time) had been invested in order to buffer negative impacts of structural change and to lay the foundation for new positive developments. According to FES (1999) money was dedicated primarily to two areas:

- On the one hand, development and modernization of infrastructure. Today NRW has a dense network of streets, highways and railways. It has the largest inland port (Duisburg), two international airports (Cologne/Bonn and Düsseldorf),

a well functioning supply and disposal of materials, 14 universities with around 160,000 students, 20 technology centres as well as 13 research and development centres. The federal and regional government set up various institutes and research institutions (e.g. Max-Planck, Fraunhofer institutes and a regional Science Center) as well as public-private-partnership-research institutions.

- On the other hand, the government invested in programs to compensate social change and disruptions. Social support schemes were primarily directed towards economic sectors which had lost competitiveness, like the underground mining of coal or steel processing. In Germany, the billions of non-productive subsidies for decaying industries in the Ruhr-area were subject to considerable political debate. Other regions with similar problems offered alternative policy responses without comparable social supportive measures. In many of these places population has shrunk considerably, for instance Pittsburgh, USA, a former stronghold of the steel industry has seen much migration since the 1970s and whole districts of England and Wales have broken down. In NRW these market-liberal policies had never been an option. A general consensus in society would not have allowed the economic and social decay of the Ruhr-area with its 8 million inhabitants.

Retrospectively, the NRW structural policies appear to be ambiguous: After decline of heavy industries based on the extraction and processing of natural

resources (coal and steel) the government tried to cope with structural change by turning towards the only resources left in abundance: human resources. The federal and regional government invested systematically in research and education which raised the level of education and improved innovation capacities in industry. As there was a large supply of capital and human resources, this had been a consistent answer to the challenge of a changing competitive environment, but the ecological dimension was neglected. A competitive industry emerged based on technical innovation. In physical terms this meant increased productivity by replacing humans with machines. Consumption of natural resources and use of man-made capital for the manufacturing industry increased on the expense of the large labor force. The perception of environmental protection had been limited to reactive end-of-pipe approaches and did not yet result in structural policies which would actively improve resource efficiency of the regional economy.

3. ECO-INDUSTRIES IN NRW

Environmental end-of-pipe thinking remained dominant in the Ruhr-area for more than 30 years. Willy Brand's programmatic slogan: "Blue skies above the Ruhr" was implemented by the federal government in collaboration with the regional government of North-Rhine Westphalia. Strict environmental legislation was passed and large investments in environmental clean-up technologies were made. Thus, NRW invested in the health of its population and their environment, and became a first mover on the way towards an environmental goods and

service industry. Today, eco-industries have become a large and highly competitive pillar of the NRW economy (Nordhause-Janz and Rehfeld, 1995). Nevertheless, it is difficult to collect empirical evidence on its regional economic value.

A general problem with assessing the size of the environmental technology and service industry is that economic data is not collected systematically, as it is not an industrial production sector in itself, but a cross-sectoral industry. Another problem is the “integration paradox” (Schepelmann 2005): When environmental protection and resource management are integrated into management and manufacturing, they become part of the mainstream cost management of a company and thus not counted as environmental investment. For example, is a fuel efficient car or power plant an environmental good? Is a management that allows cost reductions based material and energy savings an environmental service or simply good cost management? Thus, we may assume that the share of environmental technology and service industries is usually the more underrated in official economic statistics the better it is mainstreamed and integrated in planning and production.

The NRW statistics and different research projects have not solved the “integration paradox”, but they give a conservative impression of the size of the eco-industries in the region. For example, in the late 1990ies the Ministry of Employment commissioned a study to assess the size of the sector in NRW (KNI, 1998). According to the research based on a survey among more than 1200 companies more than 117.000 people had been employed in the eco-industries in NRW in 1996 which is equivalent to about 2% of the total

employment. With a total turnover of more than 22 billion EUR the sector invested about 2,5 billion EUR.

The KNI data can be set in relation to an Ecotec (2002) assessment of the turnover and employment in of eco-industries in the European Union. Although both studies use different methodologies in different base years it gives an indication of the importance of NRW eco-industries in the EU. A relation of the NRW data of 1996 and the EU data of 1999 would result in a calculated share of NRW in both turnover and employment of 13%. NRW where 4,8% of the EU population lived had thus a proportionally much larger share of eco-industries. In relation to the overall employment in NRW the “green” share had been 2,4% while Ecotec (2002) estimates the EU average share of green employment to be at about 1,3%.

In 2006 around 25% of the German green industry was based in NRW. Some sectors were very strongly represented, e.g. the water sector (more than 40%) or clean air (30%). According to estimates of Rehfeld and Schepelmann (2007) the eco-industries in NRW had a turnover of 1.8 billion euros. About 50% of this turnover was generated in the water treatment industry. All in all an export volume of 459 million euros was realized in 2004. The direct employment was estimated at 183,000 jobs, which was approximately 2.2% of the total employment in NRW.

In summary, eco-industries have met with rather favorable conditions in NRW:

- High pressure on health and environment (water, air, soils) originating from a high density of polluting industries (steel, coal, chemical industry).

- A rapidly expanding environmental awareness and public discourse during the 1960ies and 1970ies.
- Since the beginning of the environmental discourse a consistent social-democratic government, later a series of coalitions between the social democrats and the green party with largely influential leaders responsible for environmental policy.
- A high turnover of eco-industries.
- A high share of eco-industries in the overall employment.

4. MESO-POLICIES IN NRW

Only a few studies describe environmental goods and service industries in NRW as whole. In spite of the economic success of the sector, appropriate regional policies are still in their infancy. Nevertheless, lessons can be learned by looking at the meso-level of selected eco-industries, because meso-policies are a decisive level of a successful multi-level ecological industry policy.

“Meso-Policy is the total of policies, which are directed at a managing structural change and its consequences” (Meyer-Stamer, 2000; p. 1 own translation). It is characterized by

- Negotiations between the government with non-governmental social actors.
- Institutions which are able to formulate and implement meso-policies.

While scope of macro-economic policies in the European Union is increasingly diminished by globalization of the economies and trade agreements as well as more and more harmonization within

the Economic and Monetary Union, meso-policies are still quite unhampered by external policy developments (Esser *et al.*, 1996).

The function of public meso-policies is the compensation of market failure and promotion of economic development. It is a crucial part of multi-level governance characterized by a cross-sectoral approach involving a number of public and private stakeholders. On the meso-level policy networks define the relationship between controlled and controlling agents. Esser *et al.* (1996) define the development of the meso landscape primarily as an organisation and steering problem. The self-organization of meso systems determines to a large extent the chances of success for implementing target-oriented economic development policies (structural policy). It is primarily the meso systems (policy networks) which allow or inhibit political control of economic developments within the scope of regional policy.

4.1. Detection and documentation of meso-policies

Meso-political developments are usually not described in standard scientific literature. Therefore other media have to be used for analyzing informal and formal meso-policies. In NRW the internet has proven to be an ideal carrier of relevant meso-political information.

The central function of meso policies is networking and assisting the formation of governmental and non-governmental actors into functional differentiated systems (policy networks). The different regional ministries and subordinated agencies provide a large variety of internet portals for public

relations, information exchange and the formation of networks. In NRW these had been connected to regional initiatives (so-called Landesinitiativen). Recently, these have been reduced and concentrated into 16 so-called cluster-initiatives:

1. Automotive.
2. Biotechnology.
3. Chemicals.
4. Energy Research.
5. Energy Industry.
6. Agri-Food Business.
7. Healthcare Industry.
8. Information and Communication Technologies.
9. Cultural and Creative Sector.
10. Plastics.
11. Logistics.
12. Mechanical Engineering/Production Technology.
13. Media.
14. Medical Research.
15. Nano/Micro+Materials.
16. Environmental Technologies.

While typical scientific literature gives no systematic overview of environmental meso policies in NRW, the internet allows a close monitoring of the meso landscape. Before the knowledge-based society used the internet as a vehicle of dissemination and networking it would have been necessary to arrange specific interviews with governmental and non-governmental stakeholders and to screen "grey literature" (information brochures, leaflets, working papers etc.). This time-consuming and usually slow and incomplete methodology can more or less be substituted by creative internet research. Nevertheless, some of the results presented in this article have been validated by means of expert interviews. It did not appear that the use of the internet

resulted in a distorted perception. The internet not only carries information, but also filters information, as it only allows the discovery of information which is actively put there. The following analysis was made worked under the assumption that governmental meso-policies which cannot be found on the internet are not relevant, because they have not made use of one of the most important networking mediums. Thus, these initiatives would not fulfill their characteristic networking function and therefore have little significance.

The information available on the internet is constantly updated, this has the disadvantage that it is very volatile. For instance, during research some of the information used in this article disappeared and was substituted by other content. The limited stability of the research results seem to be in proportion to the fuzziness of the object of study. Meso-policies are generally a complex, adaptive trial-and-error process which is often influenced by spontaneous political developments, elections and other socio-economic changes. The following sections will display the state of meso-policies in two strategic eco-industrial sectors with high regional relevance: energy and waste management. The results presented in this article are based on broader systematic research performed by Schepelmann (2005) and are only meant to give a general impression of the trends and problems associated with environmental meso-policies in NRW.

4.2. Energy efficiency and renewables policies

The NRW ministry of economy claims in its climate strategy that NRW is "energy-

oriented like no other region in Europe” (MWMEV, 2001; p. 16). Almost 30% of the German energy production is based in NRW. More than 80% of the NRW electricity production is based on lignite and pit coal.

Consequently, an extraordinarily dense meso-structure is based in NRW *“with a network of technology centres with transfer facilities to industry, economy and trade. The perception of energy technologies as technologies of the future is therefore a distinctive feature of the innovation profile, which is characterized by an adaptive energy policy. The technological and industrial aspect of energy policy in NRW is manifested among others by an increasing number of enterprises, which develop innovative technologies and components and services for innovative energy transformation and use”* (MWMEV, 2001; p. 17).

The rich meso structures of NRW continuously produce options for energy policy, which are selected, implemented and evaluated in market-related activities, for example:

- The so-called land initiative “NRW future energies” (Landesinitiative Zukunftsenergien NRW).
- Energy-related research and technological development.
- The programme “rational use of energy and regenerative energy sources” (REN-Programme, now: progres.nrw).
- The energy agency NRW.
- Energy-related programmes of the consumer protection agency NRW.
- The efficiency agency NRW.

- The action programme 2000plus “municipal framework energy in NRW”, the initiatives Communal Label, KommEN.
- The campaign “Climate protection in private households and offices”.
- The agreement with the housing sector “coalition for climate protection”.
- The power plant modernization programme NRW.
- The market place for absorption heat pumps NRW.
- The stakeholder network “fuel cells”.

Often, these measures support research and technological development (RTD), consultancy, consumer relations, marketing and classical industry policy. Typically, RTD and consultancy is coupled with stakeholder networks. The initiatives cannot be portrayed in detail. Therefore, only a few highlights, which are mutually supportive, will be mentioned in order to illustrate the meso-policies in NRW which support sustainable energy production and services.

In 1987 the NRW government established the programme “The Rational Use of Energy and Use of Renewabl Energy Sources” (Rationelle Energieverwendung und Nutzung unerschöpflicher Energiequellen, REN). Since 1996 it is named progres.nrw¹. The programme has an annual budget of about 50 million EUR. Since its creation more than 51,000 projects have been funded with about 640 million EUR. Private investments in combination with the programme’s cofinancing amount to

¹ <http://www.progres.nrw.de>.

a total investment in sustainable energy structures of about 3.2 billion EUR. The objective of the programme is to tap the industrial and technological potentials which are offered by a rational use of energy and renewable energies. This objective is met in cooperation with stakeholders from industry, science and public administrations. The programme consists of a bundle of legislative measures, consulting and financial support actions. Activities include support for research, development and technological demonstration as well as the removal of administrative hurdles. These activities are accompanied by public awareness campaigns. In the framework of the campaign “energy consultancy 2000+”, for example, different chapters of the consumer agency NRW offered energy consultancy services on the rational use of energy to consumers.

In 1996 the “NRW State Initiative on Future Energies” (Landesinitiative Zukunftsenergien NRW) was created primarily with financial support from the REN-programme. The initiative was supported by different ministries. The activities ranged from applied research (supported by the Ministry for Education, Science and Research), technological development and demonstration (Ministry for the Economy, Energy and Transport) to introduction to the market (Ministry for Urban Construction and Living, Culture and Sports as well as the Ministry for Environment and Nature Protection, Agriculture and Consumer Protection). The initiative was a strategic platform for future energies, but also a forum for consultation, a framework for action as well as a clearing house for information, contacts and cooperation. The land’s initiative was meant to accelerate innovation in NRW

by mediating cooperation and strategic alliances as well as the introduction of new technologies, products and services nationally and internationally. The initiative tried to target the entire NRW meso landscape.

More than 3,000 stakeholders from research, government, industries and NGOs were coordinated in 17 working groups:

1. export and trade;
2. building and construction;
3. biomass;
4. solar thermal technology;
5. absorption heat pumps;
6. sectoral energy concepts;
7. fuel cells;
8. energy-related services;
9. firedamp;
10. water energy;
11. hydrogen power;
12. cogeneration;
13. energy storage;
14. photovoltaics;
15. geothermal energy;
16. wind energy;
17. power plant technology.

Particularly innovative or significant projects were further developed into so-called “lead projects”. These had to have technological or economic advantages as well as benefits in terms of energy savings, climate or environmental protection. Additional criteria were developed for the building and construction sector.

Lead projects according to these terms were, for example, solar cell production sites, solar-powered settlements, wind energy plants, fuel cell cars or the use of waste heat.

The activities of the NRW State Initiative on Future Energies were accompanied

by public relation activities. An annual conference of the land initiative displayed the latest technological developments and the progress of the working groups. The land initiative was also represented at national and international fairs. Public relations were additionally supported by a NRW atlas for future energies with a corresponding database and magazine.

In 1990 the Ministry of Economy created the Energy Agency NRW². The agency is the central governmental networking agent and information centre actively promoting and brokering help for improving energy efficiency and the increasing the use of renewables. The target group is primarily small and medium sized enterprises. Furthermore, the agency informs municipalities, engineers, architects, craftsmen, NGOs, churches, parties and other associations. For industries and municipalities the agency is the focal point for all questions related to energy contracting.

Since 2007 the NRW Energy Agency and the NRW State Initiative on Future Energies have merged in the “EnergyAgency.NRW”. This has created a central meso-political platform with competencies ranging from research funding, technical development, demonstration and market introduction to energy consultancy and training. The “EnergyAgency.NRW” organizes innovation networks and strategic alliances. It provides energy consultancy services, contracting solutions for companies and administrations, as well as information and continuous training services for experts and the general public. The agency offers technology platform for research, industry in the focal areas:

- Energy Efficiency and Renewable Energies for Companies and Local Authorities.
- Energy-Efficient and Solar Construction.
- Innovative Power Plants.
- Biomass.
- Fuels and Drive Systems of the Future.
- Fuel Cells and Hydrogen.
- Solar Energy.

In addition to technological platforms, consultancy and training the agency is also engaged in information campaigns directed at the general public, such as the “Wood Pellets Action” (www.aktion-holzpellets.de) or the “NRW Heat Pump Marketplace” (www.waermepumpen-marktplatz-nrw.de) and other information activities by means of information brochures, market guides, radio publicity, internet portals, and a hotline.

4.3. Municipal waste policies

Municipal waste policies in NRW shed light on the considerable difficulties of governing material flows and waste streams. The management of municipal waste is to a large degree under the responsibility of the NRW municipalities. The NRW government’s responsibility is primarily restricted to monitoring municipal waste streams and their disposal by public and private companies. Although turnover and employment in this sector is considerable, the NRW government does not apply meso-policies comparable to the energy sector.

Altogether the structure of the waste sector is rather opaque, it is in a process of economic concentration and characterized

² <http://www.ea-nrw.de>.

by diverging interests. There is no “land initiative waste” which could contribute to higher transparency. Scientific literature on the development and governance of the waste sector in NRW is scarce; nevertheless web-based research has led to quite interesting results^{3, 4}.

According to the German constitution, the legislative competence on waste management is on the federal level. By issuing the circular economy legislation (Kreislaufwirtschaftsgesetz) the federal government shifted the emphasis of waste legislation from deposition towards recycling. The legislation had an impact on consumption and production patterns in Germany as recycling quotas, e.g. for glass, aluminum and paper, rose significantly. The federal legislation was complemented by legislation on the state (*länder*) level. Since 1999 NRW has new waste legislation that regulates the responsibility of public waste management, especially in municipalities.

Also on the EU level there is development of relevant legislation, e.g. in the area of electronic wastes or end-of-life vehicles. The Thematic Strategies on the Prevention and Recycling of Waste and the Sustainable Use of Natural Resources indicate an increasing importance of prevention. However, growing recycling and waste incineration capacities could contradict waste prevention. This can happen if companies develop a commercial interest in using or treating (increasing) volumes of waste. In North Rhine Westphalia this seems to be the case. In addition to this strategic contradiction there have been a number of cases of fraud and corruption,

which indicate a lack of governance in the waste sector of NRW.

In 2002 the federal association for secondary raw materials and waste management (BVSE) published a press release which used clear language on the state of waste management in NRW. The BVSE organises about 600 SMEs in the waste sector with an overall turnover of about 10 billion EUR and about 50,000 employees. In a press statement the BVSE president, Hans Jürgen Cieron, contradicted a statement of NRW Prime Minister Wolfgang Clement after the detention of a number of the Prime Minister’s social democratic party colleagues in the context of municipal fraud scandal. Clement said in a TV interview that he regarded criminal actions in NRW as being common practice in the waste sector. Cieron replied that increasing familiarity between municipal policy-makers and business would foster corruption. Informal networks would grow at the expense of BVSE’s SME constituency and the tax payer. Already in an earlier press release issued two weeks earlier he had stated that no other regional government in Germany would mix public with private interests as much as the NRW government.

After a number of scandals the NRW government set up the task force “anti-corruption” for shedding light on the waste business in NRW. After a short period the final report of the task force was removed from the internet, due to legal pressure from the accused. The final report explains (Untersuchungsstab Antikorrupption, 2003; p. 17, own translation):

In recent years the situation of the waste sector has changed considerably. At the beginning of the 1990s a national state of emergency related to waste treatment

³ <http://www.bvse.de/home.html>.

⁴ <http://www.nrw-luawebapps.de/aida>.

was expected. Nowadays, significant over-capacities need to be acknowledged. Next to decreasing waste volumes the circular economy legislation is responsible. The changing conditions of waste legislation have contributed to a new situation; new structures for final disposal and responsibility have emerged. Until then, a public waste sector based on public interest had been protected with monopoly rights. Suddenly and for the first time in their history they were confronted with market competition and the resulting need for cost reductions.

According to the task force this changing situation gave rise to non-transparent public-private structures. With the aim of governing these structures municipal representatives were delegated into the controlling bodies of these new public-private companies, but according to the task force (*ibid*, p. 31):

The lack of technical understanding of the municipal representatives was in stark contrast to the know-how of their private counterparts.

After a while municipal waste management in NRW got out of control. Eventually, private interests partly dominated public interests, especially during preparations of tender procedures (*ibid*, p. 43):

The revision of waste treatment during the 80s and beginning of the 90s required new concepts of waste incineration, re-use and disposal for meeting the political objectives of the municipalities. Since the necessary technical know-how was often not available in their administration, the municipalities adopted waste treatment concepts of their private counterparts. This created dependencies among administrations and political decision-makers, which raised significant doubts concerning their neutral position.

The report of the task force indicated insufficient capacities for governing

municipal waste streams in NRW. Especially on the municipal level there seemed to be a lack of necessary knowledge and governing approaches among elected and official representatives.

5. NRW ECO-INDUSTRIES IN A NATIONAL AND GLOBAL CONTEXT

The cases of NRW meso-policies on energy and waste management show two extremes of eco-industrial meso-policies. On the one hand, we can find a sophisticated scheme to organize stakeholder participation, research, technological and market development with the objectives of increasing energy efficiency and the use of renewable energy sources. This does not necessarily indicate that energy policy in NRW as a whole is more sustainable than in other regions, but in terms of target-oriented eco-innovation it probably represents an example for “best practice”.

On the other hand, the case of municipal waste management in NRW is an example of worst practice, as it rather shows the absence and even subversion of governance. Also in this case, it does not necessarily indicate that waste policies NRW are less sustainable than in other regions; recent developments in other European municipalities for example in the Italian city of Naples have shown that the state of waste management can indeed be worse. It shows the political risks that are connected to the lack of governance in relation to eco-industries as they often affect capital-intensive and strategic functions. In relation to steering eco-innovation the subversion of governance by corruption seems to be a problem which is not sufficiently described,

but nevertheless pertinent. The insufficient contextualization of corruption in public private relations also seems to be the case for governance literature in general.

In order to assess the economic importance of governing waste-management and energy efficiency as well as renewable policy in NRW they need to be seen in the context of national strategies for eco-innovation in Germany, as the world's leading supplier of environmental technology and services. As shown above, North Rhine-Westphalia and the Ruhr area play a central role in the history of the German ecological industry policy. Thus, NRW eco-industries should also be put in context of recent and future developments of national and global green markets.

According to recent assessments of the German Federal Ministry of Environment (BMU, 2009) the German environmental industry is booming and will continue to grow. 40% of all companies in the industry were able to realize an annual growth rate of 10% between 2004 and 2006. More than 5% of German industrial production consists of environmental goods and services. From 2005 to 2007 the production of the overall eco-industry grew by 27% in total. The strong development of the environmental industry in Germany also had an influence on the labour market. Eco-industries registered an average increase of 15% in labour forces between 2004 and 2006. Between the years 2004 and 2006 the sector generated 300,000 additional jobs. In 2006 4.5% of all German employees were working in the environmental goods and service industries, which amounts to almost 1.8 million people.

Today, Germany has a 16% share of the global trade of environmental goods and

is gaining importance in global markets. Surveys performed among companies in the German eco-industry sector showed that a high growth rate in turnover is expected in the coming years, especially in renewable energies and renewable resources. According to the survey of the consultancy company Roland Berger (Berger, 2008) it is expected that in the medium term (2030) the environmental industry will overturn the traditional drivers of German economic growth, such as machine and vehicle construction. According to Berger (2008) sustainable energy production, energy efficiency, resource and material efficiency and circular materials management (Kreislaufwirtschaft) will be strategically decisive lead markets for eco-innovation.

With sophisticated meso-policies aiming at efficient energy use and renewables NRW seems to be well positioned in relation to the first two strategic fields identified by Berger. Also for improving resource- and material efficiency the region has exemplary meso-policy instruments. For resource and materials efficiency of SME's NRW can build on more than 10 years of experience. The regional Efficiency Agency of North Rhine-Westphalia (*Effizienz-Agentur NRW*, EFA) is providing effective and differentiated consultancy services. It has established a number of tools to improve production, products, materials cost accounting as well as financing of efficiency measures in companies. This complements activities on the national level where the German Material Efficiency Agency (*Deutsche Material Effizienz Agentur*, DEMA) provides two basic programs. First, the NeMat program, which supports the networking of companies in order to strengthen their competitive position based

on cooperative improvement of material efficiency. Second, the VerMat program, which supports the improvement of the performance of companies by broking a pool of consultants. Yet, the measures only affect a small number of companies and are not developed to a degree that can significantly change production patterns.

In relation to the strategic competence of circular materials management the region has considerable problems in the waste management of municipalities. Large incineration capacities and insufficient governance structures will contribute to uphold a structural interest in a high throughput of materials. Waste and water treatment are the largest markets for environmental technologies and services. Some of the leading national players of these sectors are based in NRW.

As long as end-of-pipe thinking prevails on the global market for environmental goods and services, these sectors will still be well positioned and competitive. Nevertheless, a fundamental shift towards more integrated and precautionary approaches is likely. This will also be a challenge for traditional eco-industries. In waste management, for example, the European Commission's Thematic Strategies on the Prevention and Recycling of Waste as well as on Sustainable Management of Natural Resources in combination with the planned EU Eco-Innovation Action Plan indicate first steps in the direction of dematerialization, resource efficiency and the prevention of waste. Emerging systemic approaches of Eco-Innovation (EU), Sustainable Materials Management (US) and Circular Economy (China) have the potential of radically changing the demand for the environmental goods and service industry.

6. THE NRW ENVIRONMENTAL TECHNOLOGY CLUSTER

For further promoting eco-industries the NRW government has created an environmental technology cluster coordination. The cluster coordination (Umwelttechnologien.NRW) works under the auspices of North Rhine-Westphalia's Ministry for the Environment and Conservation, Agriculture and Consumer Protection. The cluster coordination wants to support technological innovation, create an identity of the sector and improve international market conditions for environmental technologies from NRW in the following areas:

- Water and waste water.
- Waste disposal.
- Clean air.
- Soil decontamination.
- Measurement and control technology.
- Environmentally friendly products.
- Resource efficiency.

For increasing innovativeness of the sectors the cluster management wants to promote technologies by initiating project partnerships between research, companies and investors. It offers a platform and database for more than 3,500 companies in NRW and events aimed at specific target groups. Furthermore the cluster wants to support projects for promoting and marketing of the NRW environmental technology cluster. Energy research and energy technology are each organized by their own cluster management. Also other environmental relevant sectors such as the automotive and chemicals industry have their own separated cluster management. Thus, the environmental

technology cluster only represents a faction of the NRW environmental goods and service industry. In the light of the large public interest in climate protection this is an obvious inconsistency of the NRW environmental technology cluster concept, which can only be explained with different political competences of the ministry for environment and the ministry responsible for energy policy. It remains to be seen how the NRW government will deal with cross-sectoral and cross-cluster industrial activities. Especially cross-sectoral energy and materials management is a major challenge for industry policy in general, which cannot be tackled by isolated sectoral and political approaches.

7. SUMMARY AND CONCLUSIONS

NRW is in a state of transition from a region with heavy industry and extreme environmental pollution towards a region of structural change with a dynamic and competitive eco-industry. During the second half of the 20th century there was an early and broad consensus in the German society that living conditions in the Ruhr area had been intolerable and that investments in cleaning-up the environment had to be made. Ambitious political objectives ("Blue skies above the Ruhr area") in combination with binding legal requirements for pollution control have fostered technological development of end-of-pipe solutions.

The political insight and action came at a time when the Ruhr area was in the process of structural change. The dwindling of heavy industries (coal and steel) put less pressure on the environment and offered the opportunity to develop a modern and green profile of North-Rhine Westphalia.

Although the environmental goods and service industry has become a driving-force of growth and employment in NRW, it is still difficult to monitor the industry. On the one hand, the NRW government barely publishes records about the development of one of its most dynamic industries. On the other hand, defining eco-industries is still difficult because it represents also a cross-sectoral industry, which is statistically more hidden, the better it is integrated into mainstream economic development ("integration paradox").

In the absence of updated published regional statistics and reports on the development of the eco-industry in NRW it is difficult to assess macro-level effects of the ecological industry in NRW. Furthermore, the heterogeneous nature of eco-industries would only allow very general conclusions. Therefore, the most meaningful level to describe ecological industry policy in NRW is the meso-level. This article has tried to shed light on ecological meso-policies in NRW in two strategically important sectors: the energy efficiency and renewable energy sector as well as municipal waste management sector. This is not meant to be representative of the regional energy and waste sector as a whole nor is it meant to be representative for the quality of energy and waste policies in NRW. It rather shows that in these two specific areas that the nature and governance of meso-structures is decisive ecological industry policy.

Meso-structures are usually underestimated when economic and political drivers of eco-innovation are proposed, because activities either choose a micro-economic perspective by describing eco-innovation at company level or they look primarily at macro-economic factors

or macro policies (e.g. by Jänicke, 2008; Jänicke & Zieschank, 2008; Bleischwitz, 2007; and Bleischwitz *et al.*, 2009). The meso level is usually insufficiently described. For example, in a major study about the eco-industry in the EU Ernst & Young (2006) identified five key market drivers for the environmental industry:

- The compliance with EU and member states' legal requirements and policy objectives such as water quality standards or a threshold for a minimum ratio of renewable energy production.
- The development of technologies and emerging new market segments or solutions, such as monitoring of new pollutants or media or the remediation of former industrial areas in cities.
- Market incentives in order to enable the competitiveness of environmental industries compared to conventional industries, such as fair pricing based on internalization of environmental externalities.
- Availability of public funding for co-financing investments of the environmental industry.
- Consumer awareness on the special character of environmental products and technologies, their existence at all and their benefit for the consumer.

It is probably correct, when Ernst & Young conclude that *"compliance with policy objectives and legal requirements set by EU and national authorities will be the main drivers of eco-industry growth in the near future"* (Ernst & Young, 2006; p. 48). Nevertheless, they fail to

acknowledge the ability of stakeholders in industry, science and policy to respond to policy objectives and legal requirements with innovations, but also for absorbing public funding and co-financing schemes as a prerequisite for eco-industrial structural policy. If compliance with environmental policy objectives and legal requirements are "imported" from higher governance levels of the EU *aquis communitaires* will primarily be based on imported technologies and know how, it will ultimately support eco-industries and employment in the traditionally strong exporting Member States like France and Germany. The opportunity of using ambitious political objectives for supporting regional development would be lost. Therefore, meso-policies need to be developed, by which political decision-makers, economic stakeholders as well as RTD are able to embrace environmental policy in order to develop their own regional eco-industrial profile. Thus, a key market driver for eco-innovation on the regional level will be the ability of cooperation between political decision-makers and public administrations, economic actors, as well as education, research and technological development. Models for such an industry policy developing a triple-helix between science, policy and market have been outlined by Etzkowitz & Leydesdorff (2000). They could be put in a greater framework of systemic competitiveness (Meyer-Stamer, 2009; Meyer-Stamer *et al.*, 2004) and transition management (Kemp and Loorbach, 2006). A combination of these approaches for the design of modern ecological industry policies would be a promising perspective for a sustainable regional development.

REFERENCES

- BERGER, R. (2008): *Green Tech made in Germany. Umwelttechnologie-Atlas für Deutschland*. München: Vahlen.
- BLEISCHWITZ, R. (ed.) (2007): *Corporate governance of sustainability: a co-evolution view on resource management*. ESRI Studies Series on the environment. Cheltenham et al.: Edward Elgar Publisher.
- BLEISCHWITZ, R., GILJUM, S., KUNDT, M. & SCHMIDT-BLEEK, F. et al. (2008): *Eco-innovation. Putting the EU on the path to a resource and energy efficient economy*. Available at: http://www.wupperinst.org/uploads/tx_wibetrag/ws38.pdf.
- BMU, BUNDESMINISTERIUM FÜR UMWELT NATURSCHUTZ UND REAKTORSICHERHEIT (2009): *Umweltwirtschaftsbericht 2009*. Available at: http://www.bmu.de/files/pdfs/allgemein/application/pdf/umweltwirtschaftsbericht_2009_kurz.pdf.
- BRÜGGEMEIER, F.-J., TH. ROMMELSPACHER: *Blauer Himmel über der Ruhr. Geschichte der Umwelt im Ruhrgebiet 1840-1990*. Essen: Klartext.
- ECOTEC (2002): *Analysis of the EU Eco-Industries, their Employment and Export Potential*. Contract no: C1961. Ref: 11/04/02. Brussels: DG Environment.
- ERNST & YOUNG (2006): *Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU*. Available at: http://ec.europa.eu/environment/enveco/eco_industry/pdf/ecindustry2006.pdf.
- ETZKOWITZ, H. & L. LEYDESDORFF (2000): «The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations». *Research Policy*, 29, 109-123.
- ESSER, K., W. HILLEBRAND, D. MESSNER, J. MEYER-STAMER (1994): «Systemische Wettbewerbsfähigkeit: Neue Anforderungen an Unternehmen und Politik». *Vierteljahreshefte zur Wirtschaftsfor-schung*, 64, 186-199.
- FES, FRIEDRICH-EBERT-STIFTUNG (1999): *Strukturwandel, Tertiärisierung, Entwicklungspotentiale und Strukturpolitik. Wirtschaftspolitische Diskurse Nr. 130*. Bonn: Friedrich-Ebert-Stiftung.
- KEMP, R. and D. LOORBACH (2006): «Transition Management: a reflexive governance approach». In: Voß, J.-P., D. Bauknecht, R. Kemp (ed.): *Reflexive Governance for Sustainable Development*. Cheltenham: Edward Elgar.
- KNI, KLAUS NOVY INSTITUT (1998): *Umweltschutzwirtschaft in NRW. Strukturen, Beschäftigungspotentiale und Qualifizierungsbedarf*. Düsseldorf.
- MEYER-STAMER, J. (2001): Was ist Meso? Systemische Wettbewerbsfähigkeit. Analyseraster, Benchmarkingtool und Handlungsrahmen. *INEF Report Nr. 55*. Duisburg. Available at: <http://inef.uni-due.de/cms/files/report55.pdf>.
- MEYER-STAMER, J., C. MAGGI & M. GIESE (ed.) (2004): *Die Strukturkrise der Strukturpolitik. Tendenzen der Mesopolitik in Nordrhein-Westfalen*, Wiesbaden.
- MWMEV, MINISTERIUM FÜR WIRTSCHAFT UND MITTELSTAND, ENERGIE UND VERKEHR DES LANDES NORDRHEIN-WESTFALEN (2001): *Handlungsfelder und Maßnahmen der Klimaschutzpolitik in Nordrhein-Westfalen*. Düsseldorf: Ministerium für Wirtschaft und Mittelstand, Energie und Verkehr des Landes Nordrhein-Westfalen.
- NORDHAUSE-JANZ, J., D. REHFELD (1995): *Umweltschutz "Made in NRW". Eine empirische Untersuchung der Umweltschutzwirtschaft in Nordrhein-Westfalen*. München: Rainer Hampp Verlag.
- REHFELD, D., PH. SCHEPELMANN (2007): *Wachstumsbranche Umweltwirtschaft*. In: Reutter, Oscar, ed.: *Ressourceneffizienz - der neue Reichtum der Städte : Impulse für eine zukunftsfähige Kommune*. München : Oekom Verlag, 234-241.
- SCHEPELMANN, PH. (2005): *Die ökologische Wende der EU-Regionalpolitik. Die regionale Resonanz von umweltpolitischen Indikatoren des Lissabon-Prozesses der Europäischen Union*. Hamburg: Dr. Kovac.
- UNTERSUCHUNGSSTAB ANTIKORRUPTION (2003): *Abschlussbericht*. Düsseldorf: Innenministerium NRW.