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SYSTEMIZING STRUCTURAL CHANGE:
HOW STATES CAN LEARN FROM EACH OTHER

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Abstract

- Bedingt durch den Niedergang der Montanindustrie sind das Land Nordrhein-Westfalen und der strukturähnliche US-Bundesstaat Pennsylvania im unwiderruflichen Wandel der kommerziellen Struktur begriffen. In Pennsylvania wuchs im Bereich der erneuerbaren Energien der Windkraftsektor stetig an.
- Analysiert man diese Entwicklung, so lässt sich ein dreigliedriges Leitbild-System von diesem erfolgreichen Strukturwandel ableiten, das PEG-System: Preservation, Education, Government.
- Das PEG-System kann dem Land NRW als ‚Schablone' dienen, anhand derer sich der Erfolg eines Strukturwandels in verschiedensten kommerziellen Bereichen messen lässt.
- Bei der perspektivischen Anwendung des PEG-Systems auf den Windkraftsektor in NRW deutet sich an, dass das Land sein Potential noch nicht ganz ausgereizt hat.

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1. Analytical Framework

Structural change is the fundamental alteration of an economy's sectoral composition due to the collapse of a region's primary commercial segment. This change is often accompanied by severe unemployment, burdened communities and years of economic stagnation. However, structural change is also the bridge to a brighter, more prosperous future – a chance for the regions to reevaluate their industrial repute, to reposition the economic input and, in the end, to redistribute the economic burden not on one, but on many shoulders.

Inherent to the process of reevaluation, repositioning and redistribution is the element of *learning*. How do regions adapt to new structural and fiscal conditions? How do they integrate their traditional economic compositions into a diverse market? And how do they measure the 'success' of structural change? These questions have to be answered – not once, but on a daily base, by political, economical and civil actors.

The *Bundesland* North-Rhine Westphalia (NRW) and the state of Pennsylvania are certainly familiar with the problems of being trapped in this tight framework of old burdens and fresh initiatives. In terms of structure, NRW and Pennsylvania share a similar history, founded on industrial advancement and mono-cultural drifts in the coal, iron, and steel sector. The commercial sectors in both states have been subject to necessary adjustments, albeit at different speed and intensity. Due to the steel- and dockyard-crisis in the 1970s, both Pennsylvania and NRW underwent a radical structural change from the industrial sector to the service and technology sector. However, the transition proved to be difficult: Pennsylvania and NRW witnessed steadily rising unemployment rates, reaching its peak in the early 1980s, with local unemployment rising to 17 per cent and 20 per cent, respectively (Stokes 2008:65, Danielzyk 1992:85).

While NRW has certainly been successful in overcoming many perils of structural change, such as assuring a sound base of employment and investing in prospective sectors, it must secure a progressive and forward-looking attitude, striving towards scientific advancement especially in trendsetting industries. It is thus worthwhile to halt and take a look at the current state of affairs on the other side of the ocean. How is Pennsylvania coping in the struggle? What can these regions learn from each other? Is it possible to avoid mistakes, to transfer each others' ideas?

Despite some difficult stages during the transition, Pennsylvania has taken a leading position in environmental technology and the regenerative energy sector on a global scale. Through specific political and structural programs, innovative businesses have settled in the Commonwealth, turning a steel and coal-based monoculture to a precursor in the generation of alternative energy. Especially the wind energy sector has flourished. The aim of this study was to find a pattern; a system which could explain why a 'burdened' state such as Pennsylvania underwent such a successful structural change in the field of renewable energies. And

if there is a system behind it, the task was to find out whether it is universally transferable and whether NRW could profit from this system in the future.

The study focuses on the wind energy sector; the reasons for this are threefold: first, it allowed for a look at the perspective of the businesses, those attracted by specific programs and incentives. Second, the engagement of both NRW and Pennsylvania in the wind energy sector gave the study a comparable dimension. Third, focusing on the wind energy sector was a way to 'peep through the lens': to focus on the particular while creating a general picture, thus testing the universality of the alleged system and portraying the inductive nature of the study.

The study was conducted in the light of the partnership agreement between the states of Pennsylvania and NRW, which was formalized by Governor Edward Rendell and Minister President Jürgen Rüttgers in 2006. The partnership agreement strives towards the development of stronger commercial, educational and political relationships and has grown significantly during the last years, particular in the area of economics and alternative energy.

In order to get a neutral perspective on the system behind a successful structural change in the wind energy sector in Pennsylvania, it was important to not only rely on information from inside the Commonwealth, but to interview experts from other states and representatives of the federal government. All of the interview partners have been studying the achievements in Pennsylvania regarding renewable energy and have transferred policies and ideas to their respective states. It was primarily during these interviews that the PEG-System evolved.

2. The PEG-System

'PEG' is an acronym for Preservation, Education and Government, three pillars which the research identified to be the sound foundation behind successful structural change. Each pillar consists of three layers, serving as a guideline for concentrated action – the layers outline specifically what needs to be done in order to build up a basis for a thriving transformation of the economic composition of an affected region. The study argues that the PEG-System represents an ideal model of structural change. According to this model, the process of structural change can be labeled a success when a given region affected by economic downturns fulfills all requirements set by the three pillars. The PEG-System is not only confined to the wind energy sector, but may be used in all other commercial sectors to measure what has been accomplished and what needs to be done. The following segment will illustrate how the PEG-System was established and how it was utilized in analyzing structural change in the wind energy sector in Pennsylvania.

Image 1: The PEG-System

The first pillar of the PEG-System is also the first requirement in need to be fulfilled when structural change is inevitable: the preservation of the foundation of the old economic structure – the workforce. As it was outlined above, when commercial sectors shift and traditional industries dissolve, rising unemployment is unpreventable. However, what *is* preventable is a negative perception of those formerly employed in these sectors. These workers shall not be viewed as an additional burden to the indispensable alteration of the economic structure. These workers constituted the backbone of a formerly successful commercial sector. Their skills and knowledge should be preserved, but redirected to fit the new market situation. It is vital to understand that a skilled and experienced workforce presents an essential comparative advantage when attracting foreign direct investment. In the following segments, it will be highlighted how specialization may heighten the attractiveness of a region for both outside companies as well as young professionals looking for options to start their own business in a prospective sector.

2.1.1 Maintain Workforce

The regions around Pittsburgh and Butler County have been fundamentally affected by the declining coal, iron and steel sector in the 1970s. Unemployment in the Pittsburgh area rose to 14.7 percent in 1983, while Butler County was witnessing unemployment rates of about 17 percent. These numbers were alarming, considering that both regions were the economic epicenters of the state of Pennsylvania. However, when looking at today's numbers, one may observe a steep decline of unemployment. Despite the crisis, unemployment dropped to about 7 percent in Pittsburgh and to 7.5 percent in Butler County. How is this possible? How could these regions overcome the dramatic downturn of an economic sector which has been feeding into the communities state-wide? Just looking at the mere numbers may tell the observer two things: first, since the primary sector broke away almost entirely, there had to be some kind of structural change. Basically, the region had to reinvent itself. Second, since unemployment numbers decreased steadily from the 1990s onwards, the workforce had to be repositioned to other fields of employment.

Journalist Bruce Stokes from the 'National Journal', a D.C.-based magazine, was researching on structural change in Pittsburgh and Butler County, situated about 30 kilometers to the North of the city. In an article titled "The G-20 Can Learn From Pittsburgh", Stokes argued that leaders of the world's largest economies, who met at the G-20 summit in Pittsburg on September 24 and 25, 2009, could see "new sources of growth if they would simply have some nuts-and-bolts discussions with Western Pennsylvania officials and executives" (Stokes 2009:62). The article generated some interest: what yet undetected sources of growth could these leaders possibly find when observing Western Pennsylvania? How did Pittsburgh and Butler County manage to decrease unemployment at such high rates? During the interview, Stokes highlighted that one of the most vital preconditions for a successful transition of the commercial sectors is to maintain the skilled workforce: "The general point is: as long as you can maintain a manufacturing base, you will create feed-in jobs. The struggle is to keep those jobs in the community. The steel mills began to outsource work to a smaller company in the community instead of outsourcing it to other countries, thus attracting trained manufacturers to locate their business and workforce in the community". The community-based companies attracted an enormous growth potential. However, keeping jobs in the community entails a vast effort. Pittsburgh's greatest challenge, next to the ongoing structural change, was the fact that demographically, the city is among the oldest large cities in the USA. Hence, it was "necessary for the city fathers to create an atmosphere where young people want to live". Important in this context is not only the fact that young manufacturers are taken care of, but that his or her partner has the chance to work at a suitable position, too. Stokes pointed mainly towards universities as possible employers – in fact, today, the University of Pittsburgh is one of the largest employers in the region (Stokes 2009:62). The

success of maintaining a skilled workforce is clearly visible in the example of Pittsburgh and Butler County. However, the question remains in which fields of employment these workers were able to find new jobs and where they could in fact exercise their expertise.

2.1.2 Advance Specialization

The example of Pittsburgh and Butler County illustrates the importance of maintaining a skilled workforce and thus keeping profession within the communities. Consequently, this generates the necessity to create new employment options. The crisis of the steel industry in the 1970s - which can be linked to all other fields of occupation in the primary sector - demonstrated that apparently, the demand for certain types of steel that Pennsylvanian mills were accustomed to generate actually decreased. Thus, the expertise of the workforce in the steel sector had to be fine-tuned or, at times, redirected in order to adjust to the new market situation. A new economic engine was needed, an engine which would incorporate the knowledge and proficiency of the steel workers. The answer to that call was specialization.

Basically, specialization in the first pillar can best be described as using one's expertise to produce a niche product. In Pennsylvania, many steel workers who have been working in the industry for years reposition themselves on a newly developed market. They now use their know-how to produce towers and blades for turbines by the order of the wind energy sector (Dodge 2008). In addition, many steel suppliers have been focusing on the construction of the wind turbine engines as well as small parts such as ring-stiffened shells or in the optimization of welded structures (Uys et. al. 2007:1339). Specialization also occurs in the supplier and utility factories, especially with regards to equipment manufacturing and foundries (Flowers 2009; Ross 2009). Crane operators working in tower manufacturing plants or truck drivers now exclusively supplying wind mill construction sites are also part of the bigger specialization scheme (Dodge 2008).

In the Pittsburgh area, the basic idea of local steel producers was to work together with university-graduates from Carnegie Mellon University and the University of Pittsburgh in order to locate untapped potential in the steel sector. This potential was sited "distinctively in the high-technology sector, more specifically in computer manufacturing and computer-related spin-off companies", Bruce Stokes explains: "Steel producers now focus primarily on electrical steel, which is for example used to build generators. This particular kind of steel is manufactured through a special alignment of molecules which would let electricity run through the steel faster. Large quantities of this particular kind of steel are being exported". The close collaboration between local steel producers and computer specialists from adjacent universities proved to be one of the most important instruments job-saving initiatives in the region: "Basically, if you have a niche product, you don't have to go out of business! This is more efficient, and not all jobs are lost".

2.1.3 Boost Start-Ups

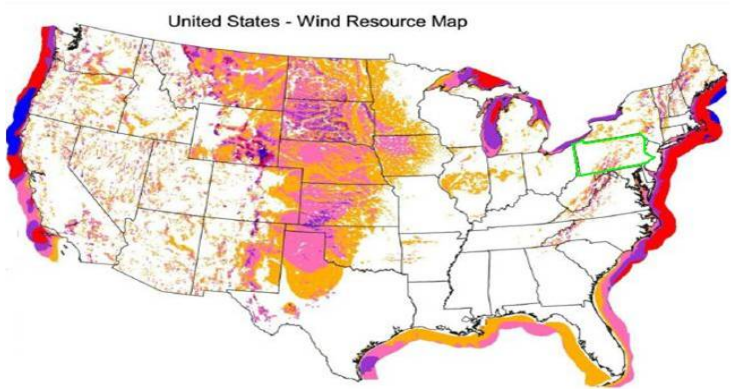
The primary goal of every regional entrepreneur in the midst of structural change is to maintain skills and talent. In order to formulate a future prospective for his or her business, the entrepreneur has to resort to young professionals capable of leading the company into a new generation of productive advancement. Yet it is unfortunate reality that many young postgraduates are leaving the industrially coined regions in order to pursue academic or economic careers elsewhere in the country where job opportunities seem to prosper. In the case of Pennsylvania and the entire Appalachian region, primarily the big cities on the east coast and elite university locations as well as job opportunities in the areas adjacent to Washington D.C. were prime targets of 'talent migration', as Grover G. Duling, associate dean at the Eastern West Virginia Community & Technical College in Moorefield, WV, points out. Duling has been working very closely with students willing to pursue a career in the wind energy sector. Thus, he has been paying close attention to the developments in the role model state of Pennsylvania, arguing that he continues to search for the 'best way' to motivate young people to start their own business in the still up and coming market, but at the same time keeping talent inside the states: "One of the main goals within the process of structural change is to provide incentives for young people to stay in their regions or communities". This view is also supported by Bruce Stokes:

> "Economists state the following scenario: an ambitious young person working in a manufacturing enterprise in a community has very good ideas for the company, but due to certain structures within his business, he never has a chance to articulate his ideas or translate them into something substantial. He will eventually leave the company to start his own business, but wants to stay in the community due to personal reasons: his wife, his kids are in school, and so on. Innovation will stay in the community as long as people are bonded" (2009).

It must be the prime target secure talent and innovation by offering financial, structural and private perspectives. During the Appalachian Wind Conference in Roanoke on 23-24 September 2009, which was organized by the Appalachian Regional Commission, the US Department of Energy and the American Wind Energy Association, a range of young professionals demonstrated how they could profit from the rising wind energy market in Pennsylvania. When it became apparent that wind energy was being outlined as the market of the future by the Pennsylvanian government, some students came up with the idea to start-up a company which would locate areas within the state which would meet all requirements necessary to initiate the construction of wind park projects. Before a company may set off the construction process, certain requirements have to be met. First and foremost, the 'quality' of the wind has to be measured. Many students in universities around the Appalachian Region, especially in Ohio, are working on wind measuring devices in order to gather accurate data

on the wind resources in the areas in question. The data is fed into a commonly operated computer system and then illustrated on so-called “wind resource maps” (*see image 2*).

Image 2: Wind Ressource Map



(Flowers 2009)

In the wind energy sector, the potential for start-up companies to specialize in a given field is vast. Prior to the actual construction process, firms need specific information about the access of transmission. Also questions concerning financing, environmental compliance, the permitting process and also the site access have to be answered accurately before any construction worker can set food on an actual site (Jodziewicz 2009). All these possible fields of engagement have one thing in common: the necessity of highly trained professionals with a profound knowledge on renewable energy, above average technical skills and issue-specific expertise. In fact, companies like Gamesa[1] consistently ask for “more money for issue-specific start-ups on wind energy”, as Kurt Geiger from Human Capital Management Department of Gamesa North America explains. On first sight, it might seem odd that major companies such as Gamesa or Iberdrola[2] would raise the issue of start-up companies focusing on the pre-construction phase; in fact, these companies have a wide range of international experts for every issue in question, making it seemingly unnecessary to invest money in outside expertise. But investigating the business routines in the wind energy field does

[1] Gamesa is a company specializing in sustainable energy technologies, mainly wind power. Gamesa is market leader in Spain and is positioned among the most important wind generator manufacturers in the world (www.gamesacorp.com).

[2] Iberdrola Renewables is a leader in optimized energy solutions tailored to meet the needs of wholesale and large commercial and industrial customers. In the wind energy sector, Iberdrola manages the marketing and development of wind and thermal energy facilities, shaping and firming, scheduling and transmission management (www.iberdrolarenewables.us).

provide valuable information on why issue-specific start-up companies are more and more in demand. First, the wind energy market continues to grow – not only in Pennsylvania, but on a worldwide scale. With a growing market comes competition. Gamesa and Iberdrola might have the biggest investment potential; however, a range of international firms – such as Siemens or GE – started enormous mega projects in the form of on-shore or off-shore wind parks. Unavoidably, wind energy is tied to the question of space. The areas where wind resources are sufficient become scarce, says Gary Verkleeren, senior business developer at Iberdrola Pennsylvania. Young experts with a specific knowledge of the region in question may provide fast and accurate information, which, simply put, safes companies new to the market an enormous amount of time. Most start-up companies are regionally or even locally based; their founders have studied in nearby universities and are profoundly familiar with the specific geographical surroundings, the degree of environmental concerns or the explicit problems regarding permits. They may provide major companies with detailed, issue-specific information based on months or even years of comprehensive research and in-depth analysis, taking advantage of the infrastructure provided by universities, colleges or technical schools. A side-effect is obvious: young experts are more prone to staying in their accustomed regions and communities (Jodziewicz 2009).

The example of the successful integration of local and regional start-up companies in the business-cycle gives us three dimensions on they can be a vital in the process of structural change. First, start-up companies emerge where students and young professionals can be convinced to stay in their communities or return once they have graduated. The states must countervail ‘talent migration’ by sending strong signals to the students in universities and colleges, but also to high school graduates, underlining the benefits of starting one’s own business in a prospective sector. Furthermore, studies show that the “continued existence of […] firms has […] sustained a technically competent workforce that has encouraged other industries to start up” (Stokes 2009:62). Hence the maintenance of the local workforce as well as specialization efforts send a strong psychological message: ‘our jobs are safe, because we have found new ways and new ideas to sustain our economy’. Second, the state must be proactive, providing tangible financial incentives – such as start-up funds or tax cuts - as well as structural frameworks favorable to young businesses – for example the access to research facilities, data, infrastructure and open cooperation with technical school and universities. Third, these young companies must be introduced to the professional business cycle as fast as possible, thus ensuring the possibility to generate revenues rapidly. In recognizing these dimensions, structural change may indeed be a bridge to a brighter tomorrow.

2.2 Education

The second pillar of the PEG-System is education, which includes a strong focus on the science sector in colleges and universities. It will be argued that education needs to be goal-oriented, meaning it must be organized along the specific requirements of a newly constituted market. Consequently, universities must allow for businesses to outline what kind of expertise the market currently needs; more precisely, cooperation between universities and the business world should exceed merely theoretical frameworks. Cooperation schemes must include the academic supervision of colleges and universities as well as practical training and monitoring on behalf of the companies. These schemes should benefit the traditional workforce, thus certifying that experienced workers may be able to specialize in obligatory fields of employment.

2.2.1 Integrate Businesses

The fundamental importance of education in the process of a structural change is widely acknowledged with regard to the encouragement and advancement of young professionals. However, the cooperation between universities and steel mills in Pittsburgh demonstrated that in order to guarantee career and employment options and hence to attract local and outside professionals, the educational sector is in need of coordination along the lines of economic necessities.

Prof. Jonathan Miles of James Madison University in Virginia has researched on the opportunities of educational cooperation in the wind energy sector and its specific funding sources. Wind technician programs are being created in colleges, universities and technical schools throughout the USA; so far, there are over 100 schools with wind specific programs. Miles highlighted that by 2016, approximately 1300 technicians will graduate annually from these academic institutions: “students migrate to the industry once they get in contact with the facts of wind energy and the possibility it offers”. Again, what becomes apparent is the necessity of redirecting ‘talent migration’ by offering the concrete prospect of jobs and job-specific education. Cooperation programs between universities and businesses provide students with a very clear picture of the potential and direction of their place of employment, thus enabling them to continuously adjust and refocus their field of expertise and ‘keep up with the times’. In the wind energy sector, the American Wind Energy Association (AWEA) even established a “seal of approval” to support wind specific programs in universities and colleges. While one could assume that technical colleges might have an issue specific advantage in terms of the sphere of interest of its students, there seems to be no constraint to curiosity when it comes to renewable energy: “traditional universities feed into the energy sector as well”, says Kurt Geiger of Gamesa North America, claiming that students trained in traditional, high-level academic institutions such as Pittsburgh University or Carnegie Mellon “could be hired im-

mediately" in terms of their technical, issue specific skills, even though every student is mandated to undergo further training at Gamesa facilities for their specified jobs. In fact, Pennsylvania is home to forty-five schools as well as eight community colleges with a strong technical background, which, according to Geiger, "is already an incentive for companies to come to the Commonwealth".

Of course, businesses should neither set academic standards nor should they determine the content of curriculums, but close cooperation with regard to practical appliances of theoretical frameworks in a professional surrounding is instrumental in securing the future of regions struck by economic downturn. Universities and colleges must assure to offer courses and programs which match the new commercial sectors developed under structural change. In other words, universities must guarantee to integrate the specific requirements of newly attracted businesses, which is only possible through close cooperation between educational facilities and the business world.

2.2.2 Initiate Training Programs

There is a wide range of possibilities on how to pursue cooperation between the business and academic sector. In Pennsylvania, the most outstanding initiatives are specialized training programs; while it is not uncommon that newly hired employees will undergo training programs within the companies to become acquainted with its structures, principles and work ethics, the interesting aspect is the fact that these programs are designed specifically by both universities and companies in concerted action.

The Spanish wind turbine manufacturer Gamesa recently built a wind energy training center in Philadelphia (Redmond 2008:2).The students are trained by business personnel; however, universities give advice on how to arrange the curriculum so that it may connect to the university standards and exigencies. When asked about these training programs, Gamesa's Kurt Geiger shared some interesting insight: "the programs offered to students by Gamesa are funded directly by the state, which presents a major incentive for young people to get involved". Geiger added that the training center as well as issue-specific programs drew interest from young students all around the USA.

However, Geiger did not mention which government provision was allowing for the allocation of state money to these specific grants. The amount of money pouring into these programs would offer valuable information on the investment proportions of the state government in the field of education, which again would again provide an idea to which extent these programs are transferable to other regions worldwide. While one may only speculate at this point in time, there is evidence to believe that the initiative is covered by the Energy Independence Fund, which was created under the Energy Independence Strategy in 2007 (see *2.3.1 Provide Structure*). The financial plan for this fund foresees $106 million as venture capital,

grants and loans for the expansion of energy companies. The money is generated through a system benefits charge on electric power consumers, which increases the price paid per kWh for residential, commercial and industrial consumers (Government of Pennsylvania 2007:4). In this case, these training programs would actually be indirectly covered by the citizens of Pennsylvania themselves. Due to the fact that the company uses the grants to build and train expertise, thus creating more options for future employment, it could be argued that indirect public involvement may also be a way of 'legitimizing' Gamesa's approach; on the other hand, a specific bill designed for the support of valuable training programs wuld be a logical second step.

Generally speaking, if a company works closely with universities and the state government to enhance training, education may become more goal-oriented, more designed to serve the transforming market. In the future, structural change would be accompanied by young, highly-trained professionals with a clear field of expertise. Nonetheless, since the aim of structural change is the redistribution of the economic burden on many shoulders, specialized training programs must be adopted in a variety of commercial sectors.

2.2.3 Realize Experience

The last 'layer' of the third pillar concentrates on the realization of experience in the process of specialized education or what Grover G. Duling calls the "capitalization on transferable skills". Admittedly, this concept is very novel and hence lacks hard data; with regard to actual academic outputs its effect is yet to be tested. Still, it is a very promising approach to a topic which has yet been unrecognized, leading the way for other innovative educational concepts.

In the light of the arguments made for specialization, Duling highlights that the market has to rely on the "knowledge foundation of workers who would like to transfer their skills", e.g. from an occupation in the traditional steel sector to specialized wind energy manufacturing opportunities. Over the years, these people have learned how to 'handle' steel; they have experienced the practicalities of the job first-hand. Duling now argues that their skills, as it was demonstrated in the preservation pillar, are transferable to the wind energy sector – but this transfer entails that workers may take part in planned university or college courses, which are explicitly designed to match their level of practical expertise. The workers do not have to attend full courses in a field they have been working in for years, but may take exams in related university courses right away, hence allowing them to focus on other requirements in the process of specialization. This would severely limit the time these workers spend in colleges, and allow them to get back into working life as soon as possible. At the end of the course, they would earn a full wind technology degree, hence providing new employment possibilities. Duling began to install these programs at the Eastern West Virginia Community & Technical College in Moorefield. While Duling's idea might be new and is definitely in need

of assessment once the program has been established for some time, it bears enormous potential. The aspect in need to be preserved is the realization of experience and the benefits for workers. Indeed, opening up specific courses in colleges and universities to experienced workers who might not have been to an advanced academic institution before could forge specialization and prepare a skilled workforce for future tasks.

2.3 Government

The initial task of the government is to give change a structure, a legal and mandated framework within which the adjustment of the commercial sectors to the new market situation may occur. It is the task of the government to construct a detailed, constitutive agenda which offers security to international investors and sparks interest in the region by open communication and commitment to new commercial visions. In the midst of structural change, all government acts should be tied to job creation and advocate cluster-building, meaning that a large variety of economic branches are taking part in and benefit from structural change. In order to pursue these policies, governments must foster corporation between different societal actors, such as unions and business associates during the agenda-setting and policy formulation phases. In order to build large support for government programs necessary to foster change and create a stable market, all actors have to be heard and recognized.

2.3.1 Provide Structure

Even though the most groundbreaking wind energy projects were set off in the term of Governor Edward Rendell, the first government-led initiatives relevant to the wind energy sector date back to 1999. In that year, the state government under then-Governor Mark S. Schweiker introduced the Electric Deregulation Bill. This bill was a first step towards opening up the Pennsylvanian energy market to foreign investors, allowing independent generators to enter Pennsylvania to generate power – albeit at their own financial risk. It enticed residential consumers to switch power providers, thus creating more competition in the energy field. The bill was viewed as an overall success, primarily because electricity prices dropped immensely (Walker 1999). However, in the long run the main success was the attraction of foreign businesses. It is safe to assume that without the Electric Deregulation Bill, wind energy companies like Iberdrola, Gamesa, Siemens or GE could not have entered the Pennsylvanian market.

The second piece of legislation with utmost importance in the provision of structure was the Alternative Energy Portfolio Standards Act (AEPS) signed by Governor Rendell on November 30th, 2004. This law provided that “all electricity suppliers in Pennsylvania must provide 18 percent of their energy from advanced energy sources within 15 years” (PennFuture 2004). All affected companies were required to gradually increase their utilization of alterna-

tive or renewable energy over time (Popowsky 2009). For private investors, the AEPS was nothing less than a secure, mandated job guarantee. Iberdrola's Gary Verkleeren confirmed in an interview that the main reason for his company to locate their headquarters in Pennsylvania was the mandated portfolio standard: Iberdrola was now "definitely looking for a long-term commitment" in Pennsylvania. The same held true for Gamesa: according to an internal report, the state-mandated renewable energy portfolio standard was fundamental in the decision to actually locate the manufacturing facility to Philadelphia (Gamesa 2009). Of course, the reasons for entering the Pennsylvanian market are more complex, ranging from the manufacturing heritage and skilled labor force to the energy vision articulated by the state government and Governor Rendell. But the AEPS was an essential criterion for the business world. Chris Ross, Republican member of the Pennsylvanian House of Representatives, was part of the commission developing and revising the AEPS. To him, "the whole package was responsible for the success of wind energy in Pennsylvania." The main achievement of the portfolio standard was "to give all companies investment security – the companies knew that until 2020, their engagement in Pennsylvania was safe and sound". Additonally, the AEPS was revised in a way that "everybody profited" from it due to the vast attraction of private investment: the manufacturing and construction industry, the communities through the stimulation of local tax bases, the citizens through a cleaner air and water supply (PennFuture 2004). Tom Tuffey, director of PennFuture, Pennsylvania s leading environmental advocacy organization, also highlights that the procurement strategy inherent to the AEPS as well as the fact that it entailed an enhancement mechanism which would automatically increase the percentage of energy provided from renewable sources in 2020 made the law stand out.

In 2007, the state government issued another revolutionary, long-term act, the Energy Independence Strategy (EIS). Generally, this strategy aims at reducing the reliance on foreign energy sources, most notably oil. However, Governor Rendell's vision was to attract some of the world's leading advanced energy companies to Pennsylvania, thus making the Commonwealth a destination location for clean energy investors. Hence under the EIS, the Energy Independence Fund was established, which would redirect $850 million into renewable energy sources and was specifically designed to render possible three strategic aims: to accelerate the role that Pennsylvanian companies play in the production of clean energy components and systems by investing $ 100 Mio. in venture capital, grants and loans to attract private investors; to initiate clean energy economic development projects by investing $ 500 Mio. for infrastructure, construction and early development support for energy projects; and to keep energy jobs close to home by establishing long-term contracts between companies ad developers of wind farms and solar arrays, thus vitally improving the goals set in the AEPS (Government of Pennsylvania 2007:1-3). Rendell also underlined that these wind

farms have to be built in a place that “directly supports the grid that serves Pennsylvanians” (ibid.:3).

In 2008, the government issued the Alternative Energy Investment Act (AEIA). Its primary aim was to create long-term incentives for the development of alternative energy projects. The act provided $600 million in grants and loans to start-up companies, as well as tax credits for alternative energy productions and financial incentives for small businesses and consumers (ReedSmith 2008:1). In the same year, the House of Representatives passed Act 129, the so-called Energy Efficiency Bill, outlining process-specific measures and new requirements in generating electricity resources. The bill established wind energy as the least cost intensive electricity source (General Assembly of Pennsylvania 2008). Act 129 highlights initiatives on how to use energy more efficiently. While these proposals are more technical in nature, they underline the tendency to move towards a greater energy efficiency scheme (Eldridge 2008:6ff).

All these political programs have one thing in common: they provide a sound structure for the successful shift from mono-cultural drifts in the iron, coal and steel sector to a broad-based renewable energy market. Most programs offered financial incentives or a security provision for private investors. But most importantly, they were effective because they were building upon each other: each act formed a structure on which new programs could be articulated. The continued amelioration of the political framework would have absorbed any shocks the market had to endure due to structural change. As the example of Gamesa shows, the outcome of these policies were more than positive: today, Gamesa employs over 1000 workers in Pennsylvania alone; over 500 of these positions are ‘green collar positions’ where employees are represented by the United Steelworkers Union. The company has invested over $200 million in Pennsylvania, including $34 million to convert 20-plus acres of a former industrial site from a brown-field into a modern manufacturing center. There is an imminent benefit for local economies: while over 100 US-suppliers of raw materials for the production of wind turbines and components are hailing from 24 states, Pennsylvania-based companies supply the largest portion or raw manufacturing supplies and materials, representing 40.9 per cent of all suppliers. The state-government and Gamesa agreed to set a new goal for the future, stating that 75 per cent of suppliers should be locally based (Gamesa 2009).

2.3.2 Create Jobs and Cluster-Building

“The initiatives by the state government were successful because they were tied to job creation!” Chris Ross explains. Indeed, the creation of jobs is the most fundamental task of a state government in the process of structural change. All political and structural programs

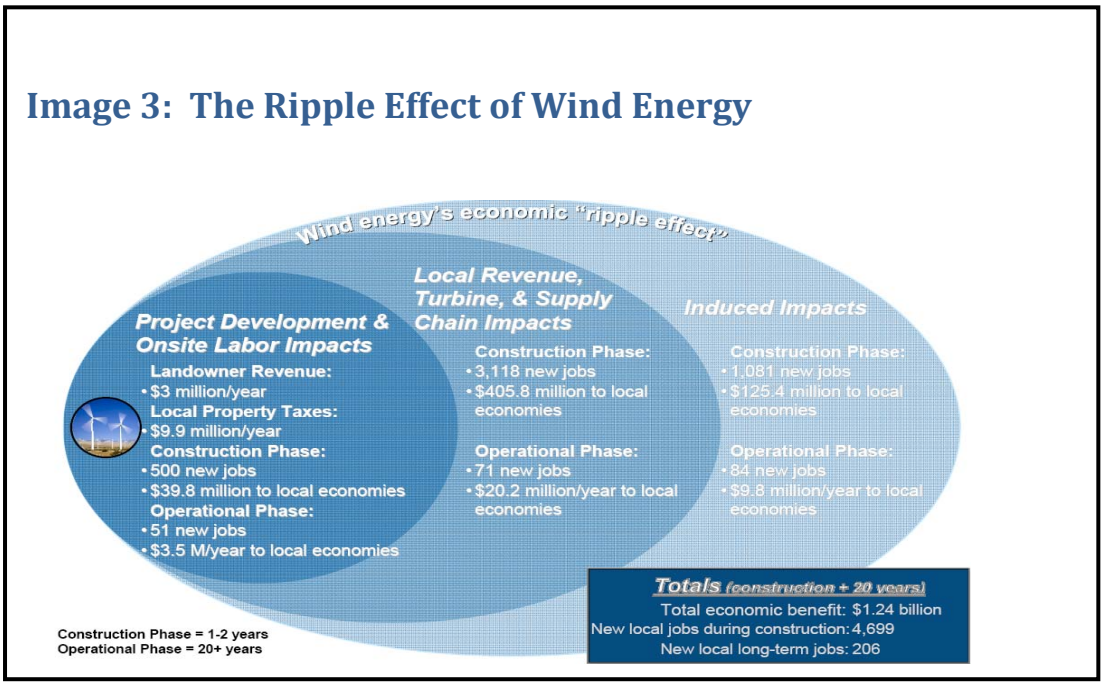
must ensure that jobs are being created rather than eradicated and that as many commercial 'clusters' or branches as possible benefit from enhanced employment options.

"The wind energy sector always pushes cluster-building tendencies: manufacturing companies, subcontractors, component suppliers are all settling near wind energy sites", says Scott C. Sykes, President of Genesis Development, a Kentucky-based green energy company. In terms of generating cluster-building tendencies through effective policies, "Pennsylvania has a reached a role-model status"; noticeably, firms from all over the Appalachian region are seeking to follow Pennsylvania's example.

The wind farm project sites in Pennsylvania are a good example on how new jobs are created in every step of the construction process: on-site labor at the project location comprises truck drivers, crane operators, management and support, construction, earth moving and cement pouring. Off-site labor is created along the supply chain: blade and tower manufacturers, steel mill jobs, parts, services, property taxes, financing, banking, accounting, equipment manufacturing and sale. Last but not least, construction sites create induced jobs: construction workers want to eat in restaurants, want to buy a car, and want to use public transport or enroll their children at a local school or kindergarten. However, money is spent in local communities (Flowers 2009).

Jim Marker of the Somerset County Board of Commissioners in New Jersey highlights that wind energy generates a so-called 'ripple effect': a long term, wave-like flow of fiscal benefits resulting out of the construction and operation of a wind park (*see image 3*).

Image 3: The Ripple Effect of Wind Energy



While the construction phase usually requires 1 to 2 years, the operational phase lasts approximately 20 years. Marker calculates that the onsite labor impacts during the project development phase could result in landowner revenues amounting to about $3 million a year, while local property taxes could rise up to $9.9 million. 500 new jobs are created in the construction phase and 51 jobs during the operational phase. The supply chain impacts are also substantial: over 3000 jobs are created during the construction phase, 71 jobs during operations. The induced impacts are also amounting to over 1000 new jobs in the construction phase. Due to on- and off-site job-creation, Marker believes project developer gain immediate support of the community. “It is not that a developer can employ 500 people right away”, says Marker, “but in the first years 30 to 40 new, well paid jobs are created which feed directly into the community”. Additionally, wind energy has zero effect on farming, thus wind parks may be built with the help and support of local farmers, who would earn money by hiring fields and turfs to the developers. He demonstrated that during the construction of a wind park, the total economic benefit may amount to $1.24 billion, with 4.699 jobs created during the actual construction and 206 long term jobs resulting out of maintenance jobs during the operational phase of a wind park.

The ripple effect demonstrates quite graphically the enormous potential of cluster-building. It also serves as a reminder that effective, forceful and coherent government programs need to be in place in order to ensure that many branches may profit from structural change.

2.3.3 Promote Corporation

The last ‘layer’ of the third pillar covers corporation. When it comes to structural programs or incentive-based policies, the government needs wide public support. Thus, in the agenda-setting and policy formulation phase, it is significant that a broad range of societal actor are taking part and are being heard – most importantly those directly affected by the decisions in question.

The reason behind this is fairly simple and can best be exemplified by the case of Gamesa’ s talks with the state government and representatives of the United Steelworkers (USW) prior to their engagement in the region. The USW is the largest industrial union in North America with 850.000 members, ranging from steel, paper, forestry, rubber, plastics, and aluminum to chemicals, oil, glass, cement and energy industries. Due to the states’ heritage, the USW is extraordinarily strong in Pennsylvania (Redmond 2008:1). The business site knew from the very beginning that the USW represents the vast majority of people employed in the wind energy sector, and that an open confrontation with the USW was doomed to fail. Kurt Geiger illustrated that the involvement of USW members during the talks with the government was a reason that “the old rustbelt workers are now back in labor”. The company developed strong bonds with the USW, resulting in the fact that newly organized workers employed at Gamesa

in Ebensburg and Fairless Hills, Pa., approved their first labor agreement with 80% approval (USW Newsletter 2007).

The government on the other hand could rely on the fact that the USW would support all major programs which would generate more jobs in the renewable energy sector, thus having a strong partner on its site for upcoming elections (Gerard & Zoi 2008:3, Redmond 2008:1). The USW was interested in the establishment of credible, long-term job opportunities in the wind energy sector:

> "A recent study showed completed by the Renewable Energy Policy Project indicates that an RES (Renewable Electricity Standard) in the 15-20% range has the potential of creating 850.000 new jobs in component part manufacturing, and would therefore serve to revitalize many of our devastated heartland communities. For the USW and its members those numbers are not just projections, but jobs that have been created in the wind industry in once shuttered steel mills in Pennsylvania" (Gerard 2007).

Corporation proved to be vital in the assertion of different interests. Structural change needs to be met with coherent structural programs which create a strong incentive for companies to invest in a given region. These programs need to be firm and supported by a wide range of societal, political and economic actors. The dilemma is that on the one hand, incentives have to be strong enough so that companies are not inclined to leave the discussion, while on the other hand, the government must ensure to systematically promote workers rights and the position of the union. Corporation is thus an indispensable part of successful structural change.

3. 'Perspectives'– Pretesting the PEG-System in NRW

This pretest should only give a perspective on how the PEG-System can be utilized to measure success of structural change in the wind energy sector in NRW. Since the focus of this study has been the generation of the PEG-System as well as its first appliance in an actual case of structural change in Pennsylvania, there is only preliminary data concerning wind energy in NRW; interviews with experts, enhanced text coverage as well as new data processing will be added in a follow-up master thesis. In order to evaluate the full potential of the PEG-System, in a second step it has to be put to the test in a range of other commercial sectors affected by structural change, which will also be conducted in the thesis.

In the early and mid-1980s, the result of the coal, iron and steel crisis hit NRW and left its debilitating mark. Unemployment rates amounted to 15 per cent; especially the Ruhr region, the 'German rust belt' and epicenter of the crisis, had to struggle with redundancy: 440.000

people were without a job, 325.000 of which had been directly employed in the coal, iron and steel sector (Danielzyk 1992:85). Municipalities were trapped in a vicious circle, almost crushing under the pressure of social welfare expenditures while bearing witness to local business taxes dropping cumulatively. In order to break the circle, the state had to induce a vigorous change of commercial structures:

> "Im Sinne einer zeitlich, räumlich und finanziell abgestimmten Landesentwicklungspolitik sollten nicht nur der Niedergang des Bergbaus ‚sozial gestaltet' und die verbliebene Kohlenwirtschaft modernisiert, sondern die Region durch eine Steigerung der Mobilität von Boden, Kapital und Arbeit für eine umfassende Restrukturierung der Ökonomie vorbereitet werden. […] Dem sollte ein Ausbau des Bildungswesens und der Wissenschaft, vor allem aber eine Rationalisierung der Raumstruktur dienen" (ibid:89).

The state government hence focused on a multi-layer-strategy: the modernization and mobilization of grounds, capital and work as well as education and rationalization processes. How successful was the state of NRW in fostering new employment options? What are the achievements of structural change in the wind energy sector?

Preservation

The 'Energy and Climate Protection Strategy NRW' brought forward by the Department of Energy highlights the vast potential of renewable energy in terms of fostering regional employment. According to this study, medium-sized business dominate the market, the sales volume amounted to 1.2 billion Euros with 4.500 people employed directly in the wind industry in 2006 – not including supplier networks (Ministerium für Wirtschaft, Mittelstand und Energie 2008:38).

However, the Department identifies medium-sized supplier networks as one of the primary advantages of NRW: the companies „konnten als Zuliefererunternehmen im Zuge des Strukturwandels und der strategischen Unternehmensausrichtung in der Windenergie einen zukunftsträchtigen Wachstumsmarkt für sich erschließen" (ibid.). Traditional suppliers are enrooted in component supply and equipment manufacturing, but also related to steel-based jobs such as foundries and plant construction. Wind power lobbies enjoy open support from supplier networks and service providers state-wide (Agterbosch & Breukers 2008:644). In terms of specialization, NRW-based supplier networks are dedicated to wind-related technology such as the production of engines for wind turbines or specialized blade manufacturing devices (Breukers & Wolsink, 2700:2742). Plant construction companies engaged in wind energy even had a sales volume of € 4.5 billion and 18.500 employees, most of them working in medium-sized business structures, with clear outline on specialization in the wind industry (Ministerium für Wirtschaft, Mittelstand und Energie 2008:38, Redmond 2008:2).

Hence, on first sight it can be stated that NRW has managed well to maintain the skilled workforce especially inside supplier networks and to integrate them in the wind energy market, using the instrument of specialization. Based on these facts, NRW predicts a rise in sales volume to about €15 billion and an increase in employees to 40.000 in the renewable energy sector until 2020. The export contingent is currently at around 60 per cent, but also predicted to rise within the upcoming years (Ministerium für Wirtschaft, Mittelstand und Energie 2008:5). Still, the question remains whether a certain 'point of saturation' has been reached in NRW, especially in terms of the construction of new wind parks. In fact, exports rise steadily due to NRW's focus on specialization, but the added value is pouring out of the state. While Pennsylvania has managed to attract foreign businesses, no leading wind energy provider operates from within NRW (Agterbosch & Breukers 2008:642).

In NRW, wind energy projects have been developed already in the late 1980s, with grassroots support of the public. With growing social acceptance, a wide range of different start-up companies emerged in the new sector, triggering technological innovation as well as enormous mobilization of private capital flowing into start-up companies and locally owned projects. The potential of the market and the activities of localized actors had been noticed by other market actors, leading to a shift in the configuration of the type of entrepreneurs active in the market from young start-up companies to professionalized, medium-sized companies. Additionally, the federal governments' banking institutes would provide soft loans to project developers, thus assisting to materialize a sound base of implementation and a flourishing home market for turbine manufacturers and related services (Breukers & Wolsink 2007:2741). But due to continuing professionalization of the market as well as upcoming problems relating to the feed-in tariff system (*see Government*), the number of start-ups plummeted in the late 1990s. Seemingly, neither the market nor specialized government programs did present enough incentives for young professionals to actually develop and promote new projects and start-ups in the wind energy sector; also, there was no broad-based cooperation or mandated agenda of assistance between medium-sized companies and start-ups (Agterbosch & Breukers 2008:642ff). In the course of the last years however, one may observe a change in attitude regarding new business ideas and wind energy: in 2007, two young entrepreneurs developed a new electric motor and more efficient synchronic generators, which are primarily applied in wind turbines in order to produce power more rapidly to its enhanced compositional structure (Dortmund-Project 2007). In 2009, the Department of Energy initiated a contest where 24 renewable energy-projects were funded with €23 million (Landesinitiative Zukunftsenergien NRW 2009). While it very possible that these are only selective highlights, there seems to be a steady rise in awareness of the economic prospective of wind energy, especially with regard to specialized manufacturing and supplier networks.

Education

When applying the second pillar of education, one may observe profound transformations in the cooperation between companies and universities. While there is an underlying suspiciousness about augmented involvement of business actors in the academic world on part of many students, there have been fruitful partnerships between faculties and businesses in sectors with extensive importance for wind energy. For example, the engineering and plant construction faculties at the Ruhr-University of Bochum and the Technical University Dortmund built up a high-performing education and research center. Through enhanced cooperation under the banner of 'Engineering Unit Ruhr', networking effects are utilized to ameliorate the worldwide position of the scientific research facilities on a world-wide scale. The 'Engineering Unit Ruhr' has partnered with firms like steel-giant ThyssenKrupp and the power-provider EON (University of Bochum 2007:5).

Under the guidance of the cluster 'EnergieRegion.NRW'[3], a new competence center 'wind energy engineering' was developed. The competence center is a consortium of component suppliers, service providers, wind park carriers, universities as well as various institutes. It is the aim of this project to tackle new challenges in various branches of plant- and engineering construction with focus on wind energy by testing and verifying mechanisms (EnergieRegion.NRW 2009). The cluster proved to enhance the strategic connection between medium-sized firms and research facilities. Thus, even though cooperation between businesses and universities have been less 'direct' than in Pennsylvania, different channels of communication emerged via cluster politics or competence centers. Combined training programs are still very uncommon and more likely to happen with university involvement inside the companies (Köpke 2009a). As expected, capitalizing on transferable skills via the realization of experience does not seem to have gained ground yet, while it remains an interesting concept in terms of specialization effort within the NRW market. After all, while there certainly is still room for improvement in terms of active business involvement and concerted action via training programs or similar plans, NRW is on the right track. The University of Duisburg just recently sparked off its informational branch day under the topic of wind energy (University of Duisburg 2009). Awareness seems to be on a steady rise.

Government

In NRW, the success of wind power implementation was "praised and associated with a strong environmental awareness and political commitment in German society and politics" (Breukers & Wolsink 2007:2740). Already from 1987 onwards, coherent government pro-

[3] The state government of NRW has delegated the management of the cluster of energy economics to the 'EnergieAgentur.NRW', thus forming the 'EnergieRegion.NRW'. The cluster provides possibilities for different actors to make use of networks along the whole chain of value creation (EnergieRegion.NRW 2009).

grams were developed in order to accompany the rapidly developing wind energy market, thus giving the apparent economic change a structure. In 1989, the Federal 100/250 MW Wind Program was adopted, which provided a fixed payment per kWh of renewable electricity as well as investment support for private generators. The initiative amounted to the Electricity Feed-In Act in 1991, which would guarantee renewable generators access to grid and a proper remuneration price when privately generated power would be fed in the public power system (ibid.: 2741). The fundamentals of this feed-in tariff system are still intact today. The system proved to be effective when combined with other programs which would guarantee non-discriminatory financial incentives as well as the diversity of actors involved in the development of wind energy (ibid.: 2747). However, two problems emerged: first, the broad-based support for wind energy dropped first around 1997 with the launch of the 'privileging act', which compelled municipalities to find adequate spaces for the construction of wind turbines. This act further limited participatory actions and co-determination of the municipalities in fields of energy policies and drew widespread local opposition. As a result, the wind energy decree of 2005 guaranteed that municipalities do not have the obligation of advancement and may decide whether or not they want to concentrate wind parks in their adjacent areas (Windkrafterlass 2005:3-4). Local opposition to wind power, however, has still accelerated ever since. Second, from 2001 onwards, the feed-in tariff system has been subject to repeated revisions in the light of the development of the federal Renewable Energy Bill, which was adopted in 2004. This bill decreased the guaranteed feed-in price by four percent (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit 2008:10), leading to insecurity by investors as well as local private generators and, in the end, to a severe decline in local involvement (Breukers & Wolsink 2007:2744).

While wind power was first accepted as the primary alternative energy source, what becomes apparent is the fact that in contrast to Pennsylvanian approach, there have been no extensive fiscal programs supporting wind energy. Although the Energy and Climate Protection Strategy of the NRW Department of Energy clearly aims at inventing and researching on new technologies to boost the contingent of renewable energy, and while corporation along the line of the strategy was put into effect, it has not yet resulted in the construction of actual manufacturing facilities within the state (Ministerium für Wirtschaft, Mittelstand und Energie 2008:6, 11). This might be the biggest problem which can be identified on first sight. NRW is still exporting specialized technology and know-how to many countries and states, including Pennsylvania. But due to a lack of construction sites, NRW does not have the chance to benefit from on-site, off-site or induced jobs along the supply line. NRW also misses out on economic benefits generated from the ripple effect. In addition to that, regular customers in the wind energy sector relying on NRW's traditional fields of competence seem to reposition themselves: wind turbine manufacturer in Northern Germany started to build its own foundry

as suppliers in NRW do not have the overall capacity to deliver the desired amounts of melted steel (Köpke, 2009). If NRW could attract companies like Gamesa or Iberdrola, the overall benefit through job creation and cluster-building would very likely be immense. But in order to provide incentives, comprehensive fiscal programs need to be formulated – a risky undertaking in the course of a financial crisis. In Pennsylvania, every initiative conducted by the state government with regard to wind energy drew large support from politicians across the aisle and powerful unions in the state. Governor Rendell managed to convince his citizens that every dollar spent on these resources in form of grants, funds or tax cuts for incoming companies is a dollar spent on job creation. However, as Representative Chris Ross outlined, “there was an enormous risk” that all the money spent on incentives would not be enough to catch the attention of international companies.

4. Conclusion

Utilizing the PEG-System as a model and an analytical tool demonstrated that the success of structural change cannot be traced back to random efforts or coincidental agenda-setting procedures, but that it is the result of a sound pattern of actions cumulating into a universal system. Through profound research on the change in commercial structures in Pennsylvania, the study was able find this system and organize it as a threefold, multi-layered pillar structure. The example of Pennsylvania proved that in order to overcome economic downturns and unemployment, programs conducted in all three pillars need to be coherent and attuned to one another.

Having put to test the PEG-System as a measuring device for the success of structural change in the wind energy sector in NRW, and bearing in mind the scientific restraints due limited research options, the following can be stated: with regard to the first pillar, the pretest has shown that NRW was indeed successful in preserving its workforce along the supply chain and establish a commercial branch specialized in manufacturing high quality goods for the wind industry. Despite a decline of interest concerning wind-related energy issues and a decrease in start-up companies, the heightened awareness of the potential of wind energy has eventually led to new initiatives. This path needs to be followed.

In terms of education, new forms of cooperation between universities and companies emerged. Competence centers serve as meeting places, fostering exchange between business and academics. The pretest illustrates that while there is room for improvement with regard to substantial training programs for young professionals as well as the experienced workforce; NRW is on the right track.

Concerning the third pillar, one could identify substantial room for improvement. The government has been very active in the renewable energy field, however has not been able to attract private investors willing to install manufacturing facilities. NRW misses out on the great potential of on-site, off-site and induced job creation as a result of missing construction sites within the state. Thus, it is most notably the layer of ‘providing structure’ which might need to be revised. Jobs are to be found exporting sectors, however the added value flows out of the state; the communities miss out on benefits.

The applicability of the PEG-System now has to be put to the test in various other commercial sectors undergoing structural change. The system can be fine-tuned along the research process; yet this study claims that the three pillars of preservation, education and government remain the major requirements for success. The system allows for differences in perceptions, culture and stages of structural change, but not in alteration of the fundamental model by the omission of one of these pillars.

Learning from the experiences of others is a key to success. The PEG-System may be used as a learning model between states with similar structural problems, measuring accomplishment as well as the tasks ahead.

Bibliography

AGTERBOSCH, Susanne; BREUKERS, Sylvia, (2008). Socio-political embedding of onshore wind power in the Netherlands and North-Rhine Westphalia. Technology Analysis & Strategic Management, Vol. 20, NO. 5, September 2008, 633-648

BUNDESMINISTERIUM FÜR UMWELT, NATURSCHUTZ UND REAKTORSICHERHEIT (2008). Vergleich der EEG Vergütungsregelungen für 2009.BMU: http://www.bmu.de/files/pdfs/allgemein/application/pdf/eeg_verguetungsregelungen.pdf

BREUKERS, Sylvia; WOLSINK, Maarten (2007). Wind power implementation in changing institutional landscapes: An international comparison. Energy Policy 35 (2007): 2737-2750

DANIELZYK, Rainer (1992). Gibt es im Ruhrgebiet eine "Postfordistische Regionalpolitik"?. In: Geographische Zeitschrift 80 (2): 84-105.

DANIELZYK, Rainer & OßENBRÜGGE J. (1996). Lokale Handlungsspielräume zur Gestaltung internationalisierter Wirtschaftsräume. Raumentwicklung zwischen Globalisierung und Regionalisierung. In: Zeitschrift für Wirtschaftsgeographie 40 (1-2): 101-112.

DODGE, Catherine (2009). Steel-Mill Wind-Turbines Show Obama's Right or Chases 'Fantasy'. Bloomberg: http://www.bloomberg.com/apps/news?sid=akjbUdlowd9c&pid=20601087

DORTMUND-PROJECT (2007). Start2Grow Newsletter. Ausgezeichnetes Start2Grow-Team auf Erfolgskurs. Start2Grow: http://www.start2grow.de/downloads/newsletter/start2grow_newsletter_04.pdf

ELDRIDGE, Maggie (2009). American Council for an Energy-Efficient Economy, Testimony before the Pennsylvania General Assembly, House Consumer Affairs Committee, June 4th, 2009

EnergieRegion.NRW (2009). Netzwerk Windkraft. http://www.energieregion.nrw.de/page.asp?TopCatID=11897&CatID=11905&RubrikID=11905

FLOWERS, Larry (2009). Wind Energy Update. National Wind Technology Center, NREL. Presentation at Appalachian Wind Summit – September 23rd, 2009

GAMESA (2009). Company Information - Internal Report. Contact Person: Kurt Knaus, Spokesperson Gamesa USA

GENERAL ASSEMBLY OF PENNSYLVANIA (2008). House Bill No. 2200, 1-79, Session of 2008

GERARD , Leo W. (2007). Letter to U.S. Senate concerning “Energy Independence and Security Act”. United Steelworkers: http://legacy.usw.org/usw/program/adminlinks/docs/07-12-12_usw_Senate_Energy_Compromise_Bill_Letter.pdf

GERARD, Leo W.; ZOI, Cathy (2008). Investing in Clean Energy Would Provide Jobs & Improve Economy. United Steelworkers: http://blog.usw.org/2008/08/31/investing-in-clean-energy-would-provide-jobs-improve-economy/

GOVERNMENT OF PENNSYLVANIA (2007): Governor Rendell unveils Energy Independence Strategy. PA State Agencies: http://www.state.pa.us/papower/cwp/view.asp?Q=459791&A=11

JODZIEWICZ, Laurie (2009). Wind Energy Project Siting. American Wind Energy Association. Presentation at Appalachian Wind Summit - September 24th, 2009

KÖPKE, Ralf (2009). „Die Flaute nimmt zu“ – Gespräch mit Reiner Priggen. In: Energie und Management, Oktober 2009:25

KÖPKE, Ralf (2009a). Stadtwerke auf Windfang. In: Energie und Management, Oktober 2009:25

LANDESINITIATIVE ZUKUNFTSENERGIEN (2009). Zweiter Förderwettbewerb „Energie.NRW“ erfolgreich: 24 Projektideen sollen mit insgesamt 23 Millionen Euro gefördert werden. Energieland NRW: http://www.energieland.nrw.de/_infopool/page.asp?InfoID=8559&find=Wind

MINISTERIUM FÜR WIRTSCHAFT; MITTELSTAND UND ENERGIE (2008). Mit Energie in die Zukunft – Klimaschutz als Chance. Energie und Klimaschutzstrategie NRW. http://www.wirtschaft.nrw.de/zAblage_PDFs/Energie_und_Klimaschutzstrategie_Nordrhein_Westfalen_290408.pdf

PENNFUTURE (2004). Pennsylvania's Advanced Energy Portfolio Standard (AEPS). What does it really mean?
http://www.pennfuture.org/UserFiles/AEPSFactSheetjcfinal1215.pdf

POPOWSKY, Sonny (2009). Pennsylvania Solar Portfolio Requirements: Costs and Benefits. Presentation at 'Solar Energy: Awareness, Challenges, and Opportunities' Conference at Penn State University – May 6th, 2009

REEDSMITH (2008). Pennsylvania's Alternative Energy Investment Act. Client Alert 08-124.
http://www.reedsmith.com/_db/_documents/bull08124.pdf

REDMOND, Fred (2008). Testimony of USW Vice President Fred Redmond before the Select Committee on Energy Independence and Global Warming. United Steelworkers:
http://www.usw.org/media_center/speeches_interviews?id=0008

STOKES, Bruce (2009). The G-20 Can Learn From Pittsburgh. National Journal 9/19/09, p. 62

UNIVERSITY OF BOCHUM (2007). Engineering Unit Ruhr – Synergien nutzen, Kompetenz stärken. Ruhr-Universität Bochum:
http://www.mb.ruhr-uni-bochum.de/sites/allgemeines/eur/Broschuere_EUR.pdf

UNIVERSITY OF DUISBURG (2009). Mit dem Wind auf richtigem Kurs.1. Branchentag Windenergie NRW. http://www.uni-due.de/de/presse/meldung.php?id=1766

UYS et. al. (2007). Optimisation of a steel tower for a wind turbine structure. Engineering Structures Volume 29, Issue 7, July 2007, Pages 1337-1342

USW Newsletter (2008). USW Endorses Rendell's Energy Independence Strategy. United Steelworkers: http://www.usw.org/usw/program/content/4090.php?lan=en

WALKER, Blair S. (1999). Pennsylvania's Electric Deregulation Seen As Success Story. Stateline:
http://www.stateline.org/live/ViewPage.action?siteNodeId=136&languageId=1&contentId=13801

WINDENERGIEERLASS NRW (2005). Grundsätze für Planung und Genehmigung von Windkraftanlagen. Ministerium für Bauen und Verkehr, Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz, Ministerium für Wirtschaft, Mittelstand und Energie, Düsseldorf.

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