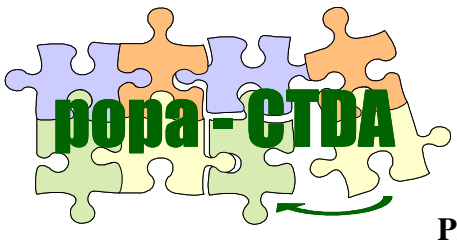
Appendix 4. WP1 - Deliverables D1-D4



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Deliverable 2: "Survey of Barriers and Drivers to innovation on environmental technologies in the European New Member States"

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Content

1 Introduction

The New Member States (NMS) have gone through a notably different path of economic development than those of the EU15. Due to the complex, in-depth socio-economic system change from totalitarian Communism to Capitalist democracy, from 1989 (and still on), many of the formerly artificially induced, inefficient and polluting industrial and other economic sectors and their installations have got phased out and shut down. This actually resulted in the improvement of environmental performance of these economies in transition, which can be traced e.g., in their air pollution and CO_2 emission relevant information collected since 1990. Some of them (e.g., Hungary) have already met the Kyoto targets, "simply" because of their "collapsed" or significantly reduced heavy (e.g., coal and metallurgical) industries.

On the other hand, many of the inefficient and heavily polluting business operations have been (and are still) kept running, mainly because of social (employment) and other strategic macroeconomic (e.g., energy security) considerations.

Compared to the overall size of these Central East European (CEE) economies, a substantial scale of new, mainly foreign, investment have taken place in the restructuring process, which is still on. This rendered the ownership, thus the control and potential to make strategic decisions, such as investing into high-tech and competitiveness, especially of the larger companies in these countries, rather complex and difficult. Regrettably the influx of new investment have not always considered duly environmental (and long-term economic) performance, creating a less robust, non-strategically planned and managed system, in which R&D and eco-innovation processes – logically - struggle. In the restructured CEE economies very few foreign owned daughter companies afford own R&D; it is usually just adopted from their foreign parent companies, if at all. In fact R&D had been strategically removed from many of these CEE companies, thus respective decisions on investing (or not) into technology development are rarely made in these countries anymore.

Naturally this situation had seriously impacted our potential to collect useful information in these countries, especially on such cutting edge and/or prospective technologies as stationary fuel cells, white-biotech and biorefineries.

There are also other factors, and differences compared to Western Europe, affecting the penetration of advanced cleaner technologies in the NMS. For instance, the public opinion is to a far less extent interested in environmental protection in this region than in many Western European countries. Further, many of the small and medium size enterprises (SMEs) are run simply to (desperately) avoid unemployment, and not as a result of natural entrepreneurial drive and ensuing attitudes. Moreover, the democratic institutions of the region are also less mature, causing substantial unnecessary administrational and regulatory burdens to business developers and microeconomic decision-makers. The use of taxes and other economic instruments is rather complicated and inefficient, and are rarely optimised to drive eco-innovative behaviours. The national and international financial community in CEE is just in the process of starting to develop special programmes dedicated to innovation and to environmental investments; and sometimes these new initiatives are missing their original objectives, due to various reasons, including the lack of expertise (e.g., in sound environmental management, sector specific risk analysis, etc.), non-transparency and corruption, and lobby interests.

Therefore when studying the attitudes towards the adaptation and associated behaviours to the diffusion of environmental technologies in these CEE economies the researcher finds it rather difficult to merge information collected here with the information collected in the more advanced Western European economies.

Consequently, in this summary report of POPA CTDA/WP2 we present a separate summary of the studied environmental technology diffusion situation in the NMS, in order to identify the significant differences between EU15 and NMS, with the aim of assisting tailor made policy recommendations for these economies to spread the use of cleaner technologies, to achieve the best utilisation of available European solutions, taking into account the specific situation in the NMS, and thus contribute to the potential policy paths aiming at the improvement of overall EU competitiveness and environmental performance.

2 Methodology

In the information acquisition phase, via the literature review, the expert interviews and then the standardised, technology specific, questionnaires, we have recognised the major differences in the drivers and barriers of environmental technologies, as well as in their level of penetration, between NMS and EU15. The number of meaningful, technology specific responses has been (due to this research being designed appropriately for the industrially and economically well developed countries) far lower than those from the Western States. The table below shows the number of responses resulting from our intensive survey activities in the NMS.

	Interviews			**Questionnaires**		
	Target	Result	%	Target	Result	%
A biofuel	2	2	100	13	12	92.3
A biorefinery	2	2	100	13	-[1]	-
E energy efficn.	2	3	150	13	4	30.8
E renewables	2	2	100	13	8	61.5
I biotech	2	2	100	13	2	15.4
I hydrogen tech	2	2	100	-	-	-
I general indust.				13	3[2]	23.1
T park & ride	2	2	100	13	10	76.9
T clean vehicles	2	2	100	13	5	38.5
Total	**16**	**17**	**106.25**	**104**	**44**	**42.3**

The attitudes and behaviours of decision-makers on the adaptation of environmental technologies have also indicated different patterns in the NMS than in the older EU states.

Therefore the aggregation of information collected in the NMS would have introduced more "noise" than meaningful information to the various technology specific statistical analyses. It made more sense, from the point of view of this study, to analyse this region somewhat differently, taking into account the specificities mentioned in the introduction.

[1] Biorefinery applications are not available in the region; instead, more effort was made on biofuels.
[2] Industrial fuel-cell applications are not available in the region; instead, questionnaires were received from general industry.

2.1 Constraints of studying certain advanced technologies

Already during the literature review it became clear that some of the environmental technologies, selected as subjects of the POPA survey, to study across the EU, would be difficult to assess in the NMS. Such technologies as *stationary fuel-cell* applications, advanced *biorefinery* technologies, as well as *white biotechnology* (*i.e., non-GMO using industrial biotech applications – a criteria the POPA Consortium has originally agreed upon, aiming at studying non-controversial "environmental" technologies*) are currently non-existing, or, at least, are far from commercialisation in these countries. Thus it is also hard to find active organisations and their strategic and practical decision-makers, as well as interested stakeholders or knowledgeable experts of these fields in the region, let alone conducting a larger sample survey there on the relevant strategic business decisions, their underlying behavioural processes, and thus the prospects for these technologies.

As to *hydrogen-fuelled industrial stationary fuel cell installations* there is no one dealing with it in the NMS. There is only one 300 kW stationary fuel cell installation - fuelled by biogas - at the Nitra University in the Slovak Republic (source: Worldwide Fuel Cell Installations, by FuelCells2000, http://www.fuelcells.org/info/charts.html, 18 October 2005).

There are only a couple of dozen traceable companies and research institutions in the NMS interested in fuel cell technologies. They are mostly active in the small size solid oxide fuel cell applications, or produce auxiliary applications like air delivery systems for fuel cells; and there is no organisation active in the field of large scale stationary hydrogen fuel cell application (source: Industry Directory on Fuel Cells, http://www.fuelcelltoday.com/FuelCellToday/IndustryDirectory/IndustryDirectoryExternal/IndDirectListCountry/0,2284,224,00.html).

It is important to realise that only about 10 per cent of the stationary fuel cell projects worldwide are developed in Europe; our continent lags far behind the US and Japan in this area. The stationary fuel cells in Europe are installed mostly (60% of them) in Germany, some (20% of them) in Italy, and a few more applications are in the Scandinavian countries, in the UK, and in other Western European countries (source: Fuel Cell Today Market Survey - Large Stationary Applications, 2 November 2005,

http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Reports/DisplayReport/0,1620,1046,00.html?Category=Survey).

Based on this status, this industrial technology has been dropped from being further studied in the NMS.

We have conducted interviews with some field experts of the *biotech* and *biorefinery* sectors, who informed us about the reasons for these technologies being so far from commercialisation in the NMS. A sample of results from these interviews is presented in the boxes below.

Biotech interviewee (professor at a prestigious CEE university) pointed out that the current (2005) state of white (industrial) biotechnology solutions across the CEE region is embryonic or non-existent, and that "*advanced biotechnology is used rather in the medical and pharmaceuticals industry"* (that is red biotech) in this region. He said that pharmaceutical industry, in general, is spearheading biotechnology. According to him, market and technological possibility for smaller scale white biotech production in CEE is very limited. Most of the products are manufactured on a few sites in Western Europe, providing sufficient amount of products (e.g., enzymes) for others, including the users, the producing companies in CEE. He also mentioned, that the general fears of society (i.e., association of any biotech with GMOs and genetic engineering are the first thoughts) is not a supportive environment for the uptake of biotechnology, in general.

Other biotech interviewee (expert at a CEE biotech company) added that the initial capital for research, uptake and product licensing is "*horrible*" in red biotech. Usually some smaller research groups are spearheading the process, but later, large multi-national companies are buying them up and running for license or patent. Synthetic industry has patented products under license for 20 years, so they have the interest to make profit out of these products.

Biorefinery interviewee (professor at a prestigious CEE university) responded on the state of biorefinery solutions across the CEE region that "*real cutting edge biorefinery does not exist in this region*". Although skills and abilities are generally available, only some alcohol producers, sugar processors and glucose manufacturers (e.g., in Szabadegyháza, Hungary, the Isoglucose Factory, which, unfortunately, has not replied our questionnaires) have biorefinery technologies, but these are rather traditional processes, having no environmental objectives. Engaging in biorefinery, in CEE, is mainly a matter of using the technology already available at companies. The income to be potentially generated by advanced biorefinery technologies in CEE would not cover the necessary investments of those new technologies. The subsidization of polluting products and processes are against the diffusion of cleaner technology innovations; presently synthetic products are cheaper options than refined bio-products, due to the economic instruments and to legal constraints. She pressed that the lobby of "synthetic" industry is also a strong barrier for the uptake of cleaner bio-technologies.

To a less extent, but difficulties of finding respondents to our survey were encountered in almost all sectors studied, partly due to the region specific situation of lacking enterprise ownership, thus the potential (and need) to make strategic decisions on microeconomic level, on investing into higher, better, more competitive technologies; and partly due to the research design that has not allowed for in-depth studying of this region.

2.2 Design of questionnaire survey

The original approach of using English language in extensive, long set of questions, loaded with technical jargon, via technology and, in some cases, stakeholder specific questionnaires, has resulted in very low (almost none) response rates everywhere. Moreover, the administration of questionnaires via the Internet has been considered far too complicated to complete by most companies and other organisations, and just added to this unfortunate situation of no responding. While experience from the Old Member States has shown that response rates were very low on the survey using this approach, in the NMS it has produced close to zero response.

In turn, the consortium has decided to alter the approach, many partners have translated the questionnaires to their local languages, and instead of relying on the Internet based responding, the sample had been contacted directly by telephone, and the questionnaires have been fielded to the receptive organizations either via e-mail or mailed hardcopy.

In addition, recognising the specific difficulties, for the NMS a shorter (but compatible) version of unified questionnaire has been developed (see it annexed to this report). It's been also decided that the survey in the NMS should not focus necessarily on the selected technologies, but rather deal generally with environmental technologies in the four selected sectors of this study: industry, agriculture, energy and transportation. This refined/simplified questionnaire then has been translated into Czech, Hungarian and Polish. The REC network has been mobilised, hundreds of organisations have been called and asked, sometimes several times, to respond.

From this point the response rates have improved significantly, and allowed us to receive a slightly higher number of completed questionnaires than that of the

consortium partner average surveying the Old Member States (42 per cent of the planned).

With the exception of advanced biorefinery technologies all the originally selected technologies have been touched upon by the completed questionnaires; however industrial hydrogen fuel-cell applications have been substituted by fuel cells in general, while white biotechnology has been substituted by biotech in general.

From the 873 stakeholders that have been approached to complete the survey 44 completed and returned it.

This number of response on 104 fields (in the simplified questionnaire) to analyse does not allow for a justified statistical interpretation. Incorporating these responses, a more sophisticated statistical interpretation might be done at the EU-25 level; however, in this report we have only applied semi-qualitative analysis.

Words of caution:

- The sample cannot be taken as representative, since collecting the answers was only possible from a continuously increased and shifted sample; where respondents were assumed to be among the more proactive, innovative organisations.
- Attitudes surveyed cannot be interpreted as objective facts on the barriers - it would be necessary to further assess whether these barriers or only their perceptions exist.
- Data should be handled with the precaution that companies might have systematically altered their scores in order to improve their image (e.g., giving higher than realistic scores on positive attitudes towards innovation, and/or lower scores on their perception about the environmental risks posed by the technologies used in their field) or to represent their business interest (giving lower scores on economic feasibility, in the hope of potentially pressuring the increase in the level of financial support by their national government or the European Commission).

3 Attitudes and expectations concerning the engagement in environmental technologies

3.1 Environmental risk perception

The respondents were asked to answer question of how they perceived the environmental effects generated by their company, the technologies used in their business. The results are summarised in Figure 1.

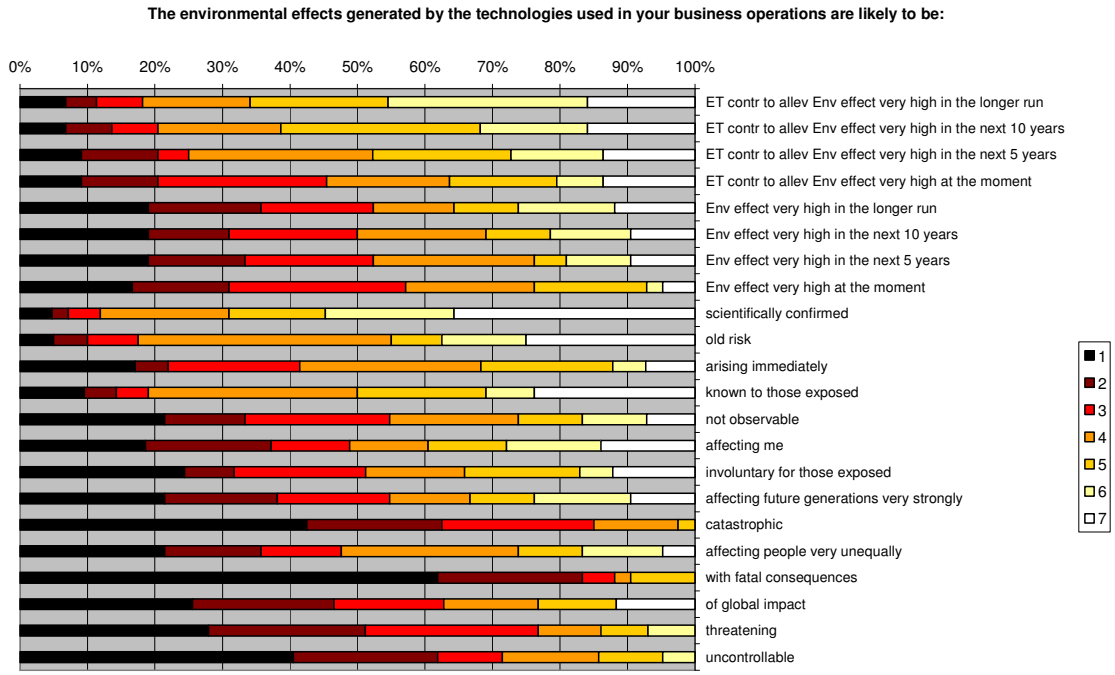

Figure 1: Frequency of response to the questions concerning environmental risk perception. Scores range from 1 (very weak perception) to 7 (very strong perception).

The majority of respondents do not find the environmental effects of their technologies being serious. Even in the longer run the majority thinks environmental effects will not be serious. How honest these answers were, it is hard to guess.

Only three categories got higher than '4' scores by the majority. These are that environmental effects are:

- Scientifically confirmed (average: 5.36)
- Old risk (average: 4.75)
- Known to those exposed (average: 4.62)

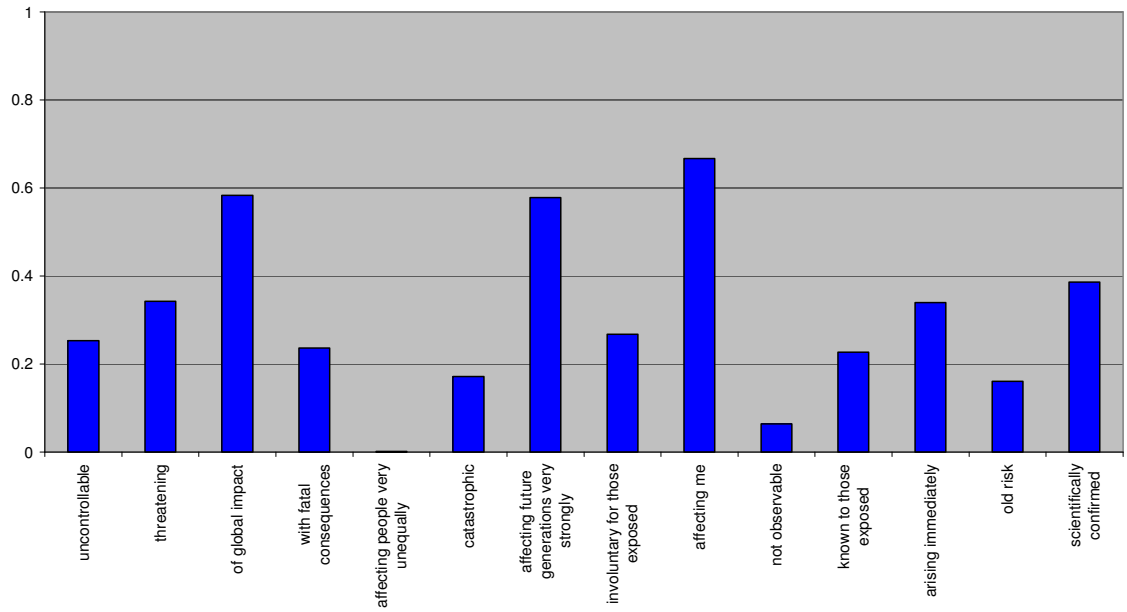

Figure 2: Correlation of environmental effect and its features

From Figure 2 it can be seen that respondents regarded an environmental effect serious if it:

- affected themselves,
- had global impact, or
- affected future generations.

This indicates the impact of personal involvement on risk perception, as well as, indicates an understanding of sustainability concerns, while not considering seriously enough the impact of local pollution.

3.2 Perceived economic risk

Another dimension of the general attitude to environmental technologies (ET) is the perceived economic risk, thus the respondents were asked about their opinion on the benefits and the risks of adopting ET. The results are shown in Figure 3.

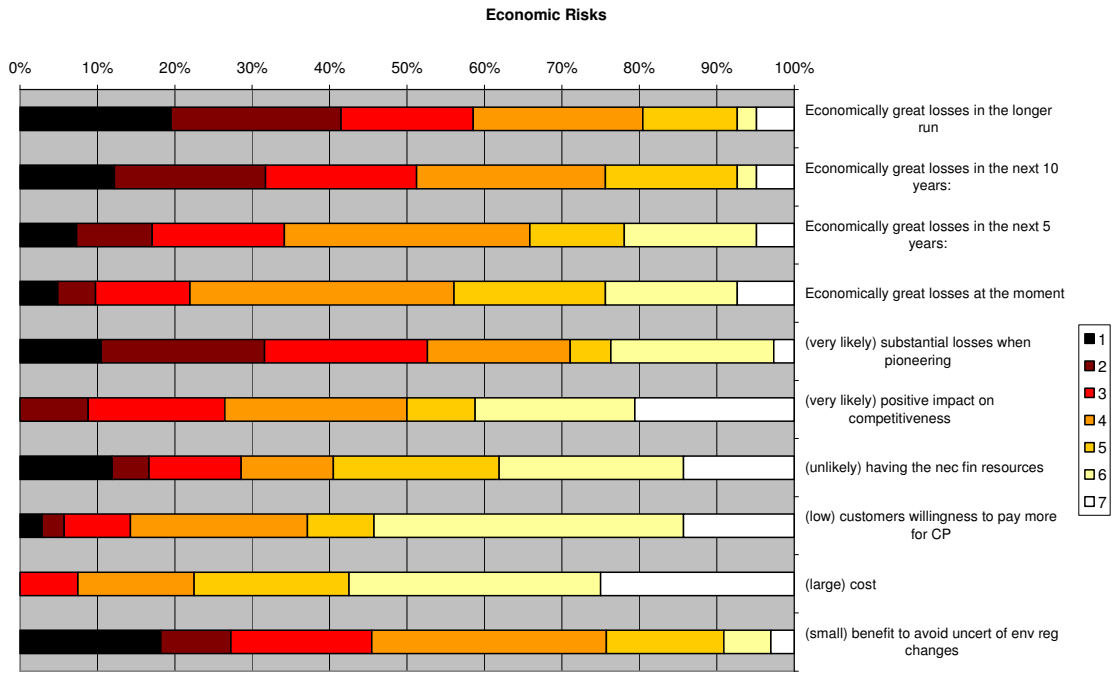

Figure 3 Frequency of responses to the questions concerning the perception of economic risk. Scores range from 1 (low risk) to 7 (high risk).

Most respondents thought that introducing ET would cause economic losses. Nevertheless, in the next 10 years and on the longer run more respondents think that introducing ET will not cause great economic losses.

More than 60% of the respondents think that the consumer's willingness to pay more for cleaner products is rather low, and almost 80% consider the respective costs rather large. Around 60% answered that it is rather unlikely to have the necessary financial resources for this kind of investment.

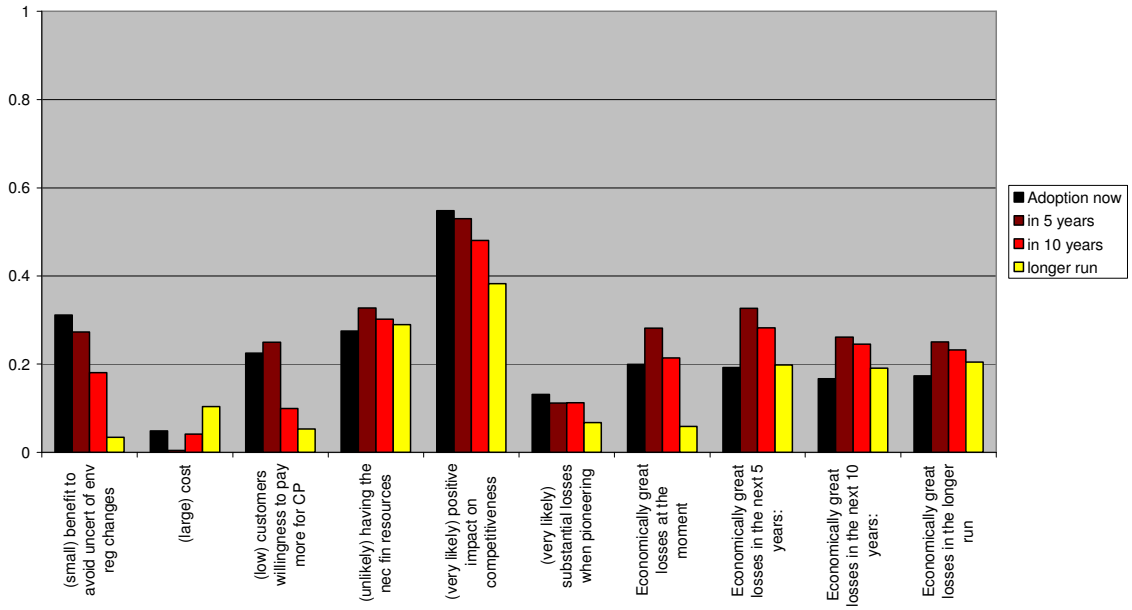

Figure 4: Correlation of economic risks and adoption

The willingness to adopt ET has correlated at the highest level with the perception of positive impact on competitiveness. Those respondents who think ET leads to competitiveness have higher rate of expressed willingness to adopt those technologies. It seems that the real driving force for these respondents is competitiveness.

Nevertheless, when comparing this information with the one gained from Figure 3, where the same respondents express their concerns about high investment costs and the risk of losses due to investing into ET, one can wonder how well they understand the nature of smart business. If ET is seen to improve competitiveness than it should not be associated with financial losses, or if investing into ET is perceived to result in losses, surely they cannot be perceived as contributing to increased competitiveness.

4 Willingness to comply with social norms

4.1 Perceived market pressure

The third section of the questionnaire assesses the perception of signals from the market. The summarized results can be seen in Figure 5.

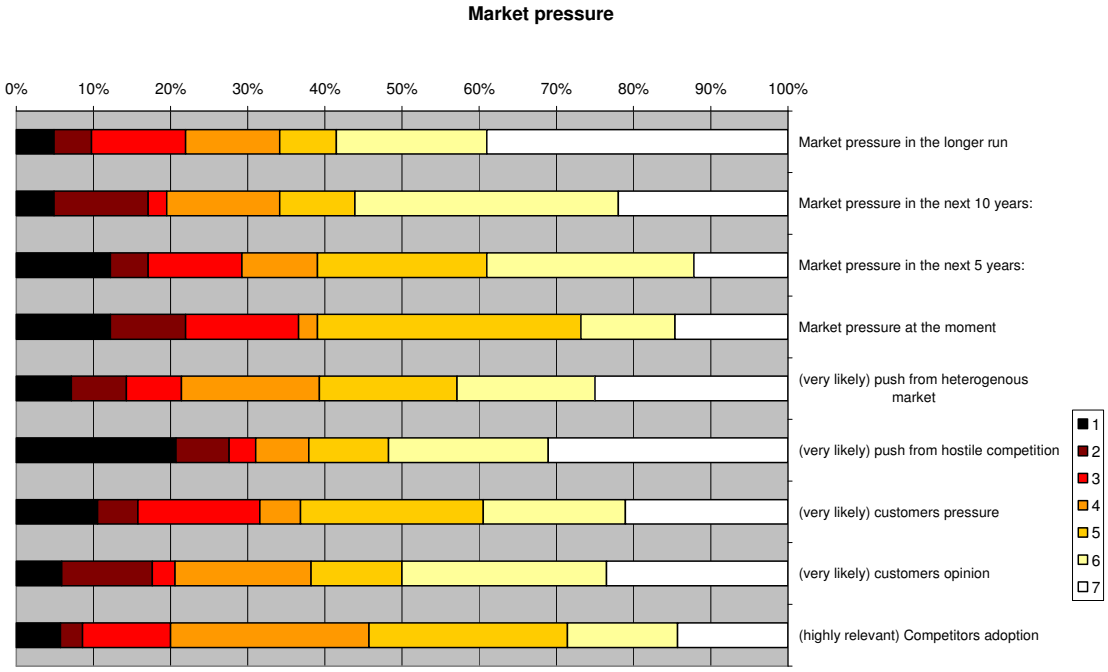

Figure 5: Frequency of response to the questions concerning market pressure.
Scores range from 1 (very unlikely/low pressure) to 7 (very likely/strong pressure).

Around 60% of the respondents found market pressure is rather relevant in introducing ET. Only 20% of the respondents have not found competitors adoption "highly relevant".

The different elements of market pressure have been judged very differently by the various respondents. This might be explained by different conditions in the different market segments the responding companies are active in, or by the inadequate knowledge of the situation.

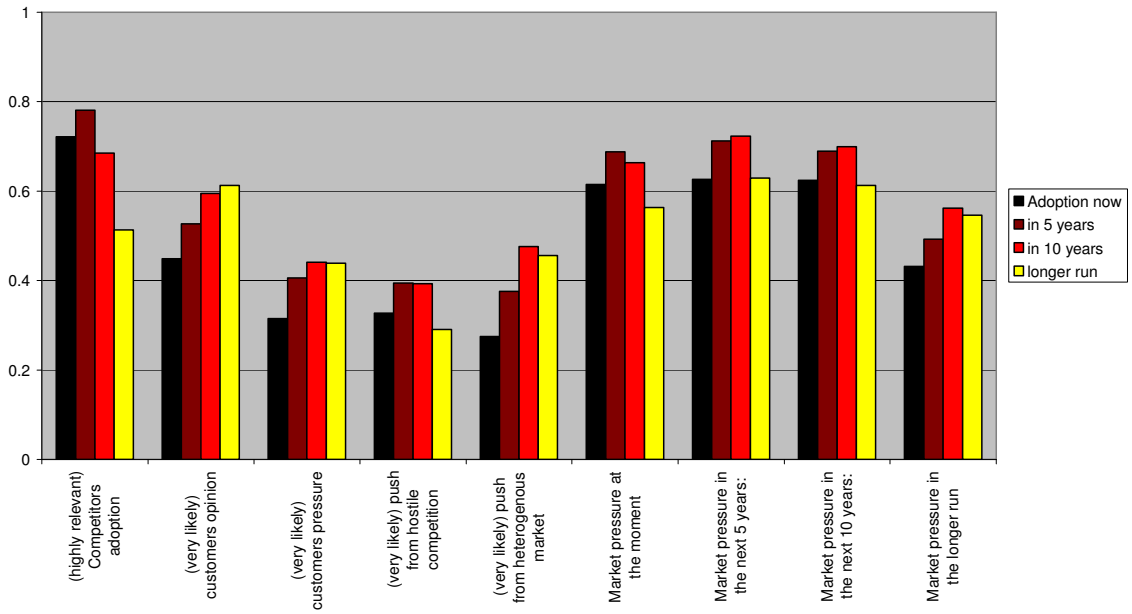

Figure 6: Correlation of market pressure and adoption

Figure 6 shows that the willingness to adopt ET has correlated at the highest level with the perception of relevance of competitors' adoption; while the perceived pressure from customers seems to be rather low.

4.2 Perceived community pressure

The aim of this section of the questionnaire was to assess other forms of pressure form the socio-cultural environment. The frequencies of the answers can be found in Figure 7.

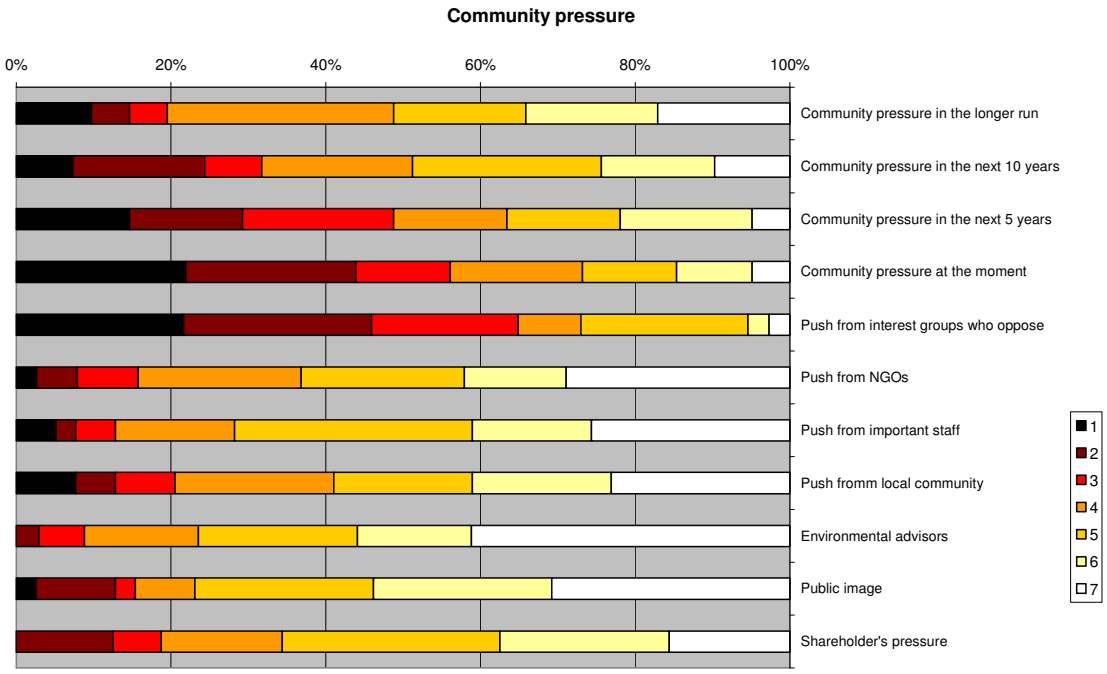

Figure 7 Frequency of responses to the questions concerning the perceived pressure from the community. Scores range from 1 (very weak) to 7 (very strong)

While all stakeholders are perceived pushing the adoption of ET, according to the respondents' opinion, community pressure, with its average score of 3.24, is generally not regarded an important factor at the moment.

This will only slightly change in the future, according to the respondents, and only in the longer run, the majority thinks, community pressure will be an important factor. Interestingly respondents have found the role of opposing interest groups little. This contradicts with the opinions gained through the interview phase. Nevertheless the importance of community pressure, in general, seems to be similarly low in the responses. Thus while the respondents indicated higher pressures from certain stakeholder groups, this does not correspond with the overall actual pressure ability of those stakeholders. For instance, public image and NGOs are scored high as pressuring towards the adaptation of ET here; however, company decision-making focuses much rather on internal pressures, as Figure 8 indicates.

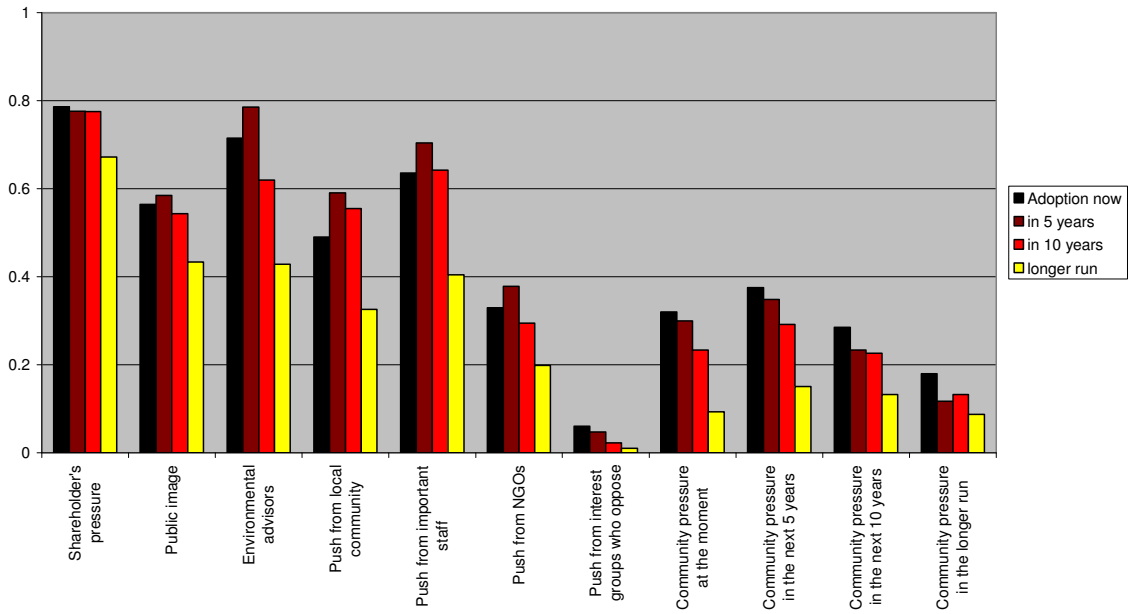

Figure 8: Correlation of community pressure and adoption

As Figure 8 indicates only the perception of push from shareholders, environmental advisors and important staff correlate highly with the likeliness of introducing ET in the companies. Therefore, in fact, only internal pressures seem to be important when taking the actual decision. This could lead to interesting questions about the (perceptions of the) state-of-mind of company decision-makers, about the sophistication level of markets and of democracy, as well, in these countries.

4.3 Perceived regulatory pressure

The questionnaire has also assessed the influence that regulatory institutions are perceived to have on the decision of companies towards adopting ET. The frequencies are presented below in Figure 9.

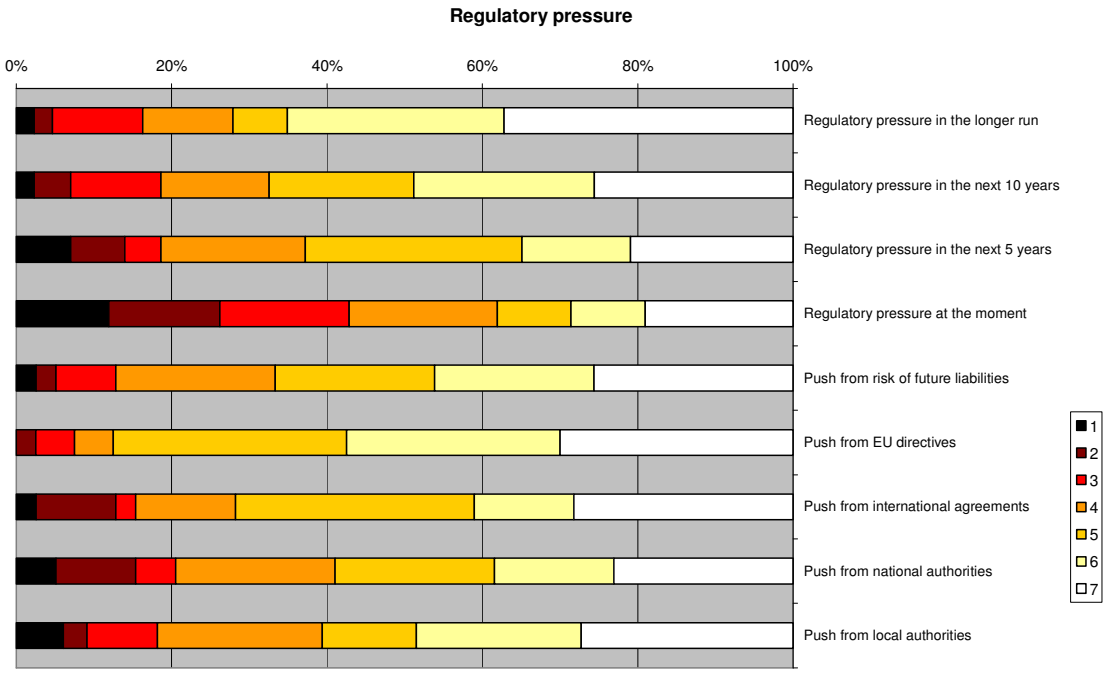

Figure 9 Frequency of responses to the questions concerning regulatory pressure.
Scores range from 1 (very low pressure) to 7 (very strong pressure)

The most important source of regulatory pressure perceived by the respondents is the push from EU directives. On the contrary at the moment only around 40% thinks regulatory pressure is rather relevant in driving the adaptation of ET. Is it because regulators in NMS do not understand the need for this pressure? Or is it because they do not want to pressure the companies? Nevertheless the general perception is that in the future, even in 5 years, this pressure will be more important.

5 Control over the innovation process

5.1 Technological capability

The respondents were asked about the technical and organizational capabilities that are needed to produce energy efficient buildings. The distribution of the scores assigned to the questions is shown in Figure 10.

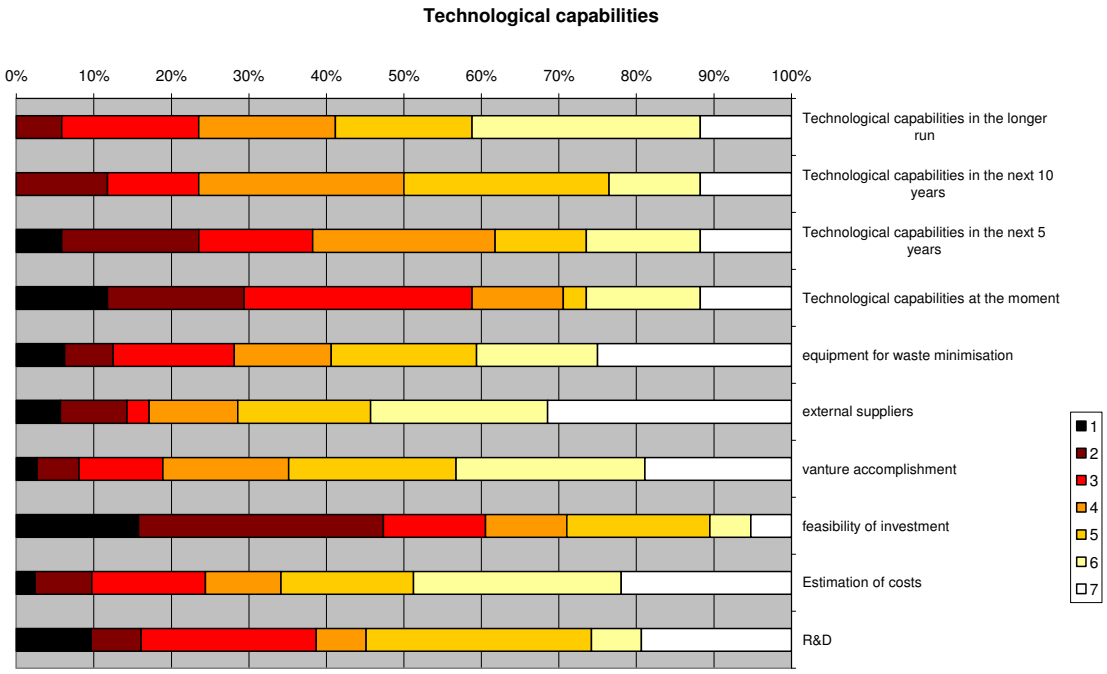

Figure 10 Frequency of responses to the questions concerning technical and organizational capabilities. Scores range from 1 (very low capabilities) to 7 (very high capabilities).

The majority of the respondents have perceived generally high technological capabilities in their company to adopt ET. An exception was the economic feasibility of the investment, where more than 60% think their company is rather incapable of carrying out the necessary investment. Or, alternatively, they might have indicated their concerns about the potential return on such investment(s).

Generally the majority think at the moment they are technologically not capable to adopt ET, but in 10 years they will be.

5.2 Organisational learning

Internal capability to integrate and generate new knowledge concerning ET was also assessed. Learning processes and knowledge issues were pointed out in the interviews as key factors. The frequencies of the answers to the questions are represented in Figure 11.

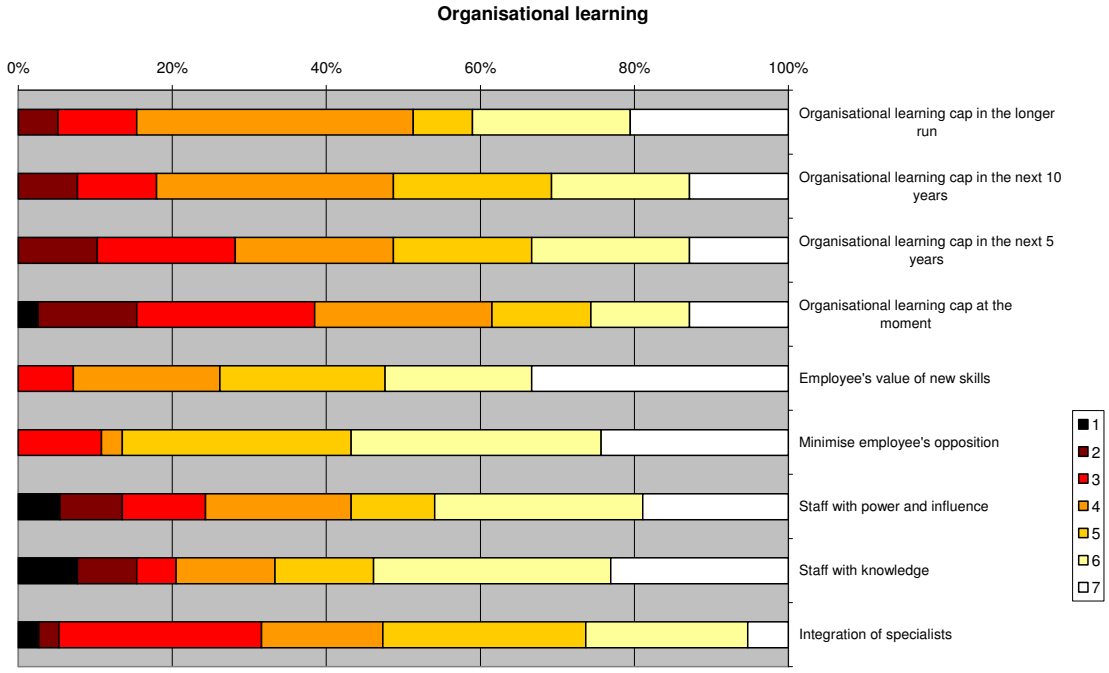

Figure 11 Frequency of responses to the questions concerning organizational learning. Scores range from 1 (very low) to 7 (very high).

Most respondent have found the organisational learning elements rather favourable for the adoption of ET in their companies. Still more than 30% answered that integration of specialists is rather difficult.

Generally at the moment less than 40% found that the organisational learning capabilities are favourable in the company. In the future only a slight improvement is perceived.

5.3 Formation of networks of collaboration

The next aspect of the control over innovation is the formation of networks for collaboration to enable adopting ET. The distribution of the relevant scores is shown in Figure 12.

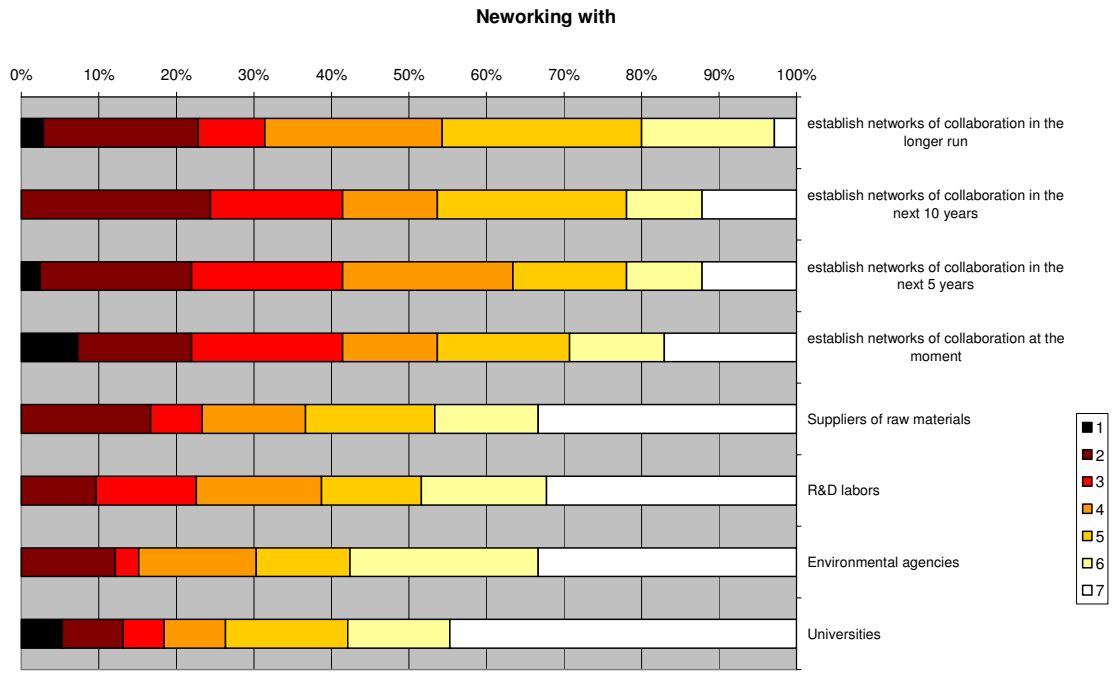

Figure 12 Frequencies of responses to the question concerning the formation of networks of collaboration. Scores range from 1 (very unlikely) to 7 (very likely).

While the majority of respondent have answered that generally it would be easy to establish collaboration networks with universities, environmental agencies, R&D institutions and suppliers of raw materials, only minority thinks that actually it will be easy to establish at the moment or in the future. Alternatively, respondents might have understood that the formation of the networks would have positive influence on ET adaptation; however they haven't foreseen it happening. Perhaps so, because they have not perceived the diffusion of ET that important for their future success.

Such inconsistencies between the answers given to the general and the concrete questions are widely seen throughout the survey.

6 Summary of and some rational for the questionnaire results

From the perceptions, or rather from the reported answers, which may or may not fully represent the true perceptions of the respondents, **environmental risks** are **accepted** (scientifically confirmed: 5.36), but **not found serious** (neither now nor in the future). The perception of environmental risks strongly correlated with personal involvement ('affecting me') – in-line with the world-wide known not-in-my-backyard approach.

The adoption of ET was perceived as **causing high economic losses**. Most respondents think that the necessary investment costs of ET are too high; they do not have the necessary financial resources, and the **consumers are not willing to pay more** for cleaner products. Surely, the markets of the NMS are rather cost sensitive; however, the costs of most consumer products are already at the level of most European countries, while companies have not yet widely invested into the higher and cleaner technologies. The "productivity" of these countries and their companies are still strongly reliant on cheap labour, regardless of any contradicting claims of these states.

Those who thought adoption of ET leads to a positive impact on **competitiveness** have favoured more the adoption of ET, thus competitiveness might be used as an efficient keyword to change the perceptions of micro level decision-makers in the NMS. Nevertheless, the perceived high investment costs and ensuing risk to financial loss, associated with ET, indicates that the companies in NMS are not easily convinced that investing into ET will eventually improve their performance, productivity and thus financial bottom line.

This might have also led them to statements on their operations causing low and acceptable/accepted environmental (and public health) risks.

While most respondents generally **recognised stakeholders' wish** to adopt ET, they generally **do not think community pressure is an important factor**. The companies in these countries do not seem to be sensitive to customer/market needs and demands (let alone the demands of citizens being directly affected by the industrial operations), but run on their own, as did in the command & control socio-economic system. Only

the perception of push from shareholders, environmental advisors and "important staff" correlate highly with the likeliness of introducing ET.

The most important source of regulatory pressure perceived by the respondents is the push from **EU directives**. This might be due to the systemic lobby work industrial associations are doing to raise the awareness of companies about the "harmful" restrictions the EC has been or is about to introduce(d), to put companies, especially in the lower developed NMS, into competitive disadvantage. However, at the moment **only around 40% thinks regulatory pressure is rather relevant**. This might come from the sad truth that regulators hardly get tough on misbehaving companies in this region. (Might corruption has something to do with this?)

The majority of the respondents have perceived generally **high technological capabilities** in their company to adopt ET. An exception was the **economic feasibility of the investment**, where more than 60% think their company is likely **not capable** to carry out the investment. Generally, the majority seem to think that, while they've got good skills, at the moment they are *technologically* (?) not capable to adopt ET, but in 10 years they will become so. In fact there is an overall perception amongst NMS experts and managers that the quality of education and thus the technical/scientific intelligence of the workforce are second to none in the world. This has been confirmed by the numerous foreign investors in the region, and by the hundreds of thousands of NMS workers having sought employment in recent decades across Europe, North America and beyond. In fact it is very likely that *economic feasibility of the investment* has not been understood as a proper factor for *technological capabilities*. The general perception and attitude in these countries is that "we could do anything, we could compete with anybody, having sufficient amount of capital to invest wisely". And this is also true, companies of NMS are not (yet) capitalised comparably to their Western competitors. Plus, besides having the proven high technical skills, the improvement of advanced (both micro and macro level) management skills is still a high demand in this region.

Most respondents have found the *organisational learning elements* rather favourable for the adoption of ET in their companies. However, **more than 30% answered that integration of specialists is rather difficult**. Generally, at the moment less than 40% found that the *organisational learning capabilities* are favourable in the company, and in the future only a slight improvement was perceived. So while the majority of

respondents have answered that it would be easy to establish collaboration networks with universities, environmental agencies, R&D labs and suppliers of raw materials, **only minority thinks** that it will be **easy to establish such network** at the moment or in the future. As previously mentioned in the respective section, this might be due to the respondents thinking of "it could be easily done, but will not likely to happen", since investing into ET is not considered an important and profitable deal.

While these inconsistencies are prevalent between the answers given to the general and the concrete questions, both answers indicate important messages. For example, definitely there is recognition of the importance of ET application; however, either to improve the companies' image or to avoid potential responsibilities at the concrete questions, the answers could alter to the positive or negative directions. Such inconsistencies, in all cases, show an internal conflict of the respondent: while he/she is clear on what should be the right answer in case of either the general or the concrete answer he/she answers tactically. This raises the attention of the researcher to issues to be resolved.

7 Results from the interviews and literature review

7.1 State and fossil fuel lobby – "no hope for green carbon resources"

Disclaimer: Under sections 7.1 and 7.2 the perceptions of the interviewed experts, from different sectors, are sampled. Their opinion is reported - unchanged. Claims of immoral or illegal activities are difficult to prove and thus presented as opinions from anonymous sources. This anonymity was guaranteed to respondents before completing the interviews.

Basically all interview respondents have answered that the major barrier to environmental technologies is the powerful fossil fuel (and synthetic industry) lobby. This response has been heard from ministry high officials, think tanks and university researchers, NGOs, SMEs and even multinationals having close contact with the fossil fuel industry. Besides the fossil fuel lobby in general, the oil & gas and the coal lobbies have been spelled out. Lack in the ET diffusion (across the world) across the sectors of agriculture, energy, industry and transport have all been connected by these claims.

According to the respondents the fossil fuel lobby is using different channels. These include direct campaign against some application in the mass media, pressure on government not to create favourable legal conditions, and "independent" experts paid by fossil fuel groups.

For example in **Poland** there was a large scale debate on the use of **biofuels** with high mass media interest and a generally supportive atmosphere. In this debate, according to the expert interviewed, oil companies, car manufacturers and their paid experts stated that biofuel is damaging the internal combustion engines we have, and thus producers will not provide guarantee on the engines operated with biofuel. After the mentioned mass media event neither the Ministry of Agriculture, nor of Energy and of Environment wanted to have the responsibility for the transposition of the Biofuel Directive. So it is now in the responsibility of the Ministry of Infrastructure, where probably the necessary expertise (and commitment) is lacking. Experts agree that the success of the Biofuel Directive will depend on the way it is transposed.

In **Hungary** there is a widespread illegal practice of filling kitchen oil into diesel-engine trucks and machines. As a result to this practice the state has mobilized its customs and tax officers to check on the use of any biofuel, and fine the excise tax (ab)users. This has caused some awkward situations when Hungarian and even foreign drivers have been stopped and harassed for hours and days as coming in from Austria, where they've tanked the state controlled, biofuel mixed diesel at the petrol stations there. In Hungary there is still excise tax on **biofuels** except for the amount, which is mixed in the standard fuels at a very low (0.7%) level. This provides monopoly situation for MOL (The Hungarian Oil and Gas Company) to be on the biofuel market and limits the use of biofuel to a very low level. In the meantime a Hungarian company (Biofilter) collects used frying oil, and after refining they export it to Austria, because in these circumstances it is not feasible to enter the Hungarian fuel market.

Among energy experts it is widely believed that **measures to implement the RES-E directive are purposely ineffective** and the states are not committed to achieve the national targets in some countries (namely in Poland and in Hungary), as a result of the pressure or cooperation (involving some special interests) with the fossil fuel lobby. Some of the specific issues mentioned include the long-time non-existing sanctions on non-compliance with the quota system in Poland, or the low, non-differentiated and short-term guaranteed feed-in-tariff system with complicated permitting procedures in Hungary; the latter has been changed to a more favourable situation recently. Nevertheless Hungary has recently introduced a new barrier to renewables, i.e. in the form of the obligatory production forecasting and concrete energy feed into the mains - in quarter hour increments! One can imagine that this creates absurd difficulties to wind and solar energy investments, since high fines need to be paid in case of failing to keep the forecasted production amounts.

Even in case of energy efficiency technologies there are administrative barriers. "Recent **Hungarian regulations make practically impossible** the promotion of **environmentally preferable technologies, which are based on local or reused resources** (like insulations made of reed, hemp, straw or recycled paper) by the compulsory permitting of local material sources for all size, even for domestic use." There are some practices to permit these building materials in Germany (sic!) at certification institutes, transporting larger volume materials on long distances. This

practice makes their use much more expensive and causes unnecessary environmental pollution.

7.2 Other barriers

The rest of the barriers mentioned during the interviews are mainly related to the above major reasons of fossil business and awkward policies, as well. These are the **cheap and subsidised fossil fuels, the low level of financial support, and the lack of information and media interest**.

Probably more relevant to New Member States, a specific barrier mentioned was the fear from (any) change. Even the recognized outdated approaches and technologies are rather maintained than investing into something different. This is likely due to the much less **entrepreneurial attitude** in the companies of these countries than in those among the Western European companies. This is probably why the respondents have found the risk of first step effect on the market often a decisive barrier.

7.3 Information from literature review

Results of the MEDREP Pre-feasibility Study, Development Context (REC, 2005a) have identified opportunities and threats in different domains for renewable energy and energy efficiency technologies in the region. The results are presented in the table through the next pages.

	Opportunities	Threats
Social	Educated engineers and technical labour-force is available in most of the NEMED countries. Emerging environmental awareness in the region contributes to a broadened acceptance and emerging recognition of RES technologies. Exploitation of modern RES technologies is an opportunity to address other environmental concerns such as land degradation, biodiversity, air pollution and human health problems. Emerging RES markets create new, higher value added employment opportunities – e.g. R&D and systems engineering and management.	Inadequate local education and expertise on RES utilization and potentials; rather poor level of planning and management capabilities. Low public acceptance for some RES installations (e.g. windmills) in some of the countries. Limited access to environmental information and RES benefits. Limited public pressure on policy makers to drive economies towards cleaner energy generation solution. Emerging RES utilities may cause shortfalls in fossil energy generation relevant jobs, e.g. in coal mining, and cause regional unemployment crises, therefore prevents governments to bravely opt for shifting to RES.
Economic	Ambitious plans to initiate national financial support schemes for RES. RES technologies represent a huge market potential. RES resources are being traded worldwide and increasingly considered international commodities. Energy prices are expected to increase significantly in high potential countries. RES related R&D and investments can cause middle and long term economic growth. RES technologies contribute to energy security, since they are based on domestic resources. Particularly heat energy options can dramatically reduce the cost of imported sources. RES innovation allows undeveloped regions to bypass some of the energy supply and demand patterns of the industrialized countries. New renewables are not subject to the economic insecurity created by the volatility of commodity prices, particular for fossil fuels on the global market. Most of the NEMED countries face continuous inflow of FDI that could drive the RES market as well.	Emerging RES utilization is still insufficient to satisfy growing energy demand. Financial risks due to inadequate support schemes and investment climate. No advanced economic instruments to leverage private sector investments. Existing public sector financial support schemes are often unsuitable to stimulate major development. A major threat is energy prices remaining low, kept there artificially, and via high costs to state budgets, by the governments afraid of true changes. Innovation in energy technology is hindered by insufficient investor potential, local R&D companies, and the lack of vision.

	Opportunities	Threats
Industrial	RES technologies offer electricity, heat, and liquid, gas or solid fuels on-demand and on-site generation without transmission and major storage losses. Infrastructure creation is promoted through the implementation of RES technologies. In addition to RES potential energy-efficiency potential is also a very important short and mid term possibility to reduce demand side energy needs. That is closely related to the eco-efficiency thus profitability and competitiveness of industry.	Energy utilities do not really want RES because of their existing fossil capacities. Centralized electric grids are inappropriate for high share of non-continuous RES utilities (such as wind or solar) as bursts and stalls cause problems. Available infrastructure creation is not supportive to RES utilization. Most industrial managers presently do not perceive RES investments interesting enough, thinking more (only) on shirt term advances.
Policy and legislation	Strengthening environmental standards and comply with EU legislative framework drive economies towards cleaner energy generation solutions. RES utilization reduces burning of fossil fuels and release of greenhouse gases thus contributes to meet Kyoto or EU targets on aversion of climate change. RES utilization contributes to reduced dependence on nuclear and fossil fuel powered power plants. It is also in-line with national energy-security improvement objectives. Liberalisation of energy markets can give an incentive to the evolution of RES. EU legislation is a driving force is many of the target countries. The externality costs of RES technologies are much lower than those of traditional power generations. Liberalized energy markets contribute to the setup of a more democratic energy utility framework by decentralization and increased competitiveness.	In most cases Kyoto targets are not ambitious enough. Sustainable development is not recognised in the target countries as major development direction, the focus is on economic growth (by all/any means). Lack of national RES and EE targets and strategies in many countries. If the perverse fossil and nuclear energy subsidies are not eliminated parallel with the liberalisation of energy markets, the RES cannot gain competitiveness (will remain more expensive than the subsidised sources). Besides cutting the market distorting subsidies on traditional energy sources, the internalization of externality costs (including those of environmental degradation and risks to energy security and resource price volatility) is inevitable for the wide scale diffusion of RES.
Institutional	Considerable Kyoto project experience in some countries. Meaningful partnership possibilities with respective local/regional organisations (e.g. Black See RES Centre).	Institutional background for hosting Kyoto flexible mechanisms is weak in countries with huge opportunities. No Kyoto project experience in some countries. Despite the EU accession and/or approximation, in some countries "outdated" administrative capacity and approach can threaten the evolution of RES.

	Opportunities	Threats
Technological	Many of the promising technologies are still at the beginning of the technology learning curve (such as photovoltaic, off-shore wind, tide and wave, etc.) and thus further decrease in costs are expected. High potential in energy efficiency improvements due to outdated technologies and processes applied. Recognition of the threat of depleting fossil resources is an opportunity for alternative technologies. RES is also a potential to preserve valuable fossil resources for alternative utilization (e.g., for advanced plastics).	Some of the RES technologies (such as wind) pose difficulties and management risks because of their non-continuous nature that are not relevant to the conventional energy producing technologies. A threat is not recognising the energy efficiency improvement opportunities and enrol into unnecessary development of new production capacities Climate change might be a major threat on regional/local RES production (wind, biomass, etc.)
Environmental	Huge natural potential. Great opportunity to phase out highly polluting or high risk conventional energy producing capacities.	Countries with the biggest potential have less developed legislative framework. Various RES technologies may cause a disruption on biodiversity and landscape, or cause noise and odour pollution. Some of the RES involves the use of special materials (e.g., solar PV and rare metals, wind and steel, etc.) that involve mining, and can become toxic or difficult to recycle when not professionally handled.
Political	Stabilized democratic framework in most of the NEMED countries is ensuring favourable conditions for RES and EE investments. RES results in improved energy security. Decreased risk of terrorism due to decentralised production. Growing impact of sustainable development lobbying and pressure groups.	Most NEMED economies do not yet value the environmental benefits of RES, or the negative impacts of fossil fuels, and do not allow RES to compete economically. External costs of fossil power generation are not included in energy production costs, so economic growth does not become compromised. Changing governments might change development priorities and commitments. Lobbying/pressure groups of conventional energy production might severely influence/limit government actions.

Barriers to eco-innovation identified by REC (2005b), a study prepared for the Dutch Presidency on eco-efficient innovation and competitiveness in the region, are the following:

Economic barriers

- Market prices — too often, markets simply reflect the direct economic costs and not the costs of environmental pollution, since the externalities are rarely internalized;
- Up-front costs — switching to an environmental technology can be costly in the short run, and rarely NMS companies can think of strategic time horizons;
- Risky investments — environmental technologies are often perceived as such, since the perception of financiers is often that the notion of *environmental* refers to slowing down, having the opposite direction from what good economic sense would require.

Regulatory barriers and standardisation

- Unclear legislation — can lead to market uncertainty and reduce the incentives to invest;
- Legislation setting limit values — can limit innovation by removing incentives to go beyond them;
- Overly detailed legislation — reduces the latitude for innovation, thereby discouraging it;
- Lack of stable legislation — deters investors;
- Divergent member state legislation — can act as a barrier to environmental technologies by fragmenting the Single Market and making market penetration subject to different requirements in different member states. This reduces the size of the potential market for these technologies and acts as a barrier to their diffusion and uptake.
- Poorly set standards — act as a barrier by favouring one technology over an environmental technology. On the other hand, the absence of standards may mean that environmental technologies are not taken up, because there is no certainty as to whether they meet particular performance requirements.

Technological barriers

- Insufficient R&D funding;
- Poorly targeted R&D.
- There are very few companies with specific expertise on ET, with local manufacturing capabilities on the systems and equipment and instrumentation involved in ET. This has a great impact on price, and moreover, on the perceptions of what is an important, integral part of the advanced economy these decision-makers want to build and manage.

Diffusion barriers

- There is a lack of information about potential environmental technologies, including no knowledge of the costs and benefits throughout the life cycle;
- There is often too little knowledge about the socio-economic issues influencing the uptake of environmental technologies;
- There are difficulties in disseminating environmental technologies because distribution channels for new technologies are not as good as those for established technologies;
- There is a lack of adequately trained staff (!) That has to be differentiated from the generally high quality scientific education in this region. While people might have comparably high(er) general knowledge, they sometimes lack the specific and adequate knowledge to perform their jobs.
- SMEs tend to have more difficulties than larger firms in accessing finance, and information that is not closely linked to their core business.

8 Potentially useful means of policy interventions

As described in the report the major barriers perceived were the financial and legislative barriers, as well as the low level of awareness about the benefits of adopting ET, and, especially, no effective community and regulatory pressures. Also the low level of R&D spending, the lack of entrepreneurial attitude, and the role of the fossil fuel lobby in policy making, have been mentioned.

Thus, as a draft list of policy recommendations, the following measures are seen to have positive influence on promoting the diffusion of ET in NMS:

- Wide-scale, advanced **awareness raising campaign on ET** (as included in the ETAP) to get society, the economic players – on both micro and macro levels -, high level bureaucrats (e.g., planners, regulators) and politicians, as well, to understood the great benefits of investing into higher and cleaner technologies, processes and methods; <<*Manage*>>
- Create **transparent policy making** with optimized targets towards decoupling economic growth from environmental pressures, with high degree of public participation. <<*Manage*>>
- **Increase R&D spending** with optimized targets for clean, clever and competitive development; <<*Innovate*>>
- **Strengthen entrepreneurial attitudes**, supporting micros and SMEs in acquiring the necessary skills to innovate; <<*Innovate*>>

It is expected that upon applying the above measures the overall financial and legislative environment for ET diffusion could significantly improve, as well.

9 Notes

This report only illustrated the results from an intermediate state of the more extensive work of finding appropriate policy interventions that can result in the adoption of ET in NMS. The aim of work package 2 in the POPA CTDA project has been to assess the willingness of the actors towards adopting ET, in order to be able to identify some key drivers and barriers. From these barriers and drivers a first view on the possible policy instruments was prepared, with respect to the key stakeholder and the time of intervention. This review has not been intended to be fully comprehensive, rather the authors wanted to provide examples and logical reasoning for some specific and typical factors influencing ET diffusion, or the lack of it, in the NMS. Besides the studied barriers and drivers influencing willingness to innovate, there are further barriers and drivers in the process from willingness to actual action to be taken.

A more comprehensive assessment of possible policy instruments that takes into consideration the results of other relevant studies is now in process, is the aim of work package 3. The results will then be presented, discussed and validated at the sectoral expert workshops, together with results from the Old Member States (EU-15) during work package 4. The results from all the case studies will then be combined by the project coordinator partner to form a synthesis report in work package 5. In the final step this report will be presented at an international conference (work package 6).

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ANNEX The simplified questionnaire for New Member State application

Attached as separate document