Investing in the Future of Jobs and Skills

Scenarios, implications and options in anticipation of future skills and knowledge needs

Executive Summary

Electricity, Gas, Water and Waste

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4. relaying the views of the stakeholders and society at large

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Overview

This executive summary highlights the main results of the final report *Investing in the Future of Jobs and Skills. Scenarios, implications and options in anticipation of future skills and knowledge needs in the Electricity, Gas, Water and Waste Sectors*. Apart from analysing sector trends and developments, the study explores four plausible and distinctly different futures and their implications for jobs, skills and knowledge in the year 2020. The study is scenario-based, and is both forward- and backward-looking. It presents a variety of options and recommendations to address future skills and knowledge needs, aimed at the sector (firms, industry at large, sectoral partners), education and training institutes, policy-makers and other stakeholders.

The study should be placed against the background of the EU's renewed Lisbon Strategy for Growth and Jobs and the recently launched New Skills for New Jobs initiative. Investing in people and modernising labour markets is one of the four priority areas of the Lisbon Strategy. The New Skills for New Jobs initiative (European Commission, 2008) presents a very first assessment of the EU's future skills and jobs requirements up to 2020. The initiative aims to help ensure a better match between the supply of skills and labour market demand and to improve the Member States' capacity to assess and anticipate the skills needs of its citizens and companies.

This study appears in a series of 16 sector studies which are all based on the same common foresight methodology and uniform step-wise approach (see table). The study combines desk research and expert knowledge, and brought together various internal (project team) and external sector experts. The methodological framework that was initially developed by Rodrigues (2007) was further developed, operationalised and applied by a consortium consisting of TNO (lead), SEOR and ZSI.

Methodological framework – the study explained in ten steps

Step 1. Identification of economic activities (sector selection)

Step 2. Main economic and employment trends and structures

Step 3. Main drivers of change

Step 4. Main scenarios

Step 5. Main implications for employment – changes by job function

Step 6. Main implications for skills – emerging needs by job function

Step 7. Main strategic choices to meet future skills and knowledge needs

Step 8. Main implications for education and training

Step 9. Main recommendations

Step 10. Final workshop (validating, complementing, finalising)

The electricity, gas, water and waste sectors – main characterisation

The electricity (generation, transmission and distribution), gas (production, distribution and trade), waste (collection, treatment, disposal, recycling) and water (collection, treatment, supply, sewerage) sectors - shorthand utilities - have a number of shared characteristics and face similar trends influencing employment and skills and knowledge needs. The sectors also differ, in (degree of) competition, privatisation, and incentive regulation, technologies and innovation. Similarly, important differences exist between Member States. As *enabling sectors* they are essential to the functioning of the economy, and therefore strongly regulated by government, aiming to guarantee availability and quality, as well as to restrict environmental impact as much as possible. The sectors are locally oriented by nature, with most activities taking place within one and the same country. Gas and electricity utilities are very often large importers of fuels; yet substitution possibilities between abroad and home are very small due to availability of resources. Gradually, and as a result of EU liberalisation policy, the market for electricity has been moving from a national to an international market. Electricity is increasingly traded internationally, even though interconnection capacity is still very limited for most countries (often less than 10% of capacity). Some trade also takes place in the waste market, with prevention and recycling companies already operating in an international market. Incineration and landfilling, however, are dominated by national players. In the water industry nearly all activities take place within rather than beyond country borders.

Investments in increasing efficiency of existing technologies, in cleaner new technologies and in ICT (billing etc.), sometimes also driven by regulation, have increased the capital intensity up to twice the manufacturing industry average (Eurostat, 2006). Electric utilities 'lead' with considerable assets per unit of revenue, with only mining and railroads coming near. For gas utilities capital intensity is somewhat lower, but still much higher than in manufacturing. As capital and skilled labour are complements, the increase in capital intensity has led to larger demands for skilled labour.

Main economic and employment trends

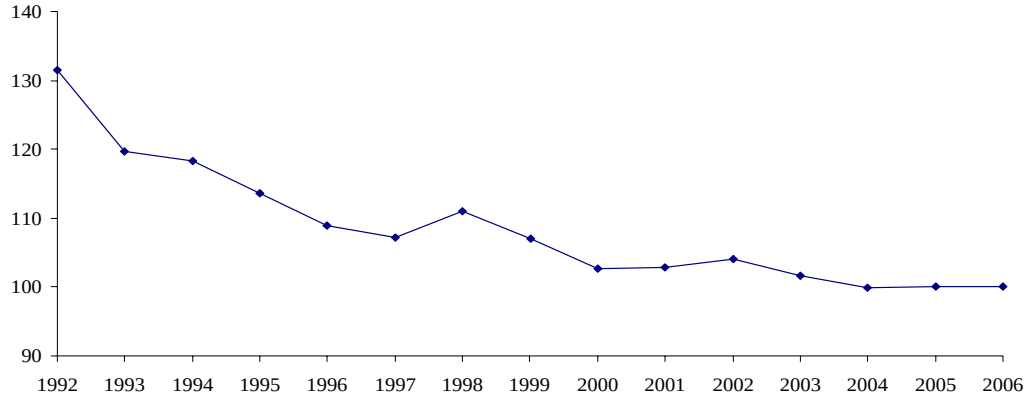
In terms of value added, the electricity and gas sector is with 177 bn euro nearly three times as large as the waste and six times as large much as the water sector. Growth of value added, however, is much higher for waste and water (2.4% and 2.0% annually, respectively); electricity and gas grew only 0.3% per year over the period 1995-2006. For all sectors growth is much higher in the new Member States than in the EU-15 (1.7% against 0.1% annually in electricity and gas; 5.2% against 1.6% in water, and 5.9% against 2.2% in waste), with large differences, however, between countries and sectors. In all sectors value added is dominated by the EU-15; value added per worker in the EU-15 is much higher than in the new Member States.

The utilities sector is traditionally a domestic sector with a small trade share, exports and imports each accounting for 12% of sector value added. Yet both exports and imports have been increasing strongly in the EU-15 and the new Member States during the last decade, with 16% and 12% annually. While the trade balance for both the EU-15 and the new Member States improved, the latter export much more than they import, while imports exceed exports for the EU-15.

The electricity and gas sector employs about 1.3 million workers in the EU. Especially in the new Member States the employment share is relatively large (1.20% versus 0.59% for the EU). EU employment in electricity and gas declined by 1.4% annually between 2000 and 2006, which is a higher than average employment decline. Similar structural differences and

trends are observed in the water sector, which employs around 400,000 people in the EU, half of which in the new Member States. Although aggregate figures for the EU are lacking, country statistics show that in terms of employment waste is as important as electricity and gas. In the Netherlands, for instance, 24,800 people worked in waste collection, treatment and recycling, against 19,600 in electricity and gas; similarly, in the UK 141,000 people worked in the waste sector in 2005, compared with about 100,000 in electricity and gas. It should be noted that employment figures in utilities are influenced by contracting (outsourcing); this is especially true for those sectors and countries that face increased efficiency regulation (more privatisation, competition, incentive regulation).

Average change in employment EU, electricity, gas and water (2006=100)



Source: OECD 2007

Employment, state-of-play 2006 and changes 2000-2006

Electricity and gas	Level 2006	Annual growth	Share in EU	Change in share
EU	1297	-1.4	100	0
EU 15	799	-1.1	62	6
NMS	499	-1.8	38	-6
Water	**Level 2006**	**Annual growth**	**Share in EU**	**Change in share**
EU	402	0.9	100	0
EU 15	202	1.5	50	6
NMS	200	0.2	50	-6

Source: Eurostat/TNO data. GDP: Gross Domestic Product

The majority of firms (91%) in electricity, gas and water employ less than 50 persons. Almost 6% of firms has between 50 and 249 employees, whereas, almost 3% has over 250 employees. In the new Member States the share of larger firms is much higher than in the EU 15. Large firms employ most personnel, however; 10% of them worked in firms with less than 50 employees and 13% in firms between 50 and 250 employees.

Employment trends by job function: shares (2006) and changes in shares (in%), 2000-2006

Gas, electricity, water	Shares, 2006			Changes in shares, 2000-2006		
	EU15	NMS	EU	EU15	NMS	EU
Managers	7	5	6	1	0	0
Computing professionals	3	2	2	1	0	0
Engineers	20	16	18	3	4	4
Business professionals	5	3	4	1	1	1
Other professionals	10	7	9	1	-11	-4

Office clerks and secretaries	17	9	14	-1	-2	-1
Service workers	1	1	1	0	-1	0
Extraction and building trades	9	11	10	-1	1	0
Blacksmiths and machine workers	4	9	6	0	1	0
Electronic equipment mechanicals	10	13	11	-3	5	0
Other craft and trades workers	0	1	0	0	0	0
Chemical process plant operators	6	11	8	-1	4	1
Other plant and machine operators	3	6	5	0	0	0
Labourers	4	6	5	0	-2	-1

Source: Eurostat Labour Force Survey/TNO data

Most jobs in gas, electricity and water are in the categories engineers, office clerks and secretaries, extraction and building trades and electronic equipment mechanics. Compared with the new Member States, the EU-15 has more managers, engineers, other professionals and office clerks and secretaries. Most occupation shares are rather stable over time, with only other professionals showing a large decrease. In the waste sector most jobs are with technicians, drivers & mobile plant operators and other elementary occupations, the employment structure being stable and over time and similar in the old and the new Member States.

Employment is dominated by medium educated employees, especially in the new Member States, with only 4% low educated employees. In both new and old Member States the number low educated has decreased and medium and high educated workers increased. The share of high educated workers is especially high in the EU-15, even 4% higher than the economy average.

Employment by share of women, age and education: electricity, gas and water, 2000-2006

	EU		EU 15		NMS	
	Level	Change	Level	Change	Level	Change
Women	27	4	22	2	35	4
Age < 40	38	-3	40	-2	35	-4
Age 40 – 50	33	-1	33	-1	33	0
Age > 50	29	4	27	3	32	4
Low education	11	-4	17	-5	4	-4
Mid education	63	3	52	1	77	5
High education	26	2	31	4	19	-1
Full-time	95	n.a.	93	n.a.	99	n.a.
Definition	Level % 2006	Total change % 2000-2006	Level % 2006	Total change % 2000-2006	Level % 2006	Total change % 2000-2006

Source: Eurostat Labour Force Survey /TNO data

SWOT analysis

The SWOT analysis provides an overview of perceived Strengths, Weaknesses, Opportunities and Threats of the sector. Strengths and weaknesses are usually taken as sector-internal factors that create, respectively destroy value. For a company these can include assets, skills or resources that a company has at its disposal, compared to competitors. Similarly, opportunities and threats are external factors that can create or destroy value. They emerge from company dynamics, the industry/market at large and are driven by demographic, economic, social, technical, social, cultural, ecological or legal/political factors (DESTEP).

SWOT Analysis	
Strengths	**Weaknesses**
o growing demand o new opportunities as result of new technologies (e.g. cradle-to-cradle, renewables, CCS) o sound financial position	o often monopolistic behaviour o complicated regulatory environment o large inefficiencies o capital intensity o "culture of incumbents" o geographically fragmented market o low attractiveness
Opportunities	**Threats**
o stable, transparent, predictable regulation o large possibilities to decrease costs o de-monopolisation o waste: cradle-to-cradle o eco-efficiency o CCS (Carbon capture and storage), 'clean' coal fired electricity plants o necessary investments in grid & production capacity o R&D o quicker procedures for new capacity o investments in renewables o investments in nuclear electricity	o lack of resources o electricity: high oil prices/shortages o water: in some countries shortages o GHG emission policies o competition from ICT for ICT-workers o competition from other sectors for technicians/engineers o loss of control as result of liberalisation/privatisation o investments in infrastructure takes long time o insecurity of supply o bad regulation o financial crisis might make it more difficult to invest
Source: TNO-SEOR-ZSI	

Main drivers of change

The last fifteen years have been characterised by significant sector dynamics due to **technological change**, R&D and innovation. ICT is a key driver affecting the billing process with the electricity, gas and water sector which has one of the highest shares of ICT workers. Also new technologies are being installed in the area of electricity generation (from renewables and non-renewables), for efficiency improvement and in the waste sector for waste treatment, deposal and recycling.

Competition is mostly restricted to regional or national markets. Only waste prevention and recycling are more open to international competition. But as a result of EU liberalisation the electricity market is becoming more integrated.

Regulation is a major influence on sector developments driving restructuring with several EU and national regulation packages affecting employment. Major regulations aim at efficiency, rationalisation, waste prevention, sustainability recycling and the support of renewable energy.

In total 26 drivers covering demographic, economic, social, technological, environmental and political factors were assessed for scenario construction. The **most important drivers** ranked in order of relevance are ‘trade and market liberalisation’, ‘EU integration’, ‘environmental regulation’, ‘natural resources’, the ‘availability and price of oil and energy’ and the ‘availability and price of other natural resources’..

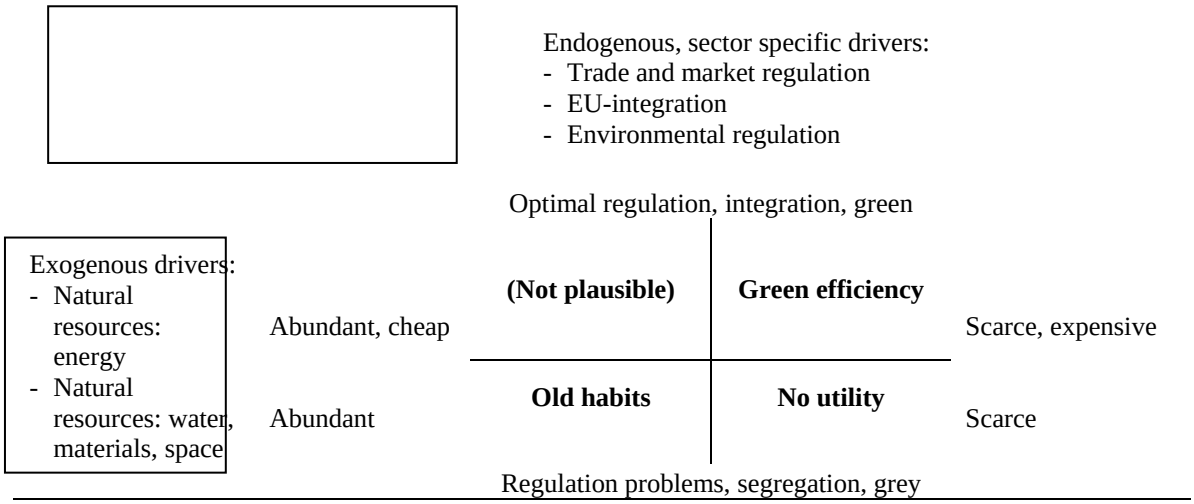
	Main drivers of change											
Category	Driver	Is this driver relevant for the sector? Y / N	How relevant is this driver for the sector? Scale 0-10	How uncertain is this driver for the sector? Scale 0-10	Are substantial impacts expected on the volume of employment? Y/N	Are substantial impact expected on employment composition? Y/N	Are substantial impacts expected on new skills? Y/N	Short, medium or long run impact? S	M	L	Are substantial differences expected between (groups of) countries? Y / N	Are substantial differences expected between subsectors? Y / N
Culture	Increasing demand for environmentally friendly / organic products	Y	6	0	Y	Y	Y	Y	Y	Y	Y	Y (esp. electricity)
Technology, R&D and innovation	Advances in IT impacting on organizational structures & new business models	Y	6	5	Y	Y	Y	Y	Y	Y	Y	N
	New types of work organisation (teams-based, sociotechnique, etc.)	Y	6	10	Y	Y	Y	Y	Y	Y	Y	Y
	Other (biomass, wind, solar, 'clean' coal fired electricity plants, nuclear, prevention, recycling)	Y	6	3	Y	Y	Y	Y	Y	Y	Y	Y
Natural resources	Availability (and price developments) of oil and energy	Y	10	2	N	N	Y	Y	Y	Y	Y	Y (electricity)
	Availability and price of other natural resources	Y	10	5	N	N	Y	Y	Y	Y	Y (when water shortage)	Y (drinking water)
Institutional / Political	Trade and market liberalisation (national level)	Y	10	5	Y	Y	Y	Y	Y	Y	Y	Y
	EU integration – deepening (single European market etc.)	Y	10	5	Y	N	N	Y	Y	Y	N	Y
	Environmental regulation	Y	10	4	Y	Y	Y	Y	Y	Y	Y	Y
	Security and safety regulation	Y	8	5	Y	N	N	Y	Y	Y	Y	Y

Source: ©TNO-SEOR-ZSI insert date

Scenarios and implications for employment

Three future scenarios have been constructed and explored: 1) *Green Efficiency*, 2) *Old Habits*, and 3) *No Utility* (see also figure). The scenarios depict plausible and credible futures for the utilities sector in Europe by 2020. Rather than wishful pictures of the future, scenarios are founded on drivers and trends observed and are derived in a logical and deductive way, hence making inferences about plausible future developments.

Four future scenarios for the electricity, gas, water and waste sectors and main underlying drivers



Source: TNO-SEOR-ZSI insert date

The scenarios apply to the four sectors. This does neither imply that future developments in electricity, gas, water and waste sectors are to be taken as one and the same, nor that development paths between Member States need to be similar. The sectors will face different dynamics in terms of market structure and developments, while driven by similar but differently impacting drivers. The way the scenarios have been constructed enables such differentiation. Note that the demographics – ageing (less young, more retirees) – and its effects on labour supply have not explicitly been identified in selecting the drivers, as demographics in the time frame of 2009-2020 are relatively certain (i.e. predictable) and play a role across all scenarios. Education and training, which stricto sensu could be perceived as endogenous factors, have been excluded. They are together with a number of other strategies and/or policies discussed as solutions in response to the scenario outcomes.

Scenario I: *Green Efficiency*

In 'green efficiency' policy instruments are developed and implemented to decrease demand and to substitute old technologies for green technologies (biomass, wind, solar) and nuclear power plants. This makes the energy market less dependable on oil and gas prices and helps to reduce the effects of climate change. The waste market shows a much larger role for cradle-to-cradle technologies, reducing the demand for incineration and especially landfilling. Water shortages are reduced by demand actions and by dealing with the imbalance in regions with water abundance. Stronger competition is stimulated by EU regulation and results in deregulation and further liberalisation of all markets. More security and safety regulation is adopted as a result of the high risk profile and the increase in possible attacks.

Scenario II: *Old Habits*

In the scenario 'old habits' energy, materials, water and space are abundant and cheap. The utilities produce what customers intend to consume. No major regulation is necessary,

although utilities are not as efficient as possible. Both in terms of costs and the use of fuels, materials, water and space inefficiencies exist. Competition is on a relative low level due to a slower pace of de-regulation and further liberalisation of transmission networks and distribution services. This results in inefficiencies. However, as abundant and cheap inputs are available the pressure for reorganising the sector is low.

Scenario III: *No Utility*

In 'no utility' inputs become scarce and expensive. Prices of oil and gas rise sharply. The same holds for prices of materials and, in some regions, water. This leads to a renaissance of 'clean' coal fired and nuclear electricity plants as well as some investments in recycling technologies. In the absence of stronger environmental regulation, development of sustainable energy production and 'cradle-to-cradle´ technology is slow. Densely populated regions have shortages in space, making the cheap option of landfilling unattractive. Climate change results in changing raining profiles, leaving certain regions with large water shortages. The institutional reaction in 'no utility' is lacking speed and content. Countries operate unilaterally; no true green policies emerge. Competition is on a relative low level due to a slower pace of de-regulation and further liberalisation of transmission networks and distribution services. This results in inefficiencies.

Implications of scenarios: job volume changes by function, 2009-2020

	Green efficiency	No Utility	Old habits
Managers	I	I	M
Business and finance professionals	I	M	M
Engineers	I	I	M
ICT professionals	I	M	M
Administration and customer service	D	M	M
Construction workers	I	I	M
Plant operators	I	I	M
Labourers	D	M	M
Overall	D	I	M

Source: TNO-SEOR-ZSI. Note: D=decrease, I=increase, M=maintain, EGW= Electricity, gas and water date

Implications of scenarios for jobs, skills and knowledge by job function

Three key driving forces will dominate the shaping of the utilities sector's future: (i) prices of energy and materials, (ii) environmental regulation and (iii) market liberalisation. Scenario "Old habits" assumes that energy prices are relatively low and that no new regulation arises that could further stimulate environmental change and liberalisation. Rising prices of energy and materials shape the scenario "No utility". This results in new capital investments increasing eco-efficiency. Quantitative effects occur for especially managers, engineers, construction workers and plant operators. The other two driving forces mainly shape the scenario "Green efficiency". Here, strict environmental regulation is implemented as a reaction to scarce energy and material supplies. Furthermore, regulatory changes of market liberalisation and deregulation drive market competition. Both have major impacts on

employment in the sector. Environmental regulation in combination with rising resource prices drives large investments in sustainable technologies (sustainable energy and 'cradle-to-cradle' recycling technologies). This has an upward volume effect on all occupations. However, this is counteracted by large structural changes reducing inefficiencies cut out by organisational reorganisation. This results, especially for the large categories labourers and administration and service workers, in decreasing net levels of employment. For all other occupations, however, this results in increasing net levels of employment.

Identification of emerging competences, skills and knowledge needs

By taking the scenarios and drivers as a starting point, logical inferences ('guestimates') of skills and knowledge needs were made for each of the identified job functions. *Skills* refer to the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualification Framework (EQF), skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments). *Knowledge* refers to the outcome of the accumulation of information through learning. It is the body of facts, principles, theories and practices that is related to a field of work or study. In EQF context, knowledge is described as theoretical and/or factual. *Competences* refer to the proven ability to use knowledge, skills and personal, social and/ or methodological abilities, in work or study situations and in professional and personal development. Competences thus defined come actually close to what is generally understood nowadays as 'soft skills'. In EQF context, competences are described in terms of responsibility and autonomy. In the practical elaboration of future skills and knowledge needs for the purpose of this study, both have been further 'disentangled' to result into six clusters of similar and related skills and knowledge needs (see box).

Overview of skills and knowledge needs identified for each job function and scenario
Knowledge ('hard skills')
• Legislative / regulatory knowledge (environmental / safety / labour / contracting); Language*; e-skills; Marketing skills; Technical knowledge; Product knowledge; Product development
Social Skills
• Team working skills; Social perceptiveness (listening / understanding); Communication; Networking; Language*; Intercultural
Problem-solving Skills
• Analytical skills; Interdisciplinary; Initiative, Multi-skilling; Creativity
Self-management Skills
• Planning; Stress and time management; Flexibility; Multi-tasking
Management skills
• Strategic & visionary; Coaching and team building; Change management; Project management; Process optimizing; Quality management; People skills crucial for collegial management style
Entrepreneurial skills
• Supplier and customer relationship / understanding; Business understanding / development; Trend setting / trend spotting

Source: TNO-SEOR-ZSI insert date

Future skills and knowledge needs by job function

Across all job functions soft skills will become increasingly important, especially so for high skilled professional job functions. The general trend of up-skilling across job functions is bound to continue in the coming years. Due to the changing nature of jobs, predefined technical knowledge capabilities will become somewhat less important while skills to adapt and learn new competences and life-long learning will be put at a premium. Certain knowledge – notably e-skills – will become more important. Emerging competences of higher skilled jobs mostly refer to *how* to learn, communicate, interact and adapt to changing environments in addition to a high quality education. Emerging competences in medium-educated job functions that mostly execute defined tasks and processes refer mostly to specific knowledge sets that can be taught through learning. Key emerging skills and knowledge needs by job function can be described as follows[1]:

Managers - in the fast paced "Green efficiency" managers have to focus on quickly picking up new trends, explore new markets and channels, invest in customer relations and optimize their processes and finance to reduce costs. Knowledge (finance, environmental and other regulation), entrepreneurial and management skills go at a premium, and so do problem-solving (creativity, initiative), self-management (flexibility, stress management), and social skills to make new solutions possible (communication, networking). In the slower paced scenarios "No Utility" and "Old habits" the focus is on improving and guaranteeing business; social skills, esp. networking, are needed to improve the prevailing regulatory framework. Strategic (management) skills become important in "No utility".

Business and finance professionals – "Green efficiency" requires more knowledge about regulation, finance, trade (new types of trade like energy exchanges) and environmental issues. Especially for sales professionals communication, networking, language and intercultural become more important as markets have to be developed. Problem-solving, entrepreneurial skills and self management are all important because of vast changes in competitive environment and regulation. In "Old habits" only one emerging skill is identified, notably project management (process optimizing). The rather stable business surroundings make "business as usual" possible. Change management and project/ contract management become increasingly important when the move is made to "No utility" and "Green efficiency".

Engineers – as one of the most important occupational functions, engineers are responsible for the functioning of grids and production plants - essential to security of supply. The recent trend of hiring more high skilled workers to improve efficiency will continue, but much more in "Green efficiency" and less so in "No utility". Knowledge is especially needed in "Green efficiency", where technological change is vast and new plants are being built; knowledge is also needed to develop new production technologies. In "No Utility" a renaissance of coal power plants will result in a higher skills demand in erecting and running such plants. The same holds for recycling plants. In "Old habits" technical, electrical and mechatronic skills are important to guarantee the quality of production and grid. Social, problem-solving and

[1] For expected changes in main skills and knowledge clusters, see tables below. More extensive and detailed accounts on future skills and knowledge needs can be found in the main report, with further differentiations made by scenario.

self-management and management skills are esp. needed in “Green efficiency” as is process optimising in “No utility.”

ICT professionals – software plays a crucial part in supporting the various business processes in the utilities sector. Programmers are important not only for business purposes but also for power system management and machines (e.g. CNC-programming). Due to expected modernisation of the transmission and distribution infrastructure in all scenarios, programming of power, gas and system management is a crucial emerging skill. More IT knowledge is necessary in all scenarios to better organise the internal processes. The main difference in skills needs is caused by the much more competitive environment of “Green efficiency” which requires ICT professionals to have more social skills in cooperating with other branches (e.g. marketing and product development) in several regions (language, intercultural) and an entrepreneurial attitude. Competition asks for self-management (stress and time management), management (project management) and a problem solving attitude, as demands from customers become more important, while managers ask for more and higher quality data.

Administration and customer service – similar to developments for ICT professionals. In “No utility” and “Old habits” project management and IT applications are important as many businesses have to invest in primary processes. In “Green efficiency” skills needs apply to competition; firm development depends much more on customer relationships, flexibility, accurateness, team work with other departments and the generation of good information.

Other occupational functions: construction workers, plant operators, labourers – introduction of competition at a large scale makes competitiveness important; strict environmental regulation changes the product mix of companies providing energy, water and waste services. These changes have a large impact on higher ranked professionals and lower ranked workers facilitating these professionals, but much less on lower ranked workers. The other occupational functions - construction workers, plant operators and labourers - are influenced in terms of volume rather than in terms of skills and competences.

Main strategic choices to meet skill and knowledge needs

In order to meet future skills and knowledge needs, apt and timely solutions – referred to here as strategic choices - are required (see table below). Strategic choices refer and relate to the medium- and longer term, even though emerging skills and knowledge needs in practice may also apply to the now and tomorrow. Essential in seeking appropriate solutions is to keep this longer time perspective in mind. Rather than focusing on one single solution, a set of linked strategic choices will in most cases be the best strategy to follow. Prioritising both in time (what first, where to follow up) and in allocation of resources (including budgetary focus) followed by further fine-tuning is a clear necessity to guarantee that skills needs are targeted and solved. Skill needs can be identified at various levels, ranging from assessments at the national or even European sector level to more precise assessments at the regional and company level. Increasingly the identification of skills and knowledge needs but also the search for adequate solutions will have to become an integral part of an overall longer-term business strategy, also for SMEs. Some solutions will be found within the company itself, e.g. through reorganising functions within or between plants, by offering (re)training trajectories or by active global sourcing of personnel. For SMEs and especially for micro-enterprises such longer-term, more strategic human resource management often will be more difficult to organise and operationalise.

In order to address the identified future skills and knowledge needs in an encompassing and timely manner, appropriate joint action is needed by all stakeholders, including the industry (firms, sector organisations and social partners), training and education institutes, intermediary organisations and, last but not least, government at all levels (EU, national, regional and local). Collaboration is needed in order to agree on and implement a package of feasible solutions. Timely, targeted and reliable information to make decisions – i.e. adequate monitoring and analysis - is an essential prerequisite.

Example. Strategic Options Decision Tool -- job function: Managers		
1. What is the maximum volume effect?	Increase	
2. What is the maximum change in skills?	20	
3. Do SMEs play a large role?	Yes	
4. Is the sector national/EU/global?	National/EU	
5. Is the workforce old?	Somewhat	
6. Is the workforce low educated?	No	
Option	**Is this option viable?**	**Actors[1]**
A. Recruiting workers from other sectors	Particularly from the private sector (e.g. the trade banking sector)	C
B. Recruiting workers from other Member States	Yes, but difficult for SMEs and often language barrier	C, E, G, I
C. Recruiting workers from Non-Member States	Possible but not very plausible (high-skilled managers available in Europe), for SMEs impossible	C, E, G, I
D. Recruiting unemployed with or without re-training	In rare cases	C
E. Recruiting young people from the education system	Apprenticeships and manager training for young professionals is solution for long term	C, E
F. Training and re-training employed workers	In-house promotion and further training in the firm, difficult for aged workforce	C, E
G. Changing work organisation	Team work, upscaling (mergers, acquisitions)	C
H. Outsourcing and offshoring	Yes, but not for many skills	C
I. Changing vocational education	Not necessary	
J. Designing and offering new courses	Custom-fit courses	C, S, E
K. Providing information about emerging skills	Not necessary	
L. Improve the image of the sector	Yes	C, S, E, G, U
M. Stronger cooperation between stakeholders	Not necessary	

Notes: C (company), S (sector organisations and chambers of commerce), U (trade unions), E (education & training), G (governments), I (intermediary organisation).* Taking the most extreme scenario.

Summary of job volumes, skills changes, strategic choices and main players for anticipatory action by scenario (selection of most important functions)				
		Old habits	**No utility**	**Green efficiency**
Managers	1. Employment volume change	M	I	I
	2. Skills changes counted	Count 4	Count 8	Count 20
	3. Emerging skills needs	Management, Social	Management, Social	Management, Entrepreneurial, Social, Problem-solving, Knowledge
	4. Most important solutions	Recruitment from other sectors, custom-fit training, apprenticeships, image-building	Recruitment from other sectors, custom-fit training, apprenticeships, image-building	Recruitment from other sectors, custom-fit training, apprenticeships, image-building
	5. Most important actors	C, E	C, E	C, E
Business and finance Professionals	1. Employment volume change	M	M	I
	2. Skills changes counted	Count 1	Count 3	Count 17
	3. Emerging skills needs	Management, Social	Management, Social	Management, Entrepreneurial, Social, Knowledge, Self-management, Problem-solving
	4. Most important solutions	Recruitment from other sectors, recruitment young staff, custom-fit training, apprenticeships, image-building	Recruitment from other sectors, recruitment young staff, custom-fit training, apprenticeships, image-building	Recruitment from other sectors, recruitment young staff, custom-fit training, apprenticeships, image-building
	5. Most important actors	C, E	C, E	C, E
Engineers	1. Employment volume change	M	I	I
	2. Skills changes counted	Count 1	Count 3	Count 11
	3. Emerging skills needs	**Knowledge**	**Knowledge**, Management	**Knowledge**, Problem-solving, Self-management, Management
	4. Most important solutions	Recruitment from other sectors, custom-fit and new training, changing vocational education, provision information, image-building, stronger cooperation	Recruitment from other sectors, custom-fit and new training, changing vocational education, provision information, image-building, stronger cooperation	Recruitment from other sectors, custom-fit and new training, changing vocational education, provision information, image-building, stronger cooperation
	5. Most important actors	C, S, E	C, S, E	C, S, E
ICT professionals	1. Employment volume change	M	M	I
	2. Skills changes counted	Count 1	Count 1	Count 10
	3. Emerging skills needs	Knowledge	Knowledge	Social, Problem-solving, Knowledge, Self-management,Management, Entrepreneurial
	4. Most important solutions	Recruitment from other sectors, recruitment young staff, training, provision information, image-building, stronger cooperation	Recruitment from other sectors, recruitment young staff, training, provision information, image-building, stronger cooperation	Recruitment from other sectors, recruitment young staff, training, provision information, image-building, stronger cooperation
	5. Most important actors	C, S, E	C, S, E	C, S, E

C=Companies; S=Sectoral organisations, U=trade Unions; E=Education and training institutes; G=Government (EU, Member State, regional, local).

Conclusions

Implications, conclusions and recommendations have been made at two distinct levels: the individual job function (micro) level focusing on options by function and those, more generally, aimed at sectoral stakeholders (including education and training) and policy-makers (meso-level). The former are summarized in the table below. At the meso-level a further distinction has been made between education and training and 'other' main conclusions and recommendations.

Conclusions and recommendations on education and training

1) Adapt and modernize vocational education and training (VET) and general education systems, but do this on a national basis rather than for the EU as a whole; add this punctuation at the end of all the points until the last one of this part where you put "."

2) Improve the information provision on skill needs and job requirements: essential for improving training and education

3) Collaborate with all relevant stakeholders and intensify co-operation in education and training

4) Strengthen co-operation in sector-specific training measures to provide flexible and up-to-date training offers

5) Facilitate training co-operations between SMEs - to be supported by national training bodies and sectoral social partner organisations and supported by public funding, along with dissemination of best practices

6) Build joint training facilities to reduce costs for especially small companies

7) Enhance flexibility through modularisation of education and training and forms of blended learning, i.e. a mixture of different learning media, learning methods and forms supporting decentralised, self-directed and efficient learning more independently in time and space

8) Supply special courses dedicated to sector characteristics

9) Supply special courses for older workers

10) Enhance transparency of the quality of training as well as improving the trans-national recognition of vocational qualifications

11-13) Pay more attention to multi-skilling, to combining technical and soft skills, and to interdisciplinary and multidisciplinary studies

14) Ensure the up-skilling of low skilled technical production workers.

Main other conclusions and recommendations

1) Improve collaboration between all stakeholders

2) Improve the image of the sector – among the young and the overall working population, especially women

3) Anticipate drivers of change - technological development and applications, changes in scarcity and prices of natural resources, and environmental and market regulation are very important for the sector.

4) Provide stability in legislation - to enable long(er)-term investment decisions in environmental technologies such as cradle-to-cradle applications and nuclear and sustainable energy

5) Improve career guidance and provide information on labour market possibilities

6) Increase international and intersectoral acknowledgement of certificates

7) Organise transfer of knowledge and expertise from old to new Member States

8) Organise and facilitate the transfer of experience of older to younger workers

9) Keep older longer in employment and support vocational training for older employees

10) Invest strongly in human capital and lifelong learning - in order to maintain competitiveness and be able to respond to favourable but also less favourable future scenarios.