EU POLICY

BRIEFS MACEDONIA

Konrad Adenauer Stiftung

FRONT 21|42

GoGreen

Low carbon society – high business potential

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www.kas.de/macedonia
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This is an attitude I come across very often. When I ask what are these "much more serious topics" the first answer I always get is: "economic development!". I must admit that I find this quite frustrating. The environment IS inevitable part of the economy. This realization dates from as early as 1970s and it is crucial part of the concept of sustainable development. And our changing climate, one of the main challenges of our time, makes this connection stronger than ever.

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TWO DEGREES THAT ARE CHANGING OUR CIVILIZATION

The World Meteorological Organization, the International Council of Scientific Union, and the United Nations Environment Program recommended 2°C global mean surface warming from pre-industrial levels as "an upper limit beyond which the risks of grave damage to ecosystems, and of non-linear responses, are expected to increase rapidly". Further on, the German Advisory Council on Global Change recommended a 2°C target based on the idea that warming should be kept within limits known from recent warm periods (interglacial).

Translating a target of 2°C into global emission reduction targets gives the following results:

- The global emissions have to be reduced for at least 50%
- To have equal emissions per capita by 2050 USA have to reduce their emissions for ~90%; EU27 for ~87%; and non-OECD countries for 26%

To put it another way – it is more than obvious that we have to transform the whole civilization from fossil fuels based to a low carbon one. And it all comes down to production and consumption of energy – the main CO2 emitter.

The famous quote by John F. Kennedy *"When written in Chinese, the word '**crisis**' is composed of two characters. One represents danger and the other represents **opportunity**"* reflects very accurately the enormous task in which we all have to participate.

We witness (still only to some degree) the danger part - summer heat waves and severe draughts, floods, wildfires… they are all part of our lives, in all corners of the world.

The good news is that (finally) we start to see the opportunity part. Energy is at the very foundation of our civilization and its transformation inevitably touches all areas of our societies. International agreements, such as Kyoto Protocol and Copenhagen Accord ensure framework for this transformation and are further translated into various legislation acts and strategic documents.

Nowhere in the world is this area so thoroughly and comprehensively regulated as in the EU.

Bearing this in mind, it is clear why the so-called "climate and energy package" of the European Union is one of the most complex collections of laws, strategies, plans and other documents. The package includes: normative acts related to monitoring and reporting greenhouse gas emissions; acts related to the European Emission Trading Scheme; joint efforts; carbon capture and storage; acts pertaining to transportation and fuels, ozone layer protection, fluorinated gases and over 150 acts related to specific aspects of energy. At the end of 2011, the European Commission adopted the 2050 Roadmap Energy Strategy, which envisages almost complete decarbonization of the power sector by 2050.

And this is where the environment and the economy come together.

THE OPPORTUNITY PART

In the 1990-2009 period EU green house gas (GHG) emissions were reduced for 16%, while the GDP in the same period grew for 40% and the production for 34%.

The Union's reduction targets are beneficial for all three aspects of the sustainable development: the environment, the economy and social development. The results of the above mentioned legislation (enforced through various financial incentives) are: improvements in the environment (better air quality, waste reduction, etc), but also 700 000 new jobs and annual profit of 91 billion Euros. The analysis "RE-thinking 2050" predicts that by 2050 there will be 6.1 million new jobs related to renewable energy.

Here are some general figures from a working document from the European Commission on green economy and jobs creation[1]:

[1] *http://www.master.eurec.be/en/Careers-and-EUREC-Awards/Articles-and-useful-links/-print/.*

- 3 million jobs should be created or retained in the Renewable Energy sector by 2020.
- Average annual growth in employment in the eco-industries in 2000-2008 was 2.7%.
- Total numbers employed have grown from 2.4 million in 2000 and 3.0 million in 2008 and are 3.4 million in 2012
- At present, the size of the "eco-industries" sector in Europe is larger than the aerospace and defense sectors
- Estimates for countries such as United States and Germany indicate that 2-3% of total employment is related to activities to reduce CO2 emissions
- The renewable sector in Europe has seen an increase of more than 300,000 employees within only five years (2005-2009).

According to the US Bureau of Labor and Statistics[2], green jobs cross over 300 industries. And a great number of these industries are directly or indirectly related to the energy transformation:

Solar energy – photovoltaic (solar electric)

Photovoltaic (PV) devices generate electricity directly from sunlight via an electronic process that occurs naturally in certain types of material, called semiconductors. Electrons in these materials are freed by solar energy and can be induced to travel through an electrical circuit, powering electrical devices or sending electricity to the grid.

Most modern solar cells are made from either crystalline silicon or thin-film semiconductor material. Silicon cells are more efficient at converting sunlight to electricity, but generally have higher manufacturing costs. Thin-film materials typically have lower efficiencies, but can be simpler and less costly to manufacture. A specialized category of solar cells - called multi-junction or tandem cells - are used in applications requiring very low weight and very high efficiencies, such as satellites and military applications. All types of PV systems are widely used today in a variety of applications.

Building-integrated photovoltaic's (BIPV) are dual-purpose: they serve as both the outer layer of a structure and generate electricity for on-site use or export to the grid. BIPV systems can provide savings in materials and electricity costs, reduce pollution, and add to the architectural appeal of a building. Though they can be added to a structure as a retrofit, the greatest value for BIPV systems is realized by including them in the initial building design. By substituting PV for standard materials during the initial construction, builders can reduce the incremental cost of PV systems and eliminate costs and design issues for separate mounting systems.

Building-integrated PV systems are planned during the architectural design stage and are added during initial construction.

Application of building-integrated PV include façade, rooftops and glazing

Solar energy - Concentrating solar power

Concentrating solar power (CSP) plants use mirrors or lenses to concentrate sunlight, creating temperatures high enough to drive traditional steam turbines or engines that in turn create electricity. The most cost-effective CSP plants are hundreds of megawatts (MW) in size, making them attractive as wholesale energy suppliers to utilities.

Investments in CSP are still not as attractive as other forms of solar generating capacities due to various specific conditions needed for this type of projects.

Solar energy – Solar heating & cooling

Solar heating & cooling (SHC) technologies collect the thermal energy from the sun and use this heat to provide hot water, space heating, cooling, and pool heating for residential, commercial, and industrial applications. These technologies displace the need to use electricity or natural gas.

Solar water heating systems are comprised of three main elements: the solar collector, insulated piping, and a hot water storage tank. Electronic controls can also be included, as well as a freeze protection system for colder climates.

[2] *http://www.bls.gov/green/.*

Obviously the solar energy related industries open many business opportunities in research and innovation; manufacture; power plant development; solar system design (for BIPV and BAPV); trade; construction; transportation and warehousing; but also in information, education, financial activities, legal activities, management of companies and enterprises, etc.

Interesting example of solar energy company - Kit Carson Electric Cooperative

(from National Geographic)[3]

In northern New Mexico the sun shines nearly every day of the year. If solar energy is going to be viable anywhere, it will be here—and a small electric cooperative in historic Taos is taking advantage of it. In addition to supporting new solar projects in its service area, Kit Carson Electric Cooperative is offering its customers the opportunity to buy solar energy from “plots” in a “garden” of solar power generation.

The solar garden concept is one way that some progressive, consumer-owned and governed electric cooperatives are integrating renewable energy into their distribution utility offerings. They construct and operate a “garden” of solar power generation with arrays of solar photovoltaic (PV) panels which convert sunlight to electricity. Consumers can buy panels outright or subscribe to their output, and the “fruits” of their part of the garden are delivered to them over the cooperative’s distribution lines.

Wind power

Wind power captures the natural wind in our atmosphere and converts it into mechanical energy then electricity. People started using wind power centuries ago with windmills, which pumped water, ground grain, and did other work. Today's wind turbine is a highly evolved version of a windmill. Modern wind turbines harness wind's kinetic energy and convert it into electricity. Most wind turbines have three blades and sit atop a steel tubular tower, and they range in size from 24 meters high turbines that can power a single home to utility-scale turbines that are over 79 meters tall and power hundreds of homes. There are three major types of wind power:

Utility-scale wind, wind turbines larger than 100 kilowatts are developed with electricity delivered to the power grid and distributed to the end user by electric utilities or power system operators;

Distributed or "small" wind, which uses turbines of 100 kilowatts or smaller to directly power a home, farm or small business as it primary use;

Offshore wind, which are wind turbines erected in bodies of water around the world.

Wind energy projects are developed by companies that seek out the areas with the strongest wind resource but also review other critical factors like acccess to land, access to the transmission lines, ability to sell the electricity, and public engagement other significant development factors. Once a site is identified, a developer will conduct wind resource assessment, sitting and permitting, transmission studies over a period of several years. The majority of wind projects are located on private land, where the developer leases the land from the original landowner providing lease payments. After early stages of development, a developer will seek out a constrict with a purchaser of electricity, raise capital from the finance markets, order wind turbines, and hire a specialized construction company to build the project. Once a project is built and delivering electricity to the power grid, a project owner or operator will maintain the project for its 20 to 30 year life.

Wind energy worldwide

Wind power has increased exponentially since the dawn of the 21st century. The adoption of wind energy globally has changed dramatically since the 1980's when California was home to 90% of the world's installed wind energy capacity. In fact, the amount of operating wind energy capacity has increase more than 16 times between 2000 and 2012, to over 282,000 MW of operating wind capacity. In 2012, the United States represented nearly 22% of the world's installed wind energy capacity, second only to China, and followed by Germany, Spain and India.

The wind industry employs across construction, development, engineering, operations, manufacturing, etc. Furthermore, wind energy is a drought-resistant cash crop, providing economic investment to rural communities

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[3] *http://energyblog.nationalgeographic.com/2013/10/21/solar-gardens-let-communities-share-renewable-power/.*

through lease payments to landowners. Previously mentioned industries (in solar energy part), also apply here: trade; transportation and warehousing; information, education, financial activities, legal activities, management of companies and enterprises, etc.

Geothermal Energy

Geothermal energy is the heat from the Earth. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma.

Almost everywhere, the shallow ground or upper 3 meters of the Earth's surface maintains a nearly constant temperature between 50° and 60°F (10° and 16°C). Geothermal heat pumps can tap into this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system and a heat exchanger-a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water.

Wells can be drilled into underground reservoirs for the generation of electricity. Some geothermal power plants use the steam from a reservoir to power a turbine/generator, while others use the hot water to boil a working fluid that vaporizes and then turns a turbine. Hot water near the surface of Earth can be used directly for heat.

Direct-use applications include heating buildings, growing plants in greenhouses, drying crops, heating water at fish farms, and several industrial processes such as pasteurizing milk.

Hot dry rock resources occur at depths of 4.8 km to 8km everywhere beneath the Earth's surface and at lesser depths in certain areas. Access to these resources involves injecting cold water down one well, circulating it through hot fractured rock, and drawing off the heated water from another well.

Currently, there are no commercial applications of this technology. Existing technology also does not yet allow recovery of heat directly from magma, the very deep and most powerful resource of geothermal energy.

Despite its potential for providing clean and steady energy, however, geothermal power development faces challenges. Geothermal projects are expensive, and it takes years to build a working geothermal plant. The high cost can discourage investment by private industry. Another challenge limiting development of geothermal energy is the fact that geothermal plants are often located in remote areas. Roads must be built to the plant sites, and transmitting electricity from the plant to distant consumers requires the construction of transmission infrastructure such as high-voltage power lines. Location is therefore a consideration for those seeking employment in geothermal energy.

Occupations in geothermal energy

It requires many workers to get a geothermal plant up and running. Different workers are needed for each phase of a geothermal plant's development.

Scientific research is an important component of geothermal development. Because drilling wells is extremely expensive, it's important that scientists select drilling sites most likely to support geothermal power. Science occupations in this industry include: ***environmental scientists*** who work with geothermal plant developers to help them comply with environmental regulations and policies and to ensure that sensitive parts of the ecosystem are protected); ***Geologists*** spend a large part of their time in the field, identifying and examining the topography and geologic makeup of a geothermal site. Geologists also study maps and charts to ensure that a site will be able to supply adequate geothermal energy. Geologists use their knowledge of different kinds of rock to make recommendations on the most cost-effective areas to drill. Some specialized geologists might help to monitor a plant's location for seismic activity and attempt to predict the threat of earthquakes; ***Hydrologists*** study water and the water cycle. They study the movement, distribution, and other properties of water, and analyze how these properties influence the surrounding environment. Hydrologists use their expertise to solve problems concerning water quality and availability. On geothermal projects, hydrologists study the water below the earth's surface. They help decide where to drill wells and analyze

the groundwater that is pumped from the underground reservoirs to the surface; ***Wildlife biologists*** evaluate a geothermal plant's effect on local animal life. Biologists ensure that the plant's impact on local animal populations is minimal. They spend a great deal of their time outdoors at the site, cataloging the surrounding wildlife and making recommendations on how to avoid interfering with local ecosystems.

Engineering occupations include *Civil engineers* design geothermal plants and supervise the construction phase. Many geothermal plants are built in rocky, difficult terrain, which require special procedures; Civil engineers also have to consider potential hazards such as earthquakes, and build plants to withstand them. These engineers are also responsible for designing access roads that lead to the plants; ***Electrical engineers*** who design, develop, test, and supervise the manufacture of geothermal plants' electrical components, including machinery controls, lighting and wiring, generators, communications systems, and electricity transmission systems; ***Electronics engineers*** are responsible for systems that control plant systems or signal processes. Electrical engineers work primarily with power generation and distribution; electronics engineers develop the complex electronic systems used to operate the geothermal plant; ***Environmental engineers*** deal with the potential environmental impacts of geothermal plants. Although geothermal energy is an environmentally friendly source of electricity, environmental engineers must consider a site's potential impact on local plants and wildlife; ***Mechanical engineers*** research, design, develop, and test tools and a variety of machines and mechanical devices. Many of these engineers supervise the manufacturing processes of drilling equipment or various generator or turbine components.

Drilling, construction and power plant operation occupations complete this list.

Obviously different forms of alternative energy have spawned various overlapping industries. Green jobs have been generated at many levels for companies that supply energy in the forms of biomass, biogas, production of energy from waste, and of course hydropower.

Other energy transformation related jobs

Websites that explain how to design do-it-yourself alternative energy solutions can attract big audiences. Such sites can be monetized with pay per click ads and can sell ebooks on environmental tips.

Environmental organizations are creating green jobs through awareness campaigns.

Electric car manufacturing has increased over the past decade and will likely continue to expand. Some of the jobs in this industry include chemical engineers, electronics engineers and software developers. Companies that make electric cars can also supply jobs in sister operations that manage charging stations. The demand for charging stations development of more efficient energy storage will likely increase.

The building sector is another one with huge potential. Part of the reason green construction is growing is that companies want green retrofitting to lower their energy costs.

Forestry is another field where energy related green jobs have potential growth. The forestry industry works closely with the recycling industry, which also saves energy.

The list is on-going.

NEW ENERGY – NEW GENERATION

(Need for new education and skills sets)

Growing industries, development of new technologies, legislative framework – they all create demand for new generation of qualified personnel, and at the same time promisse good business and caria prospects for the young people around the world.

Germany was mentioned several times as a global leader in renewable energy and this is also reflected in the German education opportunities which grow every year.

"There are about 300 courses in Germany that qualify their graduates for this growing sector," says Theo Bühler, a labour market expert from Bonn who specializes in environment and energy. More and more universities are responding to the strong demand from companies in this sector who are looking for qualified personnel. There is a need especially for engineers and technicians, as well as for natural scientists and business specialists. In the last four years the number of courses cov-

ering renewable energies has doubled. And the number of courses offered in English with an international appeal has also increased significantly. Whereas there were just seven courses available in this field in 2007, students can now choose between more than 25 options.

Here is an overview of courses with potential and good career prospects in the renewable energy sector:

European master in renewable energy (University of Kassel / University of Oldenburg)
Students study in a different European country each semester: that's the special thing about this master programme in renewable energy. It is offered by a network of nine European universities, including the German universities of Kassel and Oldenburg. To qualify for this postgraduate course lasting three semesters, a prospective student need to be a graduate who has studied at least four years in engineering, mathematics or physics. He/she also need sufficient professional experience in their specialist area and a very good knowledge of English. www.master.eurec.be/en

Wind engineering (Flensburg University of Applied Sciences / University of Kiel)
To become a wind energy specialist young people can apply to the master programme at Flensburg University of Applied Sciences and the University of Kiel prepares postgraduates for work in the wind energy sector in three semesters. The English-language course covers the fields of mechanics, electro-technology, economics and the environment. Entrance requirements are a first degree in engineering sciences, or several years of work experience, and a good knowledge of English.
www.fh-flensburg.de/fhfl/wind_engineering.html

Geothermal energy systems (Bochum University of Applied Sciences)
The main features are geosciences, mechanical engineering, plant construction and electro-technology: the master programme at Bochum University of Applied Sciences lasts for four semesters and provides specialist knowledge in geothermal energy and its applications, and it is integrated in the civil engineering sciences. The course is interesting for civil engineers and geologists, mechanical engineers and chemists. The university cooperates with the Geothermal Center Bochum (GZB).
www.hochschule-bochum.de

Renewable energy (University of Oldenburg)
From wind energy to solar technology: the course in Oldenburg is an international postgraduate programme in English extending over 16 months and is designed particularly for students from developing countries. The course combines theory with practice and case studies from the energy sector. Since 1987 more than 300 students from 70 countries have participated in the programme. The requirements are a first degree and work experience in the energy sector.
www.ppre.uni-oldenburg.de

Energy economics (University of Münster / RWTH Aachen)
Technology, economics and law: the two-year master's course in energy economics is based on this interdisciplinary mix. The course offered jointly by the Universities of Münster and Aachen cooperates with companies and organizations in the energy sector and aims to qualify people from the engineering and natural sciences as future employees and managers in the energy market. The course can also be completed in tandem with a career. The entrance requirement is a first degree in economics or a technical subject. www.rwth-aachen.de

Biobased products and bioenergy (University of Hohenheim)
The basics of crop sciences, engineering and economics for the cultivation of renewable resources and energy plants, their processing and conversion into energy: The University of Hohenheim near Stuttgart offers a bachelor course covering this range of subjects which are in high demand in this newly emerging occupational field. A good knowledge of biology, technology, economics, mathematics, physics and chemistry is important when choosing this course of study.
www.uni-hohenheim.de

Environmental planning and ecological engineering (Technical University Munich)
The use of natural resources, the treatment of waste materials, the reclamation of contaminated soil and waters:

these are major themes concerning students on the master's course at Munich's Technical University. The Programme includes not only the basics of engineering and natural sciences, but also agriculture, horticulture, forestry and planning studies. Students should have a bachelor degree when applying for this two-year master's course.
http://portal.mytum.de

Regenerative energy sytems (Technical University Berlin)
Photovoltaics, wind energy and the processing of regenerative resources: these are the main areas in the master's course which embraces the whole spectrum of energy technologies in four semesters. Individual modules enable students to gain deeper insights into certain subjects. The programme qualifies people for a position in the energy sector, building technology, administrative bodies or scientific institutions. To take part in the course you need a bachelor degree in the area of energy or process technology, or a related field of study.
www.tu-berlin.de

Renewable energy and energy efficiency for the Mena region (University of Kassel / University of Cairo)
Practice-oriented training in the fields of environment and energy for specialists from Germany, the Middle East and North Africa: this master's programme in English is offered jointly by the universities of Kassel and Cairo. In four semesters the course covers not only areas in the natural and engineering sciences; it also enables students to discuss economic, ecological and regulatory policy aspects in the energy sector. Students attend part of the course in Cairo and a second part in Kassel.
www.uni-kassel.de

Water resources engineering and management (WAREM), University of Stuttgart
Groundwater management and geohydrology, hydraulic engineering, water resources development and water management: this English-language master programme lasts for four semesters and conveys theoretical and practical knowledge in sustainable water management. The University of Stuttgart offers WAREM as a consecutive course which can be combined with the courses in conservation technology or civil engineering. The course also requires a good knowledge of English.
www.warem.uni-stuttgart.de

BACK HOME

So how are things back home? What are the educational opportunities Macedonian students have? How do we prepare our generation of new kids who will be the driving force behind the energy transformation of our society?

University "ss. Cyril and Methodius" – Skopje, Macedonia

Faculty of Mechanical Engineering

Bachelor studies
Study programme: Power Engineering and Environment
What is interesting about this study is that despite the technical subjects, such as, "Fundamentals of renewable energy sources", "Energy and ecology", "Energy from waste", etc. there is relation to management and business subjects, such as "Entrepreneurship and Small Businesses" .
Degree: Bachelor of Science in Mechanical Engineering
www.mf.ukim.edu.mk

Master studies
Study programme: Power engineering and environment
Relevant subjects in the study include "Optimization of energy systems", "Energy systems management", "Constructing hydro technical plants" etc.
Degree: Master of Science in Mechanical Engineering
www.mf.ukim.edu.mk

Faculty of Electrical Engineering and Information Technologies

Bachelor studies
Study programme: Power Engineering and Management
The first year is the same for all programmes and the division comes in the second year. Relevant subjects include "Fundamentals of Power Engineering", "Renewable Energy Sources", "Small Hydro Power Plants, "Project management", "Photovoltaic Systems" etc.
Degree: Bachelor of science in Electrical Engineering

Study programme: Electric Power Systems

This programme is similar to the “Power Engineering and Management” programme and focuses more on the electronics and electric networks. Relevant subjects include “Energy management systems”, “Energy Efficiency And Environment”, “Photovoltaic Systems” etc.

Degree: Degree: Bachelor of science in Electrical Engineering www.feit.ukim.edu.mk

Master studies

Study programme: Energy efficiency, environment and sustainable development

The purpose of the study program is to enable leading highly competent engineering staff for research, development, design and implementation of complex interdisciplinary projects in the areas of energy efficiency, the impact of electricity on the environment and sustainable development.

Degree: Master of Sciences of energy efficiency, environment and sustainable development

Study programme: Regulation in Energy, Electronic Communications and Transport

This programme provides knowledge on the need to establish a regulation in the fields related to transport of goods, commodities, people or information through large network systems, i.e. power and natural gas systems, electronic communication systems and transportation networks.

Degree: Master of Science in Regulation in Energy, Electronic Communications and Transport

www.feit.ukim.edu.mk

Faculty of Technology and Metallurgy

Master studies

Study programme: Environmental engineering

Diploma: Master of science in Environmental engineering

This is not very closely energy related study, but it studies very important factors associated with the energy sector with subjects like “Air pollution”, “Industry and environment”, “Sustainable development”, “Waste management”, “Clean production”, “Environment management” etc.www.tmf.ukim.edu.mk

University “ss. Kliment Ohridski” – Bitola, Macedonia

Technical faculty

Bachelor studies

Study programme: Energy and environmental protection

This three years study provides subjects closely related to energy and environmental protection, including subjects such as “Renewable energy sources”, “Mechanical engineering for environmental protection”, “Energy and renewable energy in rural areas” etc.

Degree: Bachelor of science in Energy and environmental protection www.tfb.edu.mk

Integrated Business Faculty – Skopje, Macedonia

Bachelor studies

Study programme: Environmental economy and Sustainable development

This is a 3 years programme including economic and management aspects in the environment. The programme is a good mix of business strategies and sustainable development in term of environment. Relevant subjects include “Energy efficiency”, “Environmental policies” etc.

Degree: Bachelor of science in Environmental economy and Sustainable development www.fbe.edu.mk

Master studies

Study programme: Environmental economy and Sustainable development

The programme is interesting because it combines the economic and law aspect of the environment and energy. Relevant subjects include “Environmental law”, “Energy efficiency”, “Corporate Social Responsibility in Environment”, etc.

Degree: Master of science in Environmental economy and Sustainable development www.fbe.edu.mk

MIT University - Skopje

Faculty of ecological resources management

Through practical application of our scientific-research methods, together we will set the standards for respecting environmental values, learn how to use natural resources in a sustainable manner, provide efficient assessment of environmental and energetic safety as well as of climate changes. The priority of this study program is to learn and establish EU standards and apply EU values concerning sustainable development and nature.

www.mit.edu.mk

ANNEX 1 – Results from the survey for young adults aged 15-22

Details about the sample that was questioned

Sex

Male **24** 24% Female **76** 76%

Age

15	**16**	16%
16	**14**	14%
17	**15**	15%
18	**8**	8%
19	**9**	9%
20	**9**	9%
21	**13**	13%
22	**16**	16%

Question 1: Have you ever heard the term renewable energy resources?

Yes	**96**	95%
No	**1**	1%
I am not sure	**4**	4%

Question 2: Where do you often get the information on renewable energy resources from?

National Magazines	**10**	3%
National TV Channels	**20**	7%
International Magazines	**11**	4%
International TV Channels	**31**	10%
Conversation with friends	**14**	5%
School	**27**	9%
Environmental campaigns and projects	**67**	22%
Internet	**65**	21%
Nongovernmental organizations	**55**	18%
I don't know where I've heard of it	**2**	1%
Other	**1**	0%

Question 3: Are you interested in any renewable energy resource for further research and education?

Hydro	**13**	13%
Solar	**55**	54%
Wind	**16**	16%
Geothermal	**5**	5%
Biomass	**12**	12%

Question 4: In your opinion, to what degree is the topic of renewable energy resources and energy efficiency represented in the current curriculum:

Not at all	**25**	25%
Insufficient	**67**	66%
Sufficient	**6**	6%
Well	**1**	1%
Excellent	**2**	2%

Question 5: Do you know of faculties in Macedonia offering studies in the area of renewable energy resources?

Yes	**27**	23%
No	**32**	27%
No, but I would like to get informed	**44**	37%
Other	**16**	13%

Question 6: Are you familiar with any company in Macedonia that works with renewable energy resources?

Yes	**31**	26%
No	**30**	26%
No, but I would like to get informed	**46**	39%
Other	**10**	9%

Question 7: Would you continue your education on studies of renewable energy resources?

Yes	**38**	38%
No	**26**	26%
I don't know	**37**	37%

Question 8: If your answer was YES on the previous question, which aspect would you like to study the renewable energy resources from?

Economic	**23**	26%
Social	**17**	19%
Civil engineering	**7**	8%
Scientific	**20**	23%
Legal	**7**	8%
Technical	**14**	16%
Other	**0**	0%

Question 9: Have you discussed at home to invest on integrating solar collector?

Yes	**41**	41%
No	**33**	33%
No, but I would like to discuss the topic with my parents	**23**	23%
We already have a solar panel	**4**	4%

Question 10: In your opinion who should implement measures for developing new businesses and jobs in the clean energy sector?

Ministry of Economy	**66**	30%
Nongovernmental organizations	**24**	11%
Employment Agency	**34**	15%
Local government (Municipalities)	**39**	17%
Universities und Faculties	**20**	9%
Companies and Business Community	**40**	18%
Other	**0**	0%

CONCLUSIONS AND RECOMMENDATIONS

The survey has been done on a small number of respondents (100), however certain conclusions can be drawn, particularly for those issues which have a high percentage of the selected answer. In this sense, it is interesting to see that the young adults have pointed out the NGO sector as the main source of information for the renewable energy resources (18% from the organizations themselves, and 22% from environmental projects and campaigns, which again are implemented mostly by non-governmental organizations), and the national media, on the other hand are seriously falling behind as informers on this topic.

Therefore our first recommendation is to continue, and even enhance the support for the campaigns on this topic of the NGO sector, but in cooperation with the media, in a way that would make it attractive and close to the young people.

It is a promising thing that the young people choose solar energy as a source which they are interested in mostly – the sun is the renewable resource with the greatest potential in our country, which unfortunately is completely marginalized by the national energy strategy.

The educational curriculum should be reviewed from the aspect of the information and knowledge it offers on renewable energy resources, a topic which is of high importance for our time, and which is obviously not represented at all.

A high 64% from the respondents (27% no and 37% no, but I would like to get informed) are not familiar with the possibilities for graduate studies related to renewable energy resources, which exist, but obviously are not advertised enough. In this regard we recommend introducing the so-called Career Days (organized on regular basis at Skopje Fair) where a stall for promotion of the possibilities in this field could be displayed, as a joint cooperation of all the faculties offering studies in this field as well as the nongovernmental organizations working on this topic. The young people are not familiar with the companies working with renewable energy resources as well (65%), which is not in the best interest of these companies – their future development might depend on the professional expertise which lies within the lines of this target group. Following the example of the international companies we recommend that the national companies should also start (at least modestly) with scholarship programmes for young people willing to further their education in this field, as well as internship programmes for the graduate students or those graduating. The percentage of young people interested in education on the topic of renewable energy resources is not very high, but if we take into consideration that 76% of the respondents are female, and energy as a topic is traditionally more attractive to the male respondents – then this percentage is not to be underestimated.

The economic aspect of all the areas in the recent years has been very attractive for the young people (the management studies are in the biggest demand), so it logically surfaces as primary in the energy field. This is not bad at all since the new generation of environmentally responsible and educated economists promises (finally) a real move towards sustainable development in the country. The understanding of sustainable development in Macedonia so far has mainly been rendered down to how to balance the economic with the environmental aspect (which has a priority), not developing economies with negative, but with positive effect on the environment and develop it further. It is promising to see the answer that points at the fact that the use of solar energy as thermal (collectors) is a relatively common topic in the respondents homes. The incentives of the Ministry of Economy for partial subsidies for solar collectors must have contributed to this result and in this regard we encourage even more energetic support in the future.

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