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EXECUTIVE SUMMARY

The USAID Energy Security Project (ESP) supported the comprehensive research study ‘*Educational Needs Assessment in the Ukrainian Energy Sector*’ (September 2020 – February 2021). The study was conducted by the All-Ukrainian Charitable Organization Municipal Development Institute (MDI).

The goal of this study was to identify the qualifications and experience required by specialists who are in demand in the energy sector, determine whether the Ukrainian contemporary education system meets the demands of the energy industry, and identify remedies that will fill the gaps between education services and graduates’ qualifications and energy companies’ real needs.

The research study consisted of three successive stages.

STAGE 1: STUDYING AND ANALYZING THE QUALIFICATION NEEDS OF EMPLOYERS (SEPTEMBER-NOVEMBER 2020)

This stage employed both qualitative methods (in-depth interviews) and quantitative methods (sample surveys). The study involved a variety of companies with various specializations (electricity suppliers, district heating companies, renewables, natural gas companies), state-owned, private and communal, big, medium, and small. Fifteen in-depth interviews with 18 senior executives in the energy sector were conducted for the qualitative phase and the quantitative sample consisted of 150 respondents representing 74 energy companies.

The goal was to analyze the companies’ needs in qualified staff, the quality of higher education in the energy fields, the importance of special and general competencies both per company and for the energy sector in general, the gender and age demographics of various professional groups in the energy sector, links between employers and educational institutions, etc.

STAGE 2: EDUCATION SYSTEM’S CAPABILITY TO MEET INDUSTRY DEMANDS (OCTOBER-DECEMBER 2020)

This stage employed a qualitative study to answers the following questions.

- Can higher education institutions in the field prepare highly qualified, well-educated, and appropriately skilled professionals for the energy sector?
- What are the gaps between graduates’ qualifications and the real needs of employers?
- What are the determinants affecting learning and the level of special and general competencies of graduates/young professionals?

These and other associated questions were discussed through in-depth interviews with academics. Interviewees were heads of departments, academics, educators, recent graduates, and other experts in the field.

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There were 23 interviews conducted with academics who represented 18 educational institutions, and eight interviews with university graduates. In total, 31 respondents (seven women and 24 men) were interviewed. The education system's capability to meet employers' demands was analyzed based on the following key criteria:

- Quality of education programs/curricula per specialty/qualification;
- Graduates' preparedness for professional life;
- Quality of the graduates' special and general competencies;
- Technical, financial, administrative, and human resources to support the learning process;
- Gender aspects of education in energy;
- Links between educational institutions and employers.

STAGE 3: MEETING EDUCATIONAL NEEDS IN THE UKRAINIAN ENERGY SECTOR (JANUARY-FEBRUARY 2021)

Based on the findings, some recommendations were prepared to tackle the current mismatch between employers' needs and the education system's capabilities:

- Recommendations to public authorities concerning possible education improvements in the energy sector;
- Recommendations to higher education institutions concerning possible improvements for the curricula and learning process;
- Recommendations on secondary vocational education/professional training in the energy sector;
- Recommendations on strengthening collaboration between educational institutions and employers;
- Recommendations on raising the profile of energy professions and gender inclusion;
- Recommendations on technical, financial, and administrative support to educational institutions.

These recommendations are addressed to the key stakeholders in education: central and local authorities, engineering/vocational schools, universities, energy sector employers, etc.

KEY FINDINGS

STAFFING NEEDS. *One-third of the interviewed companies reported acute problems finding adequately qualified candidates to fill vacancies, in particular engineers and other technical specialists. There is also a shortage of qualified competitive specialists in sales with good knowledge of the markets and marketing.*

The key staff shortage factors are:

- Uncompetitive wages, even in private companies;



- High labor emigration;
- Poor work conditions and potential health hazards associated with some professions in the energy sector;
- Vocational training system in crisis;
- Low profile of civil engineering in the labor market.

QUALITY OF EDUCATION. *The quality of education in the energy sector does not meet employers' demands and should be improved. Most respondents noted that university graduates had little or no practical experience.*

SPECIAL COMPETENCIES IN THE ENERGY SECTOR. *Each energy field requires special knowledge and skills determined by the specific field. However, there are important competencies that are in demand in every energy field.*

Many respondents believed that graduates needed more knowledge of the markets and market mechanisms in general, in particular energy economics, economic planning, and the adverse impact of monopolies.

IMPORTANCE OF THE GENERAL COMPETENCIES. *To be competitive in the labor market, young specialists need some key skills and qualities to catch up with a rapidly changing environment.*

Respondents stressed the importance of practically employing the knowledge that their young staff acquired at universities and colleges. Other important qualities were a sense of responsibility, good evaluation skills, the ability to quickly identify problems and develop adequate solutions, data search and data analysis skills, and a good understanding of labor safety and safety policies.

Respondents proposed a range of *additional competencies*: high adaptivity, stress resistance, good time management skills, creativity, change management, ability to cope with limited data/information, ability to operate effectively in a rapidly changing environment, integrity, and a client-oriented approach.

GENDER AND AGE IN THE CONTEXT OF COMPETENCIES AND EFFICIENCY. Most respondents reported no difference between men and women concerning special and general competencies in all fields except hard manual labor.

However, a correlation between age and competency level was reported. In general, young people are more likely to learn and have good IT knowledge, think creatively, and try new techniques/methods. Their older colleagues are more conservative and less likely to try new approaches. Yet younger professionals lack practical experience, and transferring knowledge and experience from older and more experienced workers to new staff is a common practice. This synergy of experience and creativity can be very effective.

The majority of the interviewees saw no difference between men and women in terms of efficiency.

LINKS BETWEEN COMPANIES AND EDUCATIONAL INSTITUTIONS. *All interviewed companies reported cooperation with educational institutions in some form. Yet there is plenty of room for improvement.*

The electricity sector is the leader in this – 92 percent of upper- and mid-level managers in the electricity sector reported some cooperation with technical vocational schools/colleges and universities.

Two-thirds of the gas companies and over a half of district heating companies (DHCs) maintained links with some schools/universities. At the same time, the cooperation between the renewable energy sector and the education sector was at a much lower level.

All energy companies employed the following modes of cooperation – onsite training, presentations and meetings with students at schools/universities, mentoring and helping students with their diploma papers, participation in examination boards, and awareness campaigns.

At the same time, the energy companies were less likely to participate in the development of curricula/training agendas/educational standards.

Financing of educational initiatives, social partnership, joint initiatives with educational institutions, joint research projects, and training courses to accommodate the needs of particular compared remain underdeveloped.

GAPS BETWEEN THE INDUSTRY'S NEEDS AND THE QUALIFICATIONS OF GRADUATES – THE EMPLOYER'S VIEW. There are some important gaps between the industry's needs and the current capacities of the education sector. The most important are the following.

- Very low level of practical experience of students and graduates.
- The curricula and training techniques do not keep up with contemporary markets and are generally obsolete.
- The theory does not keep abreast of modern technology.
- Lack of cooperation and communication between the industry and educational institutions.
- Low profile of the professions in the energy sector and lack of motivation to choose careers in energy.

EDUCATION/TRAINING QUALITY. *There are some important deficiencies, in particular, the absence of nationally-approved quality standards for some qualifications/professions.*

The most important features of the current system are:

- Most education programs/curricula were developed in line with approved national standards (if there are any) or 'general methodological recommendations';
- Education modules do not usually take into consideration industry needs and research findings in the field;
- Education modules/curricula failed to take into consideration massive recent changes in the energy sector (for instance, the recent creation of the energy resources market);

- More classroom hours are needed and the limited financial and other material resources is a serious constraint;
- Internships are often very formal and do not provide students with actual knowledge and experience;
- There are officially declared educational goals, such as equipping students with planning, time management, critical thinking, communication, interaction, team building, and data management skills, yet these are not supported by adequately developed courses/disciplines.

INTERVIEWED ACADEMICS WERE MUCH MORE OPTIMISTIC ABOUT THE LEVEL OF STUDENTS' QUALIFICATIONS. *Yet they believed that the system could and should be improved.*

Their key assessments:

- The quality of academic education is quite high (the majority of interviewed educators and graduates assessed it to be above average);
- The interviewed lecturers assessed the practical experience of their students to be at a medium or higher level (the students believed that their practical experience was average or low);
- Both the teachers and students believed that the *general competencies* of graduates were at an above-average level; students' assessments were higher.

SPECIAL COMPETENCIES. *Practical competencies* were seen as the area of the biggest concern. Practical experience takes time, lab resources, and access to knowledge and technology that many educational institutions cannot provide.

Many graduates lack practical skills associated with planning and projection, use of computer-aided design systems (CAD), and other software packages, like 3D modeling, etc. This is due to the lack of classroom hours, poor IT equipment, and lack of modeling capacities or tools for virtual and augmented realities.

The general specialization of education in the energy sector is quite narrow. Both lecturers and students were quite critical about competencies such as intellectual property protection, the ability to analyze commercial and other economic data, planning and projection skills, and problem-solving skills. At the same time, about 90 percent of the interviewed employers considered these skills as highly important.

GENERAL COMPETENCIES. According to the interviewed lecturers and students, the biggest problems concerning general competencies are:

- Poor command of foreign languages;
- Low or below-average level of soft skills, such as communication, self-management, and data processing;
- Lack of experience practically applying academic knowledge.

The study employed a multidimensional scaling method for the data obtained from academics and graduates. In general, the employers were much more skeptical about the theoretical and practical knowledge and skills of Ukrainian graduates in the energy sector. At the same time, employers were more optimistic about some personal qualities of their newly recruited staff, in particular their collective conscience, sense of solidarity, teamwork, etc.

THE EDUCATION SYSTEM'S FINANCIAL, TECHNICAL, HUMAN RESOURCES, AND METHODOLOGICAL RESOURCES.

- Regional universities face the biggest problems with lab equipment computers, IT, software, etc.
- Many educational institutions have old and worn-out lab equipment.
- Almost all educational institutions need more renewable energy labs, computer classes, automated systems, CAD systems, special software, 3D modeling techniques, etc.

Most of the teaching staff are older, with little motivation to gain new knowledge. They use old textbooks and teaching methods. Many lecturers lack practical experience.

Some graduates stressed that the curricular content was far removed from their actual work. The contents of courses and teaching methods were outdated and did not provide for their actual needs in this market.

VOCATIONAL AND TECHNICAL SCHOOLS – QUALITY OF EDUCATION.

These facilities have even more problems than higher education institutions.

According to the interviewed teaching staff, only 20 percent of vocational school graduates had adequate qualifications and skills due to the generally low level of school education, poor financial and other material resources, lack of equipment, the professions' low social profile, inadequate teaching staff wages, etc.

All energy sector professions (Qualification 141, Qualification 144, Qualification 145, Qualification 185, and the Renewable Energy Specialist Qualification) have no nationally approved standards. In other words, course contents vary significantly by educational institution

Secondary vocational education needs rehabilitation, especially at a regional level. It should include a large-scale awareness campaign to raise the profile of energy professions, increase teaching staff qualifications, improve financial resources and equipment, improve the internship system, etc. This kind of rehabilitation would be impossible without involving potential employers and local authorities.

ENERGY EDUCATION – THE GENDER ASPECT. There is a significant gender gap in energy sector education. According to teaching staff, the reasons are the general *humanization* of education, some deeply rooted stereotypes concerning the roles of men and women, and lack of awareness about career opportunities in the energy sector amongst young people, especially young women.

Virtually all respondents were confident that gender had no impact upon academic achievements, which depended on young people's attitude and willingness to learn.

According to the teaching staff at technical/vocational schools, gaps in labor legislation, arduous work conditions, and low wages are the major barriers to women in this sector.

GAPS BETWEEN COMPANY NEEDS AND GRADUATE QUALIFICATIONS – VISION OF TEACHING STAFF. Teaching staff identified the following observations and opinions concerning the major gaps between the actual needs of energy companies and graduates' qualifications.

- The whole system of internships should be improved: the current curricula do not provide enough time for students to gain good practical experience.
- Mismatches between universities' lab equipment and the equipment used in the industry.
- Out-of-date textbooks and other materials, especially at vocational/technical schools.
- Lack of teaching staff with extensive experience in the modern energy sector.
- Poor cooperation between educational institutions and energy companies.
- Lack of government support to young specialists in engineering.

These summarized results provided the basis for some recommendations.

KEY RECOMMENDATIONS

EDUCATION IN THE ENERGY SECTOR – POSSIBLE IMPROVEMENTS

These recommendations are for the key executive bodies, such as the Ministry of Education and Science, Ministry of Energy, Ministry for Communities and Territories Development, State Agency for Energy Efficiency and Energy Saving, National Agency for Higher Education Quality Assurance, National Academy of Sciences, local authorities, employment centers, etc.

- Assess and project in the mid-term (5-10 years) the labor supply and demand in the energy sector. This will provide data for planning further market developments.
- Optimize the overall structure in energy education, in particular publicly subsidized programs, based on the projections of labor supply and demand in this market.
- Develop a national program to popularize STEM education, raise the profile of technical education through well-targeted awareness campaigns, and support cooperation between energy companies and educational institutions at the regional level.
- Introduce the international standard classification of education (ISCED-F 2013).
- Develop National Standards for Energy Qualifications, in particular Qualification 185 '*Oil and Gas Engineering and Technologies*' and qualifications associated with renewable energy. These national standards will be needed at vocational schools, as well.
- Develop recommendations on evaluation methods and evaluation scales for general competencies. At later stages, higher education institutions will develop evaluation instruments.
- Develop legal amendments to enable a dual vocational/higher education system. At the legal level, the system will require a major regulation and standard trilateral agreement between the educational institution, student, and employer.

- Initiate the development of electronic training courses (e-learning) with a practical focus, and additional ‘augmented reality’ training programs (e.g., modeling emergencies at energy facilities).
- Introduce monitoring of the quality of education provided in publicly-subsidized educational programs.
- Strengthen the role and responsibilities of regional/local authorities to support regional educational institutions.

This section consists of 13 recommendations, most of which are addressed to the Ministry of Education and Science and the National Agency for Higher Education Quality Assurance.

RECOMMENDATIONS ON THE CURRICULA QUALITY AND CONTENTS ARE addressed to educational institutions, yet many of these recommendations provide for involving employers.

This block consists of two parts: (i) general recommendations for **all** educational institutions teaching for the energy professions, and (ii) recommendations for **specialized** educational institutions by course/qualification – so-called *sectoral recommendations*.

The general recommendations propose 19 interventions, with three groups of recommendations in this block.

- Revise and update the contents of programs/courses based on real industry needs and develop and publish a list of general and special competencies that each graduate should have.
- Improve the administrative and organizational basis of higher education, post-graduate education, and refresher training for teaching staff.
- Improve monitoring and evaluation of education programs.

The full report contains detailed recommendations per each of the following qualifications: *Electrical Energy, Heat Power Engineering, Oil and Gas Engineering and Technologies, and Renewable Energy*.

SECONDARY VOCATIONAL EDUCATION RECOMMENDATIONS provide for 20 interventions targeting the seven goals.

- Rejuvenation of vocational education in Ukraine.
- Raising the profile of vocational schools and technical colleges, many of which traditionally have a rather low reputation.
- Highly professional and motivated teaching staff.
- Strengthening the financial and equipment base of vocational education in Ukraine.
- Revising and radically improving the internship system and employment programs for university graduates.
- Extending the system of dual education.

- Officially approving education standards in the energy sector and revising and updating the curricula based on contemporary trends, developments, and technologies in the industry.

Most of these recommendations can be implemented by the Ministry of Education and Science, local Departments of Education, vocational/technical schools, and employers.

RECOMMENDATIONS TO STRENGTHEN COOPERATION BETWEEN EDUCATIONAL INSTITUTIONS AND EMPLOYERS. This block consists of 18 recommendations in six groups.

- Involve employers and local authorities in developing, evaluating, and revising educational programs, and strengthen cooperation between employers, local administrations, and educational institutions.
- Develop draft legislation (to be submitted to the Verkhovna Rada) to motivate energy companies to contribute to the education system.
- Extend and diversify employer representation in the Expert Councils of the National Agency for Higher Education Quality Assurance.
- Revise the membership of educational institutions' supervisory boards and establish quotas for employers who have a say in the decision-making process.
- Support research development and educational clusters at facilities that bring together teaching and research with a high-quality equipment and qualified staff. The facilities may become an important source of innovations, yet their major function will be training and retraining qualified personnel based on actual needs at the national and regional level.
- Establish effective, productive, and mutually beneficial cooperation between higher education institutions and employers.

These recommendations are to be proposed to key executive bodies in the field, such as the Ministry of Education and Science, Ministry of Energy, National Agency for Higher Education Quality Assurance, local self-governments, vocational schools, higher education institutions, employers, and associations of employers.

RECOMMENDATIONS TO RAISE THE PROFILE OF ENERGY PROFESSIONS AND ENSURE GENDER INCLUSION.

Twenty-three interventions are proposed to achieve the following eight major goals.

- Extend students' knowledge and support their interest in the energy professions through effective career guidance programs that will put more focus on female students.
- Motivate students to specialize in STEM fields.
- Improve the labor conditions for women and people with disabilities in the energy sector.
- Improve education and career opportunities for women and people with disabilities.
- Remove the artificial barriers to women's career growth, highlight women's success stories in the energy sector, and combat gender stereotypes and discrimination.



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- Support initiatives to engage new qualified human resources in the energy sector.

These recommendations are addressed to the local Education Departments and local communities, general and vocational schools, and higher education institutions, non-governmental organizations, and employers.

RECOMMENDATIONS TO IMPROVE MATERIALS AND EQUIPMENT AT EDUCATIONAL INSTITUTIONS.

- Renew laboratory facilities, provide educational institutions with modern equipment and measurement technology.
- Establish new labs and research centers.
- Re-equip or set new specialized computer classes for STEM/IT disciplines.
- Establish multi-media technical learning centers, and equip classes with multimedia equipment, etc.

These recommendations are addressed to educational institutions, local authorities, and employers.

Recommendations for equipment and material resources are given per each of the following Qualifications: *Electrical Energy, Hydroenergy, Heat Power Engineering, Oil and Gas Engineering and Technologies, and Renewable Energy*. These recommendations build on data obtained from in-depth interviews with senior executives, teaching staff, and graduates.

TENTATIVE BUDGET AND TIMEFRAME. Most of the proposed recommendations can be implemented throughout 2021-2021 and financed directly from the budgets of the relevant central and local authorities, educational institutions, and employers in the energy sector.

At the same time, some activities may require financial assistance from international projects, international education initiatives, etc. The following activities may need international financial support.

- Mid-term assessment/projection of labor supply and demand in the energy sector (\$60,000-\$70,000).
- A national program to popularize education in the STEM fields.
- National public awareness campaign to raise the profile of energy professions (\$300,000-\$340,000).
- A concept for regional cooperation programs between educational institutions and employers (approx. \$50,000).
- A pilot program for a selected educational institution to establish an educational and research cluster facility, based on public-private cooperation in higher education (\$150,000-\$250,000).

In addition, international grants may finance some of the equipment at the educational institutions.



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ACRONYMS AND ABBREVIATIONS

CAD	Computer-Assisted Design
DHC	District Heating Company
ESP	USAID Energy Security Project
IT	Information Technology
MDI	All-Ukrainian Charitable Organization Municipal Development Institute
STEM	Science, Technology, Engineering, and Mathematics
USAID	United States Agency for International Development