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THE AUTOMATION OF STANDARD PEOPLE OPERATIONS IN THE ENERGY TRANSPORT

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Abstract

The automation of business processes and operations is a global trend. Automation is software or mechanical self-fulfilling process without or with a minimal human intervention and control. In specific processes and parts of the energy transport the automation is already happening. It can replace significant part of human labour or just to take and reduce the routine physical or repeating mental efforts of the jobs. Automation tools and systems in the energy transport are strongly dominated by open-source software automation tools. Therefore, a part of professional skills required before automation will not be useful in the future, but to handle automation trend, many new skills and knowledge will be needed by the human jobs of the future.

Key words: automation, open source, software, skills, energy transport, artificial intelligence (AI), algorithm, labor, job, skills, technology

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Introduction

What are the challenges for energy transport due to enormous and intensive processes automation and how they affect the human job, skills and need for training? In this article are being researched the areas of most intensive automated processes, what are the tools of automation. The expected results of the human jobs content in the future are the topics expected to obtain answers.

The definition of automation according the International Society of Automation is: "the creation and application of technology to monitor and control the production and delivery of products and services" (International Society of Automation, 2021). The automation contains many elements, systems and functions. Automation can assure many advantages, including the energy transport. Here are the main domains:

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- Production of pharma, food, chemicals;
- Transportation – automotive, space, rail, air, including energy transport;
- Utilities – water, wastewater, oil and gas, electricity and telecommunications;
- Defense and security;
- Facility operations, environmental control, energy management, building automation;
- And many other automation applications.

The automation tools replace significant volume of routine people work. On the other hand, it requires more and more highly qualified and expensive professionals to plan, implement and manage the automation in each area, including the energy transport. The most automation intensive areas in the energy transport could be found where many required tasks are highly labor intensive or highly repetitive. The creation of automated software or machines are improving efficiency and also creating higher quality control.

Here, under automation, we will consider the software managed and automated processes that reduce the need of human intervention or allows significant period of self-guided systems without or with minimal human control. The recent software development tools, frequently based on open-source solutions, are evolving to AI (artificial intelligence and machine learning).

The benefits of AI and the numerous software applications, for instance, are increased productivity and expanded opportunities. In the energy transport the automation solutions are available in:

Energy infrastructure

Between energy sources and end energy consumers stays the transport of energy or the energy infrastructure. Making the energy supply more sustainable, saving energy and making different sectors and forms of energy (electricity, gas, heat) more interconnected will change the demand on existing and new energy infrastructure. That energy infrastructure is rapidly evolving to smart grids and their management is being constantly transferred from human employee control to automated control.

Energy transport typically is meant as moving energy from one location to another. Under energy transfer we understand moving energy out of something (solid, liquid or gas) thereby reducing its energy, into something else (another solid, liquid or gas) thereby increasing its energy. The energy transport typically is pipeline transport.

The software solutions as a ground of automation in the energy transport

Open-source development has become increasingly popular in recent years, also including the energy transport. Those solutions encourage collaborative and

transparent program development and promotes unlimited free redistribution of software source code to the open audience and accelerate changes in transition to sustainable and green energy. The point here is to deliver scalable and modular plug-and-play software components for automation. Ideally, automation solutions can be implemented much faster, and be adapted dynamically to evolving energy business models. Open-source solution is transparent for exploration of the source code for improvement and review of the algorithms. In this way everybody has access to the working model. Nowadays we are experiencing increasingly faster energy transition and automation is required even more and more. We are experiencing historical transitions, but also a mix, between major energy sources. Most of these shifts lasted over a century or longer and were stimulated by resource scarcity and technological innovations (Hammond et al., 2013).

Another aspect of energy management automation is the computer modelling. The software simulations can help in main directions like: planning of power generation capacities, energy transportation and storages. For that computer simulations are taken into consideration also dynamic parameters like time and energy consumption. The open-source led computer models are used for important decision making. The open-source platforms sued for automation purposes are quite new for that usage, but they are being constantly invented for scalable projects, realistic data, projects planning and optimization of future energy systems, known also as capacity expansion planning. Automation software algorithms are available to solve typical optimization problems in the expansion of renewable and conventional energy (Jansen, 2015).

The cost efficiency is one of the most usable characteristics of the open-source software automation solutions in the energy sector. Direct cost associated with high renewable generation is comparable to cost estimations of other energy mix. The aim is to the improvement in the cost structure and performance of renewable technologies and of course – the reduction of non-meaningful costs. One of the main objectives of an open-source energy system is to reduce total costs by reducing software development costs and facilitating the interconnection between systems. Beside the cost reasons, there are more grounds to save time, resources and human capacity by using the automation in planning the capacity of the grid and increasing the agility.

The open-source automation solutions generate significant cost savings in the energy sector. The software is available for free use in the form of community supported and improvable projects. Or it could be bought through corporate packages at very tiny price, that cover subscriptions for support and software upgrades (Pearce, 2020).

The topic of open data can also be included in the open-source models. Many open-source systems used for modeling, analysis and forecasting are based on

so-called open data. In the energy sector, open data can be divided into several categories:

Demand related open data:

- Electricity demand;
- Thermal demand;
- Transport demand;
- Industrial demand.

The open-source automation solutions have invented a flexible model involving the different elements of the system and increasing the resistance against cyber-attacks. This approach is giving the possibility to scale the structure and to provide agile vision on the strategic development of the energy transport companies worldwide. Obtaining the automated solution boosting the business processes and manage the energy streams the companies from this industry are capable of increased analysis of the consumption, monitoring and control. The addressable market are not only the utilities companies, but also the power generation, energy transport, energy transmitting and many more. The sector transport is mainly affected in this context regarding the energy transport electrification – substations, contact line and may be considered as similar.

Automation of the people labor

The opposition AI versus mankind is a philosophy matter. Going beyond of this, we find the trivial story of long historical evidence of constant innovation. It shows that the technological change has been dominantly positive in terms of productivity and surprisingly resultative regarding to employment. The trend is that productivity benefits generated by new technology inventions have been reinvested. The GDP raises as a result of that productivity as well as the consumption. Finally, the productivity and the investments increase new demand for more and more labor. In the general picture, same thing happened to employment after productivity growth in the last 50 years. The productivity gains driven by technology have gone together with rising employment. That's completely synchronized with the trend of the energy business. The invention and mass usage of personal computer is an emblematic example for support the coincidence of technological progress with the growth of the jobs number. Many jobs were terminated and many new different were generated in the United States between 1980 and 2015. That was as a result of the implementation of computer technology, shows McKinsey research (Manyika, Snaeder, 2018). The jobs of more than 200 000 bookkeepers, audit administrators, secretaries and typewriters lost their working places. But the balance by the end of the day was strongly positive: the "personal computer industry" created more than 19 million new working places in industries and sectors starting from computer hardware to

business software, online stores. The loss was relatively lower – 3,5 million jobs. The calculation is eloquent – increase of the jobs to 15,7 million. That number is close to 18% of all the newly created employment for that time.

The rise of the artificial intelligence and more advanced technologies, that can used to bear on any number of tasks, is likely to enter in a new era of rapid transformation of the working force. The labor force transition and migration from old to new roles with upgrading skills is the essence of the profession dynamics in the energy transport during the last 5 decades.

According to McKinsey Global Institute there are 2 mainstreams for job technology transformations that will affect around 14% of the working population: 1) jobs requiring routine and repeating physical activity in a predictable way and 2) jobs requiring routine and basic data collecting and processing. Both are available in the energy of transport companies. And the AI is not at all the first disruptive technology threatening to replace cognitive tasks. Since computerized calculators and Excel spreadsheets start to be used, machines have calculated and resolved much more sophisticated problems that previously required human brain work only. The difference is maybe that the acceleration of technological change today is rapidly growing, and constantly changing.

With this regard methods for development of deep learning and reinforcement-learning methods based on neural networks, the exponential increase in computing capacity made available of data can be generated. These advances are driving AI for enabling the smart grids in energy transfer, predicting the demand of oil and gas consumption, scheduling of electricity and many others. If we look at a variety of technologies with high added value, during the past 60 years, from electric cars to smartphones, the intensity of technology adoption actually hasn't changed significantly. It still takes 5 to 16 years to reach 50% adoption and 5 to 28 years to reach 80% adoption of each newly invented technology (Manyika, 2018).

This may seem frightening, but it is the only way for continuous development and innovation. It's good to embrace automation technologies for the productivity benefits they bring. The demographic trends like increased life expectancy, and decreasing population are rapidly increasing the involved groups of people. Therefore, our society really needs boosted productivity. These technologies will create prosperity (and employment) and also other societal benefits. The key challenges in some countries related to the expected future skills that will be in high demand by the working force will rise dramatically not just for all kind of tech skills, but also not less for social and emotional skills (e.g. leadership, empathy with customers), and also for higher cognitive skills related to creativity, complex information management and data processing.

Traditional industries like energy transport declare their strive for finding the right talent. These high potential professionals are expected to boost implementation of automation, which is critical to company future financial and

business performance. These companies should take the lead in the required skills upgrade and strengthening. Some businesses and companies are already starting and accrediting re-qualification initiatives. These educational efforts are just the beginning. The caliber of the occupational and skill renewal is essential for the business, but not only. Governments and educational bodies are already working together with all the company training departments. Some basic assumptions should be rethought. To redesign the jobs across energy sectors, companies will need to reconsider the definitions and qualifications for each specific skill. In our days, higher education motivates the society to evaluate graduates by their subject knowledge rather than by their proven abilities in problem-solving, creative thinking and result achievements. Such skills will be especially valuable and in highest demand in an AI driven workplace.

Alternative view is represented by the following statement: the increase of the productivity has retarded so significantly in the past 10 years and economists doubt whether we have started a new era of constant stagnancy. They envision a new period when we will need stronger efficiency growth and higher productivity more than before, so we will keep growing, as working groups in highly energy consuming countries (like Germany and Japan) are constantly aging and shrinking. Here comes potential replacement as advanced robotics automation, machine learning, and artificial intelligence, which can already surpass human abilities in high number of tasks like energy demand planning, smart grids management and energy trading. These efficiency advantages for companies are related not only to labor costs reduction. Automation also brings totally different business models, as well as enhancements that strongly exceeds human abilities, like enlarging throughput rate and quality, dropping the response times in the energy transport. Automation will enable the global economy with the necessary boost of productivity, even to enable significant jumps such as solutions and inventions affecting the climate changes and energy efficiency.

The adoption of these technologies will totally disbalance the typical way of work in the energy sector. The jobs that will be pushed out, the jobs that will be changed and those that are about to be created. McKinsey Global Institute's research (Manyika, Snaeder, 2018) forecasts that roughly 15% of the global workforce could be erased by 2030, but the newly created jobs will compensate the lost jobs. The economies keep intensive economic growth and dynamism, that is associated with strong trends sustain the demand for work. Between 75 and 375 million actively working people all over the world probably will need to change their occupational activity by 2030 as a result of the intensive automation adoption in their industrial domain.

Embracing automation technologies for their productive advantages for the workforce transitions will accelerate technology adoption. The correlation of

productivity with the employment is actually more than it might initially seems. The jump of the GDP brought by the productivity will raise consumption along with the labor demand. That correlation is already available in the past. The faster are the value gains turned into an income, the stronger will be the effect of labor demand increase.

The newly established renewable energy companies generate significant part of the new jobs. For the U. S. clean energy market 3,3 mln. jobs are reported (Marcacci, 2019). The increase of renewable energy employment for 2018 is 3,6% and expectation for 6% growth for the next year. "New energy jobs" are with higher salaries than the average in the United States. Usually the average clean energy job can reach 8-19% salary increase compared to the average standard energy production job.

Challenges of the Future for Energy and Utilities

According research of the World Economic Forum, the average risk for the next 10 years the total number of workers at risk is 11,8% for energy and utility business. That is one of the lowest levels for most of industries in this research.

Table 1: Top 10 technology adoption in energy, utilities and technologies

Share of companies surveyed	%
Internet of things and connected devices	94%
Text, image and voice processing	88%
Encryption and cyber security	88%
Cloud computing	88%
Power storage and generation	88%
AI (machine learning, neural networks)	81%
Big data analytics	76%
Augmented and virtual reality	75%
E-commerce and digital trade	71%
3D and 4D printing and modelling	69%

Source: adapted from World Economic Forum (2020).

The skills that the companies will need in the next 10 years are not surprising.

Table 2: Skills identified as being in high demand within their organization, ordered by frequency

1.	Critical thinking and analysis
2.	Complex problem-solving
3.	Creativity, originality and initiative
4.	Analytical thinking and innovation
5.	Active learning and learning strategies
6.	Technology design and programming
7.	Service orientation
8.	Troubleshooting and user experience
9.	Leadership and social influence
10.	Technology use, monitoring and control
11.	Resilience, stress tolerance and flexibility
12.	Emotional intelligence
13.	Systems analysis and evaluation
14.	Reasoning, problem-solving and ideation
15.	Attention to detail, trustworthiness

Source: adapted from World Economic Forum (2020).

Role identified as being in high demand or increasingly redundant within the researched organization in the energy and utility industry, ordered by frequency.

Table 3: Emerging job roles

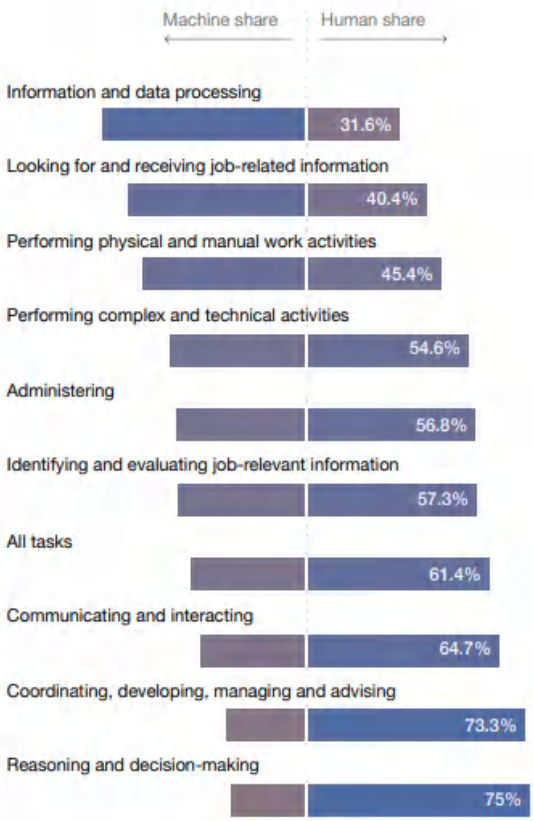
1.	Data Analysts and Scientists
2.	Renewable Energy Engineers
3.	Big Data Specialists
4.	AI and Machine Learning Specialists
5.	Software and Applications Developers
6.	Mechanics and Machinery Repairers
7.	IoT Specialists
8.	Construction Laborers
9.	Digital Transformation Specialists
10.	Robotics Engineers

Source: adapted from World Economic Forum (2020).

Table 4: Redundant job roles

1.	Administrative and Executive Secretaries
2.	Mining and Petroleum Extraction Workers
3.	Accounting, Bookkeeping and Payroll Administrators
4.	Accountants and Auditors
5.	Power Production Plant Operators
6.	Mining and Petroleum Plant Operators
7.	Mechanics and Machinery Repairers
8.	Legal Secretaries
9.	Data Entry Clerks
10.	Data Analysts and Scientists

Source: adapted from World Economic Forum (2020).



Source: World Economic Forum (2020).

Figure 1: Augmentation and automation of key job tasks by 2024 in Energy and Utility

As a conclusion, we can say that the automation, in along with the recession caused by COVID-19, is about to create a "double-disruption" scenario for workers. Adoption of technologies by the industry, including energy transport will transform duties, jobs and skills after 2025. 43% of companies indicate that they plan to reduce their current workforce due to automation technology integration. 41% plan to expand use of contractors for task-specialized work. 34% plan to grow significantly their workforce as a result of technology implementation. By 2025, the time spent by human workers on current tasks at work and those fulfilled by machines will be quite equal. A significant number of companies are reporting plans for change and relocation of their value chains, as well of their staff due to non-technology factors in the next five years.

The number of the "new jobs" that will be created will surpass the number of redundant jobs. Job termination is slowing down while job establishment accelerates. Employers report expectations by 2025 for increasingly redundant roles of the workforce to decline from being 15,4% to 9% (6,4% decline), and that emerging professions will grow from 7,8% to 13,5% (or 5,7% increase) of the total staff of responding companies. The estimation is that by 2025, 85 million jobs may be terminated by a shift in the division of labor between humans and machines, while occurring of 97 million new roles (Spence, Manyika, 2018).

The "new normal" of work is already present for a large scale of the online white-collar workforce. 45% percent of employers are set to rapidly digitalize working processes, including a significant expansion of remote work.

Conclusion

Fast implementation of automation is crucial and competitive business advantage for all businesses in energy transport. The creation of automated software or machines are improving efficiency and also creating higher quality control. Today, the meaning of automation is mainly software and less mechanically driven. The energy supply becomes more sustainable, energy saving and makes electricity, gas and heat more interconnected, changes the demand on existing and new energy infrastructure. Open-source solutions are mostly used in energy transport, they promote unlimited free redistribution of software source code to the open audience and accelerate changes in transition to sustainable and green energy. The software simulations can help in planning of power generation capacities, energy transportation and storages. Automation software algorithms are capable to solve typical optimization problems in the expansion of renewable and conventional energy. Nowadays we are experiencing increasingly faster energy transition and a mix, between major energy sources.

Automation is typical for routine and repeating human tasks and also in simple data entry and data processing. The automation erases some of the useless jobs, but creates more technological and creative jobs. The open-source automation solutions

generate significant cost savings in the energy sector, not only in the utilities companies, but also in power generation, energy transport, energy transmission.

The productivity and the investments increase new demand for more human labor. These new professionals are expected to boost implementation of automation, which is critical to company future financial and business performance. Implementation of automation technologies with their productive advantages for the workforce transitions will accelerate technology adoption again. New skills and people abilities will be needed and expected by the 'new employees' in utility and energy transport companies.

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