Smart strategies for the transition in coal intensive regions

Project No: 836819

TRACER
TRANSITION IN COAL INTENSIVE REGIONS

Roadmap for North Bohemia

WP 6 – Task 6.3 / D6.4

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1 Introduction

The presented Roadmap shows the way how to implement, until 2030 at first and then until 2050, the provisions of: the projections for the transition to 2030/2050 and the corresponding developed R&I strategies in each target region (Task 6.1), and the agreed strategies for re-skilling and re-training of the local workforce in the target regions (Task 6.2).

The *Roadmap* formulates the optimal planning and identifies a series of measures and actions for the achievement of the targets set within the R&I strategies for the smart specialization of the target region, which in the case of Czech Republic is North Bohemia, and provides the appropriate guiding directions to policymakers, aiming at the enhancement of the legislative framework and the incorporation of the new energy technologies in the energy system and of the proposed re-training procedures/schemes, as well as the stimulation of investments in the low-carbon energy sector.

The Roadmap is based on strategic documents on a national level, namely the “Innovation strategy of the Czech Republic 2019-2030”, adopted by the government of the Czech Republic in 2019, the “Research and Innovation Strategy for Smart Specialisation”, prepared by the Ministry of Industry and Trade and adopted in 2021, the “Energy policy (National Energy and Climate Plan - NECP) of the Czech Rep.”, and the “Plan for a Just Territorial Transformation”, prepared by the Ministry of Local Development, as well as on the RIS Strategies of target regions. Based on them, priority energy technologies were selected and, then, the major axes needed to accomplish the objectives have been formulated, including measures needed to overcome potential barriers and identification of measures to achieve success in priority areas which were categorized according to their importance. As major available documents cover the period till 2030, the focus will mainly be on this time frame.

The procedure for the development of an Action Plan to support the North Bohemia’s Roadmap implementation, as it was conducted, is graphically presented in Figure 1. Initially, 3 major axes were formulated. These axes, then, were specialized and – under each one of them - a number of measures looking on agreement with national and, mainly, regional strategies of Karlovarský and Ústecký districts (which together form the North Bohemia region for purposes of EU) have been defined. Then, it was explored how to overcome specific barriers and particular plans are proposed. Finally, the priority measures identified are decomposed and analysed to specific actions providing a detailed action plan towards 2030, completing thus the Roadmap.

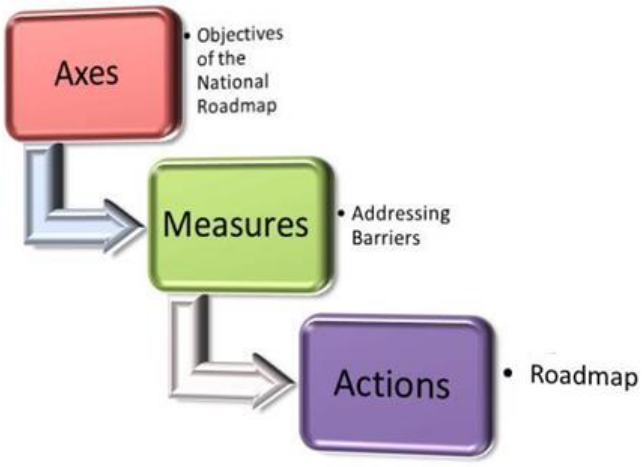

Figure 1: The three stages determining the Action Plan under the Roadmap

2 Strategic approach for the development of the Roadmap

2.1 Prioritization of R&I activities for the selected energy technologies

The basic national document on research and innovation (R&I) is the “Innovation Strategy of the Czech Republic 2019-2030”, adopted by the government of the Czech Republic in 2019 (Úřad vlády ČR, 2019). This document mainly addresses the energy and research and innovation priorities in this field, in particular with regard to high energy efficiency and the necessity of application of the smart network approach in the energy transition. This is elaborated further in the “Research and Innovation Strategy for Smart Specialisation”, prepared by the Ministry of Industry and Trade and adopted in 2021 (MPO, 2021). This document specifically mentions the energy transition and the “Green deal” as an opportunity for the Czech Republic to focus its research and development on the sectors affected by this trend, in particular the bioeconomy, the circular economy, and low-carbon technologies, energy, etc.

The National energy policy (MPO, 2015) defines five strategic priorities. These priorities include:

a) a balanced mix of primary and electricity generation based on their broad portfolio, efficient use of all available domestic energy sources, maintaining an EC surplus with sufficient reserves and maintaining available strategic reserves of domestic forms of energy;

b) increasing the energy efficiency of the national economy;

c) development of the Czech network infrastructure in the context of Central European countries, strengthening of international cooperation and integration of electricity and gas markets in the region, including support for the creation of an efficient and actionable common EU energy policy;

d) support for research, development and innovation ensuring the competitiveness of the Czech energy sector and support for education, with the aim of the need for generational change and the improvement of the quality of technical intelligence in the field of energy;

and, last but not least,

e) increasing the energy security and resilience of the Czech Republic and strengthening the ability to secure the necessary energy supplies in cases of accumulation of failures, multiple attacks on critical infrastructure and in cases of longer-lasting fuel supply crises.

In particular, with regard to coal replacement mainly in large central heat sources, this is expected to be done mainly from gas, and partly also from biomass and municipal waste.

In order to reduce emissions of greenhouse gases, there must be a maximum increase in the efficiency of entire systems, including reductions in heat losses in the distribution system. In terms of coal replacement in electricity supply, the most important change in the last decade was the construction of the Temelín nuclear power plant. Due support for renewable energy sources in recent years has increased the share of other renewable sources than hydropower, but so far - even with high subsidies - the use of renewables has not managed to replace a significant part of fossil resources. Future needs to accelerate the hydrogen economy are also highlighted in the energy concept.

Another key strategic document on the national level is a plan for just territorial transformation, prepared by the Ministry for Local Development (MMR, 2021). This document specifically highlights the need to support for research and development (R&D) infrastructure in the field of replacement of existing or the emergence of new energy sources, smart and sustainable local mobility, as well as to new business areas contributing to developing renewable energy sources. In addition, it is considered as equally crucial the support of the R&D institutions' cooperation with the application sphere (especially SMEs). Investments in technology, infrastructure, R&D in the field of low-carbon economies, replacing existing or emerging new energy sources, and smart and sustainable local mobility. Finally need to support the innovation potential of companies in the regions and their ability to apply current results of research is highlighted. To achieve these goals in the field of research and development several instruments to support research and innovation projects in the target region have been created (RESTART, 2020).

The regional innovation strategies (RIS) for Karlovarský and Ústecký districts (which together form North Bohemia region), which reflect all the above-mentioned documents, have been also consulted, as well as an analysis of the actual enterprises and other local factors workforce. The major outcome of RIS for the Karlovarský and Ústecký districts (KVBDA, 2020; UD, 2020) are presented here. Both documents highlight both the need for energy transformation and new challenges, which are mainly the optimization of energy efficiency and the adoption of new energy sources, among which renewable energy sources (RES) are mentioned. At present, the most widely mentioned RES include wind and solar energy use. Other less extensive RES are also mentioned, namely hydropower (mostly in connection with energy storage using Pumped Storage Hydropower) and geothermal. which is mostly supported by some municipality projects (https://prvnigeotermalni.cz/cz/o-projektu).

To wrap this up, both regions relay on new developments in the automotive industry - an important example may be the building of BMW testing facility in Podkrušnohorská Heap (i-dnes, 2021) - while traditional industries such as the chemistry of ceramics are expected to grow together with the services in tourism and spa. However, in both regions, energy production is expected to remain an important part of the portfolio. In terms of new energy sources, new ways of energy utilization (smart technologies of energy transmission, storage, and consumption, hydrogen, renewable sources, battery storage, utilization of waste heat) are mentioned.

2.2 Prioritization of local workforce reskilling / retraining needs

Reskilling the workforce is essential not only to conduct R&D activities but also to implement new technologies. As elaborated in report D6.3 of the TRACER Project (TRACER, 2022), this is reflected by the altitude of workers towards reskilling and readiness to change employment. Currently, there is a significant decline in mining in the Czech Republic, which is not caused neither by a shortage of stocks nor a decline in the demand for coal. It has been repeatedly discussed that the demand for coal may increase again in connection with the ongoing conflict in Ukraine. In addition to layoffs, this trend may also have an impact on rising energy prices and other negative consequences. In the event of the termination of mining, for example, in the Karlovy Vary region up to 10 thousand jobs will be lost.

The analysis of the questionnaires sent by the Economic and Social Council of the Ústí nad Labem Region shows that a higher percentage in the mining and energy industries is occupied by men and that more than a third of respondents belong to the age group of higher than 55 years. Also, that more than half of the respondents belonged to the group of vocational

education or training without a high school diploma, 32.9% of the respondents had a secondary vocational education with a high school diploma, and only the 7% of them had a university degree. At the same time, a large number of respondents are aware that a change in the energy concept will also affect their employment, and that the current situation needs to be addressed. Despite the fact that most of them plan to stay in their current job for as long as possible, a considerable number are already looking for alternatives.

Therefore, in the event of cessation of mining, it is necessary to solve several fundamental problems - the creation of new jobs, retraining, commuting, etc., while taking into account exogenous factors (covid crisis, war in Ukraine). The Czech Coal Commission should also define the necessary economic and social compensation to mitigate the impact on employees, companies and regions affected by the decarbonisation of the energy sector. Furthermore, it is necessary to respond to changes in the economic structure as quickly as possible and with maximum support from science, research and innovation. This means modernising industry and infrastructures and preparing the necessary education system for the new economy, as well as preparing people for the changing labour market.

Both regions have the lowest share of workers with university level education in the country and, on the other hand, the highest share of workers with only basic education. The result of the anonymous questionnaires is presented by the Economic and Social Council of the Ústí nad Labem Region (HSR, 2021) as follows: A total of 1649 respondents participated, of which 300 were women from the mining and 13 from the energy sector, and 1180 men from the mining and 156 from the energy sectors, respectively. 38.5% of respondents belonged to the age group of over 55 years. A larger proportion of older people came from the mining group than from the energy sector. Over half of the respondents had a basic education only or high school training without a high school diploma, and only 7% had a university degree.

Within the energy group, the proportion of more educated respondents was higher than in the mining group. Overall, 63% of respondents feel that a change in the energy concept will affect their jobs. However, 83% of the respondents intend to stay in their current job for as long as possible, and around 10% look for alternatives. The overwhelming majority is convinced that there are not enough job opportunities in the Ústecký Region. Therefore, the 65% of the respondents fear future unemployment. It must be mentioned that, the vast majority of the respondents consider it necessary for the state to help in this situation, whether through retraining, job creation, or contributions to equalize living standards.

2.3 Barriers analysis

In terms of capacity for research and innovation development, the target region (North bohemia) is underdeveloped in comparison to the rest of the country. This is in strong contrast with the fact that the region plays important role in the field of energetics, as well as in several industrial fields. The workforce with university education is below the country’s average. Consequently, the target region is far below the country’s means in the number of institutions working in research and development, number of workers in this sector, as well as in amount of money spent on RD. This is true for absolute numbers, but it gets even more pronounced when compared per 1000 inhabitants (CSO, 2021). There is only one university in the Ústecký district and no university in the Karlovarský district. Several other universities have their branch in those districts. The only University in the target region is Jan Evangelista Purkyně University (UJEP) in Ústí nad Labem. UJEP was established in 1991 and currently has eight faculties with over 10 000 students and 900 employees.

It should be stressed, however, that the Czech Republic is a rather small country geographically and students often conduct their university education outside their home district. Traditionally, most universities, as well as research institutes, are located in major cities of the country. Indeed, universities in these major cities (namely Praha and Brno) take a large share of university education. This, however, does not change the fact that overall capacities of research and development are low and should be increased.

In this aspect, it is noteworthy, that there are 32 universities in the Czech Republic, which offer some kind of technical education. As an example, several major technical universities which conduct some research in the field of energy technologies are listed here: Czech Technical University in Prague, Brno University of Technology, Technical University of Ostrava, University of West Bohemia, and the Technical University of Liberec. Besides universities stands the Czech Academy of Sciences harbour Institute of Thermomechanics, which deals with basic research related to energy technologies. Furthermore, there are six large research infrastructures (supported by the Ministry of Education) that provide services to the research community in various aspects of energy-related R&D (https://www.vyzkumne-infrastruktury.cz/en/energy/). Increasing incentives for these institutions to take part in research focused on the transition of target region may be one of the measures that can in the near future support the research capacity of target regions.

This barrier is enhanced by a lack of a qualified workforce, as already mentioned above. Even more important is the negative attitude of respondents against post coal future, as a large number of them are aware that the change in the energy policy will also affect their employment and that the current situation needs to be addressed. Despite the fact that the majority plan to stay in their current job for as long as possible, a significant number are already looking for alternatives. Another barrier is fragmented information and funding for targeted R&D. This was partly overcome by the RESTART project, which is intended to centralize information about potential funding sources and also negotiate the allocation part of the resources in various funding programs towards target regions (RESTART, 2020). However, funding is to a large extent fragmented and distributed in various programs focused largely on other targets.

3 Recommendations for Measures

3.1 Major axes needed to accomplish the objectives of the R&I Strategy

As already explained before, R&D capacity in the target region is low as is also the absorption capacity of companies and other businesses. Based on that, the major axes needed to accomplish the objectives of the R&I can be identified as follows:

1. Increase capacity of R&D sectors in target regions.
2. Increase absorption capacity of business towards technical innovation and the new technologies.

Clearly, those two major axes represent complex issues which include technical infrastructure, workforce qualification, funding, motivation, etc. Also, the absorption capacity of the industry can be negatively affected by the state of local infrastructures, which was affected by extensive mining activities in the past causing inadequate road and railroad systems and other infrastructure issues. These include also damage to ecosystems which may affect the living environment and attractivity of the region for qualified personnel to move in.

3.2 Major axes needed to fulfill the needs for workforce retraining

As already indicated, fulfilling the major objectives identified needs a qualified and motivated workforce. To accomplish the objectives of the Roadmap as regards the agreed strategies for re-skilling and re-training the local workforce in the target region, as these have been defined previously and in D6.3, the major axes related to workforce reskilling are the following:

1. Filling the knowledge, skills, and competencies gap.
2. Fostering involvement and capacity of business in research, technological development and innovation, and uptake by the labour market.
3. Planning and enabling skills development, motivation, and recognition.

As already explained, reskilling face several major issues reflected by the three major axes identified above. The first set of issues is the generally low qualification of the workforce in comparison with the rest of the country. The second is connected with the fact that mining was for a lot of time both directly and - mainly - indirectly (due to various services provided to mining companies) one of the major employers in the region. This reduces the capacity of other industries to absorb a qualified workforce. Finally, a combination of these factors shaped the mindset of most of the workers. As has been illustrated above, many of them believe that there is no replacement after mining. This certainly limits their motivation to join reskilling programs or conduct other activities toward an alternative post-mining future, including the establishment and development of SMEs and other small businesses, which may potentially improve their position in the labour market.

An increase in motivation and appreciation of the potential that post-coal regions transition brings is a major issue as regards reskilling. This fact has been recognized even by the mining companies, which gradually change to business subjects with a much broader portfolio than just mining. For example, Sokolovská uhelná a.s. has decided to transform itself into a modern, non-energy group, the SUAS GROUP a.s., where, in addition to the energy sector, it will also focus on circular economy, real estate, construction and development activities. This will create a number of vacancies despite the probable need for further professional education.

In the Ústí nad Labem region, a project is being set up by the City of Ústí nad Labem and Spolchemie a.s., under which Spolchemie will produce hydrogen for public transport. In addition, the revitalisation of the CSA quarry area is planned, where new settlements, a research centre, agrivoltaic systems, etc. will be created, providing new jobs. The region also plans to initiate other projects, such as a battery production plant, etc. Thus, these projects will also create new jobs suitable for employment by employees of the mining sector after prior qualification.

3.3 Measures proposed under each one of the main axes to overcome the barriers

The set of measures associated with the above-defined major axes are described in the following paragraphs.

Increase capacity of R&D actors in the target regions

As already explained, the R&D capacities in the target region are very limited due to the low number of universities and other research and development institutions, the low proportion of

R&D workers in the population, and to the low proportion of university-educated workers in general (this proportion is one of the lowest countrywide).

The issue of lack of facilities can be partly solved by the support of existing facilities, but the capacity to absorb additional funding may be limited. A promising way may be to create incentives for various R&D institutions outside the target region to expand their activity in the target region and cooperate with existing local universities and other R&D institutions. This activity needs targeted support. So far funding is either focused on the target region, hence attracting only limited attention from outside (if such participation is not excluded at all), or the nation-wide call, which may include partners coming from both the target region and outside. However, in nation-wide or in general EU programmes the evaluating criteria may discourage the participation of institutions in the target region (e.g. due to high emphasis on excellence).

Based on that, it is proposed to develop specific schemes which would systematically and in a targeted way support cooperation between R&D institutions inside and outside the target region. This has to be done on all levels of the R&D chain, starting from universities and research institutes focused on basic and strategic research to technology transfer and cooperation between R&D institutions with industrial enterprises. These cooperation efforts should be focused on institutions inside the country as well as on international cooperation. it is expected that such targeted cooperation projects may enable the instant transfer of know-how from other regions. The cooperation efforts will enable using local knowledge and they will support build-up of local R&D infrastructure and human resources. This may also need to use existing capacities of other R&D institutions countrywide, which many conduct R&D activities in fields related to the target regions, and many also have ongoing research activities specifically targeting these regions.

Another important aspect that should be highlighted is the strengthening of cooperation between local governments and local enterprises and R&D institutions, both the local ones as well as those involved in the cooperation projects mentioned above.

Increase absorption capacity of businesses towards technical innovation and new technologies

Not only the R&D capacity is low in the target regions, but also the capacity of current businesses to absorb new technologies is limited. This can be increased by the provision of incentives to existing companies. As already explained, many large players, such as mining companies or large industrial companies, in the region already see opportunities and necessity for such transition. This effort is worth of support. Also, the creation of new local SMEs should be supported. Another important way of support is active search for and support of incoming businesses such as BMW, which, in cooperation with Sokolovská Uhená mining company, is building a large R&D centre for autonomous cars in post mining area. Such example of cooperation between local businesses and investors from outside the region, which bring not only investment but also know how and technological innovation, should be largely supported.

There is a need to actively search for innovative opportunities the target region may bring beside tradition to the post-coal era. Those may include the typical shift to renewables, but also new look on local resources such as geothermal energy or potential for lithium mining.

Finally, the whole undertaking should not only about direct support of businesses. It is also important to support infrastructure development and the entire environment supporting the companies and economical activities in general. Mining activities have large scale influence on landscape, road and railroad network and many other aspects of infrastructure. This

infrastructure has to be improved to fit the needs of recent economy and to support economic growth.

Filling the knowledge, skills, and competencies gap

Besides building infrastructure, increasing knowledge and skills for local R&D institutions as well as closing the competence gap for both local and external institutions is needed. The competencies gap, although occurring in both local and R&D institutions as well as in institutions outside the mining region, has different reason in these two cases. In the case of local Universities and R&D institutions, it may be due to an average evaluation of previous research output by the national evaluation scheme M17+, which may make some funding sources hardly accessible, namely those aimed to support excellence in research hardly accessible. In the “external” R&D institutions, the lack of local knowledge and local infrastructure may be a major factor which made their success in these regions limited.

Similarly, as in the capacity building case described above, also here it is expected that targeted support of cooperation between R&D institutions or businesses from the target region with R&D institutions from outside the target region may be the best solution for this. Besides these cooperation programs on all levels of R&D, systematic support of education in fields that are relevant to solving major aspects of coal transition is crucial in the long term.

Fostering involvement and capacity of business and research, access, and uptake by the labour market

As already mentioned, increased R&D development capacity is limited by the small number of R&D workers (scientists) but also by the low number of local institutions that focus specifically on R&D, as well as by the low number of businesses that conduct their R&D activities in the target region. These two items are connected. To increase the R&D capacity one needs to increase the capacity of R&D in the existing institution and to attract new institutions to come to the region. Increasing the capacity of existing institutions specifically in the field of research may be possible due to a targeted joint project between an existing institution in the target region and external partners, as described above. This can be also the case in more business settings where businesses from other regions can start their R&D activities in the region in cooperation with some local companies. An example of such ongoing activity can be the BMW testing facility to test autonomous vehicles in cooperation with Sokolovska Uhelna mining company.

Planning and enabling skills development, motivation, and recognition

To apply the R&D outputs or new technologies in general, workforce reskilling is certainly needed. This is a process that is already ongoing and many reskilling programs are operating in the target region, mostly in terms of reskilling in various technical specialties. However, these reskilling programs have to be completed by follow-up programs that will allow to obtain the necessary practice in these fields. As it stands for many employers, workers after attending reskilling programs without however adequate practice are not particularly attractive.

It is also needed to work on the synchronization of reskilling programs and follow-up programs with the development of the absorption capacity of the labour market as described above. Finally, special attention has to be paid to enhancing the motivation of workers to consider reskilling as a pathway to new post-coal era jobs and to see it rather as an opportunity. This includes reskilling the existing workforce following the various reskilling programs, but also the

build-up of necessary “new” skills needed for future employment opportunities in the young generation that has already entered the workforce.

Horizontal measures

The actions described above should be further supported by a series of “horizontal measures”, concerning the information and awareness-raising of stakeholders. This is particularly important with the last axis which to a large extent deal with changing of the mindset of people living in the post-mining region. Here the important focus should be not only to people who are part of the active workforce but also to the younger generation.

Also, the issue of working with people who already retired should not be underestimated. In other regions, for example, third-generation universities are extremely popular. Although the education of retired people will not directly contribute to improvement in labour market, it may still help to change the mindset in society, as many of the retired persons are respected in their local communities and their personal example may motivate others. Finally, close collaboration with local governments and other local authorities is needed to ensure coordination between bolstering R&D capacity, labour market absorption capacity, reskilling, and follow up programs.

4 Action Plan of the Roadmap

4.1 Assessment and prioritization of the proposed measures

Here the measures suggested in part 3.3 are evaluated according to their agreement with the national and regional targets, as well as the economic and social dimensions, which include a contribution to energy and environmental targets, cost viability effect on employment and social acceptance (see Figure 2).

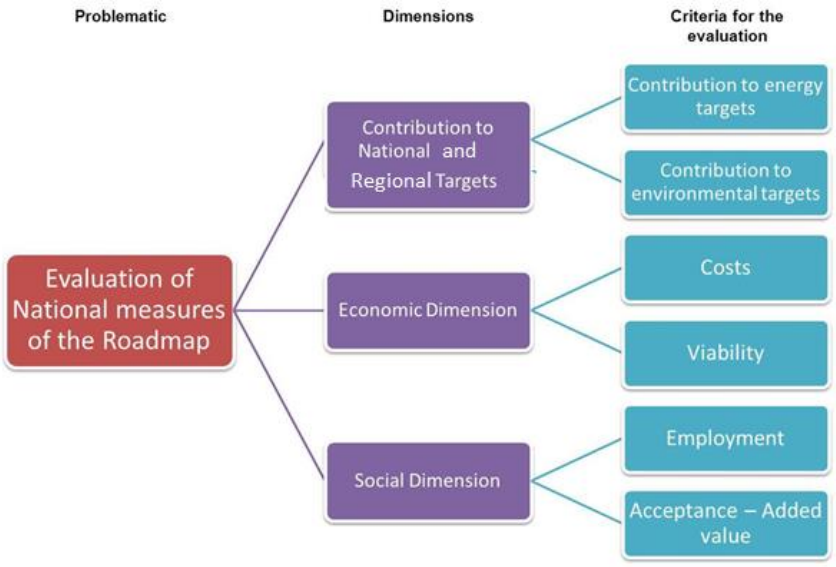

Figure 2: Dimensions and evaluation criteria of the Roadmap’s measures

The dimensions selected for the integrated evaluation of the proposed series of measures are the following:

1) The measure's contribution to the national objectives of the Czech Republic as well as to the regional RIS;
2) The economic dimension, referring to both the cost of the measures and the economic benefits arising from their implementation
3) The fulfilment of the national social needs or social dimension of the transition.

Each dimension is then divided into the individual evaluation criteria that constitute it. These criteria, in order to be in accordance with the multicriteria theory, are required to be preferentially independent of the decision-makers and to respect the monotonicity property (strictly increasing - decreasing). The second stage consists of the assignment of scores of each individual measure on the set criteria. Depending on their total scores over these three dimensions, the measures were finally classified into **3 categories**, i.e. of High (H), Medium (M), and Low (L) priority. The outcome of the major points described in the previous part is summarised in Table 1.

Table 1. Prioritization of measures suggested in part 3.3

Axis and target	Agreement with national priorities	Other aspects involved*	Priority
Increase capacity of R&D sectors in target regions			
Support of existing facilities and institutions	General agreement with national priorities	Energy, environment social target	H/M
Incentives for R&D institutions outside target region to expand in the target region	General agreement with national priorities	Energy, environment social target, cost-efficient	H/M
Supporting the cooperation and local universities and other R&D with a hose outside region	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H
Strengthening cooperation between local governments R&D institution	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H
Increase absorption capacity of businesses towards technical innovation and new technologies	General agreement with national priorities not mentioned specifically	Energy, environment social target, cost-efficient, viable	H/M
Filling the knowledge, skills and competences gap			
Supporting the cooperation and local universities and other R&D with a hose outside region	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H

Strengthening cooperation between local governments R&D institution	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H
Fostering involvement and capacity of business and research, access and uptake by the labour market			
Supporting the cooperation and local universities and other R&D with a hose outside region	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H
Strengthening cooperation between local governments R&D institution	General agreement with national priorities	Energy, environment social target, cost-efficient, viable	H
Attracting new R&D institution and business	General agreement with national and regional priorities	Energy, environment social target, cost-efficient, viable	H
Planning and enabling skills development, motivation, and recognition			
Reskilling programs	Agreement with national and regional priorities	Energy, environment, social target	H/M
Follow up programs	General agreement with national priorities	Energy, environment social target,	H/M
Training for young generation	Agreement with national priorities	Energy, environment, social target,	H/M
Motivation program	General agreement with national priorities	Energy, environment, social target, acceptance as added value	H/M
Synchronization with a build-up of absorption capacity in labour marked	Agreement with national and regional priorities	Energy, environment, social target	HM

Proposed measures in a certain extend contribute to all of the aspects mentioned in Figure 2, so here only those where the contribution is particularly strong or those where some problems can be expected are highlighted.

4.2 Specification of the set of actions required to implement the Roadmap

As concern the points mentioned in axis '**Increase capacity of R&D sectors in target regions**, there are several ongoing activities summarised by the RESTART program (RESTART, 2020). Since 2017, CZK 9.6 billion have come to structurally affected regions thanks to RESTART (specifically, CZK 3.2 billion for the Ústí nad Labem Region and CZK 1.5 billion for the Karlovy Vary Region), thanks to specific calls aiming on coal transition region or prioritization of applicant from coal transition region in nation-wide calls. The last evaluation summarizing the year 2021 was based on a survey of the Ministry for Regional Development (MRD, 2021). About 5% of the measures continue to be successfully addressed, the remaining half are already implemented or almost implemented, the other half are under solution or initiation, across all pillars - entrepreneurship and innovation, direct investment, research and development, human resources, social stabilization, environment, infrastructure and public administration.

However, particularly in the field of R&D, specific programs that would support cooperation with the target region and institutions outside the region are still missing. In this case, the Czech Technological Agency (TAČR) would be a logical body responsible for the implementation of the programme, such program, especially when funded from National sources. There may by also potential to use EU sources for such effort, and in this case the Ministry of Education and other relevant ministries should be considered as partners. This also reflects prioritization of the fields that should be supported, which clearly should vary according from the more basic and strategic research towards more applied research and development.

In the development and application stage there should be paid more attention on already indicated priority areas such as hydrogen, renewables, environment and infrastructure improvements, while in activities related to more basic and strategic research the support should be a priory less limited as this broader focus can bring new yet overseen ideas, which may potentially help in the post mining development of the region. Very important in this aspect is to Increase the absorption capacity of businesses towards technical innovation and new technologies. In that aspect, support needs to be provided to existing business, incoming business and infrastructure improvement. Here the important role of RESTART program coordinating these activities in Czech Republic should be highlighted.

A similar situation exists in **filling the knowledge, skills, and competencies gap**, where similar measures are proposed. In the case of the axis related to **Planning and enabling skills development, motivation & recognition**, there are no reskilling programs currently ongoing. According to the Labour Market Forecast, to link to coal retirement and coal utilization various scenarios for the future labour market were developed, particularly for the employment trends in the mining and energy sectors. The results do not simulate completely exogenous influences, such as covid or war situations, but instead take into account the remediation and reclamation of sites after the effects of mining. According to this prediction, in the next 5 years the number of employed persons will be stable to slightly increasing in the Ústí nad Labem Region while the Karlovy Vary Region will have a constant employment trend. The Czech Coal Commission should also define the necessary economic and social compensation to mitigate the impact on employees, companies and regions affected by the decarbonisation of the energy sector.

Furthermore, it is necessary to respond to changes in the economic structure as quickly as possible and with maximum support from science, research and innovation. This means modernising industry and infrastructure, preparing the necessary education system for the new economy, and preparing people for the changing labour market. There are many reskilling programs ongoing but they should be more effort paid on young generation, attracting young qualified people to stay in the target region or even to move there. In this point, horizontal

activities focussed on the increase of motivation searching for new yet overlooked potentials the target region may bring and raising awareness about these potentials are crucial.

5 References

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