JASPERS

Project Note N. 3

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Subject:	JASPERS comparison of SE and HBP proposals
Country(s)	Slovakia
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1. Background

The city of Prievidza and the surrounding towns of Novaky and Zemianske Kostoľany are currently supplied with district heating (DH) generated from coal combustion in the heat and power plants of Slovenské elektrárne (SE) located in Novaky. The Slovak Government aims (i) in a first "fast-track" phase to cease coal firing by the end of 2023 and in parallel and beyond (ii) to increase the share of renewable energy source.

For the first phase, a "fast-track" investment project is needed to replace the coal-fired generation source in Novaky and ensure the continuation of the DH supply for 2023/24 and the following heating seasons. In this respect, two project proposals are being developed at the moment, one from SE and one from Hornonitrianske bane Prievidza (HBP), the local mining company currently supplying coal to the Novaky plant. JASPERS is aware that more project ideas were raised in the region, but they obviously could not meet the "fast-track" implementation for 2023/24 heating season and therefore were not developed and assessed under this JASPERS assignment.

The investment proposal of project 1 - SE is based on a combination of biomass and natural gas hot-water boilers and a small cogeneration unit at the location of the existing ENO plant in Novaky. The total installed thermal capacity would be 71 MW_t in order to supply all the customers currently connected to the DH system.

The project 2 - HBP includes three main components: (i) a mix of RES sources (biomass boilers – already existing, heat pumps, possibly solar) and a small gas cogeneration unit at HBP's site in the town of Cígeľ (some 5 km South-East from Prievidza); (ii) hot-water gas boilers at the outskirt of Prievidza; (iii) a hot water transmission pipeline from Cígeľ to Prievidza. The installed capacity would be around 49 MW_t (or 51 MW_t including solar) in order to serve the city of Prievidza.

JASPERS has already delivered two individual Notes with its independent opinion and advice on the investment project 1 - SE and project 2 - HBP.

In JASPERS opinion, both projects present viable "fast-track" solutions to ensure the continuation of DH as of end 2023. However, the proposed solutions provide different strengths and risks respectively areas for further development. JASPERS does not see any of the two projects significantly outperforming the other under all considered aspects, nor does any of the two projects perfectly respond to a full transition to renewable energies (which was not the primary objective of the "fast-track" phase 1). JASPERS proposes the selection of the more appropriate solution through stakeholder discussion of the different strengths and the options to mitigate the identified individual risks.

In order to help the decision-making process and in agreement with the Slovakian Authorities, this Note provides a high-level comparison of SE and HBP proposals in the form of a simple multi-criteria analysis table, presenting the relative strengths and potential risk / development areas of the two options. An accompanying Excel spreadsheet file is delivered with this Note. It will support decision makers to: (i) complement the criteria proposed by JASPERS with the addition of other specific aspects if needed; (ii) attribute a weighting factor to each criterion (to reflect their importance) and; (iii) select a score for each project and criterion, also drawing on JASPERS' independent opinion. Based on those inputs the spreadsheet will show a summary score for each project to allow comparison.

2. Specific comments

2.1 Multi-criteria analysis methodology

The proposed multi-criteria analysis (MCA) methodology is best practice in case of competing proposals and allows using quantitative and qualitative information for project evaluation. It typically involves the following steps:

1. The first step is to agree on the primary goal of the project / options considered.
2. The second step is to list the sub-objectives of the primary goal. The sub-objectives are then translated into corresponding criteria for evaluation.
3. The third step is to put relative weight to the criteria. Usually, not all requirements have the same importance for decision-maker. Some requirements are more important than others and they should then have a higher weight than other, less essential criteria. It is here proposed that the total sum of all weights should be 100%. The starting point could be to allocate an equal weight to all criteria. Then the weighing factor of the most important criteria is increased at the expense of other less critical factors whose weight would be reduced accordingly.
4. The fourth step is to compare alternatives by assigning scores against the criteria. The proposed method uses a range from 1 to 5 (with 5 being the most positive score), but another scale of scores is also possible.
5. The fifth step is to calculate the weighted scores for each criterion by multiplying the weight of the criteria with its score. The sum of all weighted scores is the total score of the alternative.

2.2 Goal of the project

According to the agreed JASPERS assignment fiche, the main goal of the identified investments is to ensure the replacement coal in the district heating generation from the 2023/2024 heating season, without creating a "lock-in" effect that could exclude other renewable energy sources (RES) with a longer development phase.

2.3 Objectives

JASPERS suggests that the proposed new heat supply solution should satisfy certain sub-objectives, such as:

- The resulting heat end-user price should be competitive and lower than the current level;
- The proposed technological solution should be reliable (based on best-available technology);
- The proposal should have the lowest possible negative effects on the environment and human beings and correspond as much as possible to future environmental targets;
- The proposal should be socially acceptable on the regional level;
- The project should not create long-term lock-in effects that could hinder in future the transition and connection of more sustainable RES solutions;
- The proposal should provide have a limited respectively acceptable risk level, for example in relation to the expected implementation timeline and to technical and financial risks;
- The proposal should ideally provide a solution for all existing customers currently supplied from the ENO power plant.

These objectives cannot be used directly in the evaluation process due to the quite broad spread of the objectives and since they might be subject to different interpretations. Therefore, more detailed criteria with more specific scopes need to be identified.

2.4 Criteria

The guiding principles for identifying the criteria should be to: (i) be as comprehensive as possible in relation to the identified objectives; (ii) avoiding overlapping criteria and the related scopes; (iii) keeping the number of criteria to a reasonably limited number. A consultation with the national and local stakeholders was used to check the validity of the approach and to further refine the scope of the criteria, which are here proposed to be eight. If certain aspects currently considered as sub-components of criteria (e.g. share of RES in the heat supply mix, thermal transmission losses) are deemed by the decision makers to deserve more visibility and weight, other specific criteria can be added.

1. The competitiveness of each alternative will be taken into account by calculating the "**levelised cost of heat**" (LCOH) over the project lifetime. LCOH takes into account the capital and operating costs of the project as well as the possible residual value of an investment after the reference period. The indicator was estimated both in financial and economic terms, with the latter factoring in also "externalities" with the addition of a "shadow price" for CO2 emissions, airborne pollutants and security of supply related to imported natural gas. The LCOH includes here both generation and transmission (up to point "K1" for Prievidza) costs, including the related losses. JASPERS opinion is that this should be a key criterion to evaluate heat supply alternatives and should in principle have the highest weight.

   When considering the competitiveness of the proposed projects against individual heating solutions, the distribution costs (and related losses) also needs to be considered. JASPERS does

not have detailed information on the distribution systems (e.g. of PTH or Benet) so the modelling of the related costs was not include in the LCOH.[1]

2. **Security of supply** (SoS) is an important criterion to consider in planning energy infrastructure projects, including DH systems. It is much related to the technical aspects and reliability of the proposed solution. The following aspects of the project should be assessed:

   - Reliability under the stress conditions: the criteria show if a component of the heat supply system (e.g. production plant or heat transmission pipe) should fail or be shut down in a network operating at the maximum forecast levels of demand, the heat supply must still be guaranteed. This means that in this case, undue interruptions in heat supply or the spreading of failure must not occur, which means that in case of failure of one component, whether the function is still continued.
   - Age of equipment and related probability of breakdown: the new system has higher reliability because of less wear and tear and thus lower probability of breaks of equipment.
   - Energy source diversification: the use of different primary energy sources generally increases the supply security as it reduces the risk of fuel-supply disruptions and the sensitivity to the price changes.
   - Technology related reliability

   The assessment includes here both heat production and transmission infrastructure.

Environmental objectives are to be taken into account by assessing the local and global impact.

3. **Local environmental impacts** typically include a wide range of aspects, some of which are not available at this stage since they are closely related to environmental studies and procedures (environmental screening and EIA procedure when appropriate) that have not been carried out so far. For the purpose of this project, JASPERS' opinion is that the following aspects should in principle be considered:

   - Emissions of harmful pollutants to the air like CO, NOx, SO2, PMs, heavy metals.
   - Potential impact related to noise level: energy production plants located close to residential areas may have noise problem; also, wood fuel transportation to the production may increase noise level
   - Location of the proposed projects in relation to natural protected areas (Natura 2000).
   - Impact on the land use: new infrastructure such as production plants and pipes requires additional land.
   - Impact on water use.
   - Residues from the fuel combustion.
   - Visual impact.

4. **Greenhouse gas (GHG) emissions** characterise global environmental impact related to climate change and it includes mainly assessment of CO2 emissions for fossil sources (i.e. natural gas). The assessment focuses on direct emissions on a typical year of operation. Emissions during construction and induced emissions (e.g. upstream the projects in the fuel supply chain) are here not considered.

[1] In addition, it is important to consider that there may be differences between the estimated LCOH and the heat price as regulated by URSO. Differences could for example stem from: (i) differences between the ex-ante costs estimates and the actual costs incurred for the different alternatives; (ii) differences in average investment costs in the LCOH and the related depreciation included over the same reference period in the heat tariffs by the Regulator; (iii) differences between the return on capital embedded in the discount rate used in the LCOH and the interest costs and allowed profit included in the regulated tariffs; (iv) in case the investment is co-financed by public grants (e.g. EU funds), the capital component in the related heat tariffs would likely be lower than in the financial LCOH estimated ex-ante; (v) in case of cogeneration assets, differences between the cost allocation method to transfer common heat and power costs to the heat tariff and the residual net LCOH after deduction of power sales revenue.

5. **Social acceptance** of the project should include an assessment of the project impact considering:
    - Strategic fit with national policies, strategies and plans (e.g. National Energy and Climate Plan).
    - Strategic fit with local policies, strategies and plans (e.g. Upper Nitra Transformation Action Plan, heat concept of the urban area, spatial planning documents).
    - Impact and contributions of the project to the local community development, such as additional job loss or creation (or net job creation), impact (e.g. fiscal) on affected municipal administrations and their stability, use of local energy resources.
    - The overall perception of the project on the local community, including the perceived fairness of the solution in terms on balance of costs and benefits for the various local stakeholders.
    - Heat end-customers perception on service quality.
    - Investors perception of the project.
    - NGOs views.
6. **Project risk level,** the level of uncertainty involved includes an assessment of the following aspects:
    - The project is not meeting the main goals and/or the specific objectives.
    - The project is not meeting the implementation schedule, risk of delay.
    - Technological threats such as risks related to innovative technology, which is not available in the market.
    - Project financing risks (e.g. the project cannot secure sufficient funding, including EU grants from ESIF 2014-2020 and 2021-2027, or Just Transition Fund, Modernisation Fund)
    - Legal risks, including contractual arrangements, compliance with Regulator's requirements, legislation, norms and standards.
    - Heat demand risks such as not meeting peaks in demand or possible future demand decrease which may result in overinvestment.
    - Heat market-related risks such as more competitive individual heat solutions becoming available to customers.
7. The **"lock-in" effect** criterion is related to the path dependency where one decision creates a context for subsequent decisions by reinforcing the likelihood of specific choices in the future. Ideally, the lock-in effect of the project should be lowest, but a certain level cannot always be avoided. The effect should be characterized by its duration (short, medium, long term) and intensity (low, moderate or high). For example, if a new heat production plant will be located in one specific location, then it requires to have the pipeline to transport heat to the customers. Or if the new plant is using fossil fuels, then it cannot be replaced easily with the other fuel during its lifetime without major modification works.
8. The "**project scope/coverage area"** criterion takes into account to what extent the proposed investment meets the heat demand of all customers currently supplied from ENO. It should be noted that at the time of preparing this assessment, studies are ongoing to complement HBP proposal with a solution for Novaky and Zemianske Kostoľany. Also, JASPERS has received some feedback from local stakeholders that the criterion may not necessarily be relevant in the context of a decision making process at municipal level (where responsibility is limited to a specific area). In this respect, whenever appropriate, the criterion's weight can be set to 0 % in the accompanying spreadsheet table.

2.5 Comparison of proposals

JASPERS' opinion on the criteria presented above is presented in the following table. To better highlight the differences, comments specific to a given project are presented in the related project-specific column. Features (strengths or limitations) that JASPERS believes are common to both proposal are presented in a dedicated cell spanning over both project-specific columns.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
1	**Levelised cost of heat (LCOH)**	SE has recently (on 24/9/2020) provided JASPERS with a new estimate of the level of losses and optimised capex and opex figures. JASPERS has revised its LCOH for SE accordingly.[2] **Pros** Considering SE current role as DH supplier and the level of project maturity, JASPERS sees a relatively low risk of possible variations between forecast and actual costs (except if due to changes in fuel prices and demand fluctuations outside the control of SE). **Cons** Both financial and economic LCOH, as recently revised, are somewhat higher compared to HBP, mainly due to relatively higher fuel costs (also due to higher transmission losses) and	**Pros** Based on JASPERS estimates, the proposal of HBP could deliver at a lower LCOH to Prievidza, mainly thanks to (i) the lower fuel costs due to the lower level of thermal losses (generating assets closer to the consumptions point, new heat transmission pipeline) and some lower marginal cost sources (around 18% of generation from the RES part of heat pumps, plus potentially a small share of solar); (ii) lower fixed operating costs.[3] **Cons** The average cost for the entire area Novaky-Prievidza area can only be reliably estimated once the local solutions outside Prievidza are more mature. The level of uncertainty related to the cost figures currently estimated by HBP can in JASPERS' view

[2] The financial and economic LCOH are now approximately 8 % lower that the figures reported in JASPERS' Project Note n. 1.

[3] It should be noted that the financial LCOH estimated by JASPERS is lower than the heat price estimated by HBP mainly because of: (i) relatively higher demand figures and lower fuel prices assumed by JASPERS (for the sake of consistency, the same scenarios used for the LCOH for SE have been used); (ii) a 5 % discount rate is used in the LCOH (again, same assumption used for SE project): the equivalent return on capital embedded in the LCOH figures is in this case lower than the corresponding allowed profit assumed in the heat price estimation of HBP; (iii) the LCOH does not include the depreciation of the existing biomass boilers (these are "sunk cost" for the LCOH, but could potentially still be reflected in the tariff).

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
		fixed operating costs. In JASPERS opinion, account taken of possible risks, the difference could be in the range of 5% to 10 % (in favour of HBP's proposal).	be deemed to be higher than for SE project (e.g. possible deviation of actual cost from the current estimates).
		Common cons When considering also "externalities" and the economic LCOH, some 13 EUR/MWh need to be added to the financial LCOH to account for the impacts of CO2 emissions, airborne pollutants and security of supply related to imported natural gas – approximately the same figure is estimated by JASPERS for both proposal, so the impact can be deemed similar in economic terms. Once the distribution costs (and losses) are also taken into account, the projects risks not being competitive in the long-term against individual heating solutions. In this respect they should be considered as a "bridge" projects towards more sustainable solutions (proposed phase 2 after 2023/24 – increasing the share of low variable cost RES energy).	
2	**Security of supply (SoS)**	**Pros** The new production equipment will have high reliability. Technically robust and reliable solution. The use of two fuel types (biomass and natural gas) provides sufficient fuel flexibility. **Cons** Heat production located only in one location, with heat being delivered to Prievidza via a 12-km transmission pipeline. There is no back-up heat source in Prievidza for the case of a major pipe failure during the heating period, with possible loss of heat supply to all customers. The pipe is relatively old and therefore risk of failure is increasing over time. However, the pipe is above	**Pros** Most heat production equipment and the connection pipe from Cígeľ to K1 are new and therefore provide high reliability (if properly designed, installed and operated). Heat production in two locations: Cígeľ and in Prievidza. In case of DH pipe failure, a part of the heat is supplied from Prievidza's peak and back-up boiler plant. Heat supply to Prievdiza is also diversified by using different energy sources.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
		ground, which allows relevant inspection and maintenance and fast access in case of failure, compared to any underground infrastructure.	**Cons** The use of several heat sources and many components in one technological system makes the whole system more complex, and potentially generate reliability issues. Cígeľ biomass boilers were already operated in the past and therefore may have a higher probability of supply interruptions compared to new boilers. Potential issues with spare parts availability in future. The natural gas boiler plant in Prievidza should have back-up fuel (e.g. light fuel oil / LPG) capability.
3	**Local Environmental Impact**	**Pros** New production equipment, stringent emission limits, low impact. The activities would be in the current ENO site, therefore it does not require the use new “greenfield” land. Limited land impact (only related to new gas connection pipes). Activities are away from the major residential area in Prievidza. **Cons** Activities located outside, but closer than 2km, to natural protected areas (Natura 2000). No other use of RES than biomass (e.g. no solar, no geothermal) which would be very beneficial in terms of impact on air quality.	**Pros** Deployment of some cleaner RES technologies: heat pumps combined with gas CHP have low emissions, thermal solar has no emissions. Activities located more far away from natural protected areas (Natura 2000). Relatively low impact in terms of other emissions such as NOx, SO_2, heavy metals (apart from biomass boiler) **Cons** HBP existing biomass boilers could have higher unit emissions (mg/Nm^3) than the new boilers of SE. However, the share of biomass in total heat supply mix is lower for HBP compared to

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
			SE (30% Vs 50%), therefore the total annual emission of particulates is not expected to be higher compared to SE. Solar panels, new heating and gas pipes and the new gas boilers in Prievidza involve some impact related to use of new "greenfield" land (while SE's development would be almost entirely "brownfield"). The gas boiler plant in Prievidza is located close to a major urban area with the potential risk of deterioration of air quality on residential areas.
		Common cons Biomass transport to the sites implies typical environmental impact such as noise and emissions.	
4	**Greenhouse gases emissions (CO_2)**		**Cons** For HBP proposal, the exact share of RES in the towns of Novaky and Zemianske Kostoľany is still to be decided - some CO_2 emissions from natural gas is likely, but the level is still uncertain.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
		Common pros Around 50 % of total generation from both projects would come from RES, so the impact on climate change is to a certain extent mitigated. It is worth noting that biomass is considered CO_2-neutral as long as the sustainability criteria are complied with. **Common cons** Around 50 % of total heat generation would still be coming from fossil source (natural gas) in both projects. CO_2 emissions (from natural gas) have been estimated by JASPERS at around 130 g/kWh of heat delivered (for Prievidza, up to point K1).	
5	**Social acceptance**	**Pros** In general the project seems acceptable to local communities of Prievidza, Novaky and Zemianske Kostoľany. It has already received the binding opinion of compliance with local heat concepts. The project seems to be in line with Slovakian energy policy as it contributes to the decarbonisation of DH. **Cons** The project is not using locally available RES such as solar and geothermal energy, ambient energy as mining water, industrial waste heat. Because of the transmission pipe with thermal losses from Novaky to Prievidza, there could be some resistance to the project from stakeholders in Prievidza, also considering the related negative effect on the heat price.	**Pros** Good use of local energy sources such as mining water and solar; also geothermal water sources could increase in the future, which could improve the image and public acceptance of the proposal. The project seems acceptable to local community in Prievidza. The project is acceptable to DH network operator in Prievidza. The project seems to be in line with Slovakian energy policy as it contributes to the decarbonisation of DH. **Cons** The need to build a new DH pipe could create some resistance from the owners of land where the pipeline is planned to be constructed.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
		The project might be seen more favourably for Zemianske Kostoľany and Novaky, located closer to the ENO, because of higher positive economic impact (e.g. employment from operation and maintenance). On the other hand, there may be resistance to accept the local environmental impact and costs of the project considering that the local citizen would only benefit from a small share of the total heat generation.	The potential use of geothermal resources in the future (phase 2) may cause same resistance from spa business.
6	**Risks**	**Pros** Very low risks, due to maturity of the project and reliable technology. As current DH supplier and main energy utility in Slovakia, SE is an experienced project promoter with the required financial and technical capacity for the successful implementation and operation. Provided the required authorisations and permits are obtained without major delays, the scheduled implementation timeline is fully compatible with a start of the operational phase with the heating season 2023/24. **Cons** Possible legal risks related to the possible termination of contracts from the side of PTH.	**Pros** The technology used for the project is mostly mature with very limited technical risks, but high-quality engineering is still necessary for all components. The HBP group has had experience in the implementation of several investments in the last ten years in different sectors. On the other hand, HBP / PTH will need to deploy a new organisational set-up for the operation of the heat sources. Compared to SE, marginally lower exposure to natural gas and biomass risk because of heat pumps, solar and lower transmission losses). **Cons** The project involves land acquisition related risks, which might result in delays and even to risk of not meeting the 2023/2024 target which might create financial consequences to Slovakia and SE if lignite needs to be used for an additional year.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
			The cost of treated water to industrial customers could increase**.**
		Common pros Apart from the natural gas related investments (accounting for around 40 % of total capex for both projects), the projects can be supported by EU funds, which contributes to moderate the level of the heat price for the final consumers. **Common cons** Exposure to natural gas and biomass price risk. Possible SoS risks (see criterion n. 2 above). Risks of loss in demand related to improved energy performance of buildings, poor competitiveness against individual heating solutions, climate change (milder winters).	
7	**"Lock-in" effect**	**Pros** The applicable Slovak legislation foresees the obligation for heat distributors, if certain conditions are met, to connect generators of heat from RES or high-efficient cogeneration. The access to DH pipe is technically possible for the future WtE or/and RES as well as for the seasonal storage based on mines water. From an economic point of view, the relatively high variable cost would not create barriers for more advanced RES solution with low opex (provided higher capex can be funded with the support for example of EU grants).	**Pros** Existing legal framework for the connection of new RES heat (same as for SE). While the use of existing and biomass boilers might contribute to lock-in to the extent they can be used also beyond their depreciation period, their limited residual economic life would require reinvestment and replacement towards the end of the decade. This would create an opportunity for expanding the RES share in the generation mix, potentially also switching away from biomass to RES sources with lower operating costs (e.g. geothermal). The new gas boiler plant in Prievdiza would still serve in future as peak and reserve plant.

No	Criterion	JASPERS opinion	
		Project 1 - Slovenské elektrárne	**Project 2 - Hornonitrianske bane Prievidza**
		Cons The proposed solution will have single heat production location and a large transmission pipe. This technological configuration might prove challenging with respect to the possible future development of a low-temperature, 4th generation DH system with several production sites in place, depending on the availability of the renewable sources. A lock-in effect is related to the need to maintain the DH transmission pipe (need to continue operate and in later stages modernise pipe). The replacement cost is estimated to be up to EUR 8-10m. This would likely require public financing sources to neutralise the impact on to the heat price. Therefore the project could create hidden need for state support in future.	**Cons** As the project does not need transmission pipe from ENO to K1 it might need to be demolished constraining the possible development of new sources from ENO to Prievidza and preventing it to be used as (buffer) storage for using more solar based RES, or to access mines as seasonal thermal storages. Should PTH act as investor, owner and operator of the project assets, the DH business activities (generation and distribution) in Prievidza would be integrated under the control of a single company. This might reduce the incentive for the DH operator to integrate more sustainable heat generation source in the future.
8	**Project scope/coverage area**	**Pros** Project covers all the customer's demand as it maintains the current supply structure.	**Cons** Although the FS includes proposals on how the heat could be supplied to non-Prievidza customers such as Novaky and Zemianske Kostoľany, this is not yet fully confirmed. The Novaky power plant would also need a small heat source in case HBP project is preferred.

3. Conclusions and recommendations

3.1 Conclusions

In JASPERS' opinion both SE and HBP projects proposal are viable solutions to ensure the continuation of district heating as of end 2023 (phase 1). Both projects would meet the "efficient district heating" criteria of the Energy Efficiency Directive. However, neither project can fully address (i) the decarbonisation policy related to the EU climate-change mitigation objectives (around 50 % of the heat generation would still be coming from fossil sources (natural gas); (ii) the local air-quality issues (both projects plan to use biomass) (phase 2). Therefore, further RES energy project developments and investments will still be required to make the system fully sustainable in the longer-term, for example exploring the possibility to use the local geothermal source. In JASPERS view, both SE and HBP should play a role in this decarbonisation process, regardless of what project is selected now by the decision makers. The RES elements of the not considered "fast-track" project (phase 1) could be considered in phase 2, same as any other local RES project options. JASPERS is ready to assist a phase 2 – further decarbonisation of Novaky DH system.

The objective of this Notes has been to compare the relative strengths and possible risks and limitations of the two proposal against a set of criteria covering technical, economic, environmental and social aspects. In JASPERS' opinion:

- Both project would result in the reduction of the heat price compared to the current situation. The financial levelised cost of heat generation of the HBP proposal can probably be 5 % - 10 % lower than the proposal of SE. The shadow price of "externalities" (CO2 emission, air pollution and security of supply) is estimated by JASPERS to be approximately the same for the two projects. Once the distribution costs (and losses) are also taken into account, both projects may risk to be uncompetitive in the long-term against individual heating solutions. In this respect they should be considered as a "bridge" projects towards more sustainable solutions.
- As regards supply security aspects, both options can be deemed to offer an adequate and comparable level of technical reliability, although with some differences. All production assets of SE are located in Novaky, and all heat to Prievdiza is transported via a 30-year-old pipeline, which could have some failure risks in the medium and long term; there is no back-up heat supply source close to the customers. HBP proposals have production in two places which increases the system reliability. On the other hand, HBP might have certain reliability risks related to the use of biomass boilers and because of a more complex system with different supply sources in two locations.
- From an environmental point of view, it should be stressed that in the case of HBP the solution for Novaky and Zemianske Kostoľany is still under definition, so impacts are not fully comparable. Also, the information available at this stage (EIA procedures still to be carried out) does not allow to fully assess all critical dimensions. In general, the impression is that the relative advantages and drawbacks of the two options could balance out, determining a more or less equivalent overall impact.

  As regards local impacts, while lower emission limits would apply to the new biomass boilers of SE, actual emissions (also on the HBP project) might differ and would need to be verified. On the other hand, HBP proposal would have the advantage of also deploying cleaner RES technologies (heat pumps and possibly solar). In terms of location both options have elements relatively close to residential areas but SE option is entirely planned in the current ENO site, far from the major urban area of Prievidza. As regards the use of new land, HBP option implies greater impact, also with possible impacts associated to construction works.

  As regards the impact on climate change, RES generation would account for some 50 % of heat production in both cases. In the same way, both options will involve CO2 emission from natural

gas use. Overall, JASPERS estimates a carbon intensity of heat from HBP project to be very similar to that of SE.

- In JASPERS opinion both project should score well in terms of social acceptance, also considering both options would improve the situation from both the point of view of the heat price and the environmental impact, two important aspects for the citizens. The use of local resources such as the mines water (and possibly solar) under HBP proposal might be seen as an advantage. SE project might be considered more favourably from Zemianske Kostoľany and Novaky residents because of induced economic impact, including maintaining employment. On the other hand, there may be resistance to accept the environmental impacts and associated costs considering that the local citizen would only benefit from a small share of the total heat generation.
- As regards the project risks, SE proposal is at a more advanced stage of development. HBP may face some land acquisition related risks, which might result in implementation delays potentially jeopardising the start of operations for the 2023-24 heating season. For the rest, the risk profile of the two proposals can be deemed to be similar. Investment costs related to natural-gas assets would in principle not be eligible for EU funds support; as the share of this expenditure is roughly the same in both projects, the scope for support from EU funds appears similar.
- The risk of possible “lock-in” effect from a technical, economic and legal point of view is considered to be moderately low, though non-negligible for both projects. HBP’s proposal might have an advantage in relation to the need to replace the (existing) biomass sources sooner than SE.
- The proposal of SE has the advantage of supplying all customers currently connected to the DH system. HBP proposal is at the moment only covering Prievidza, although studies are underway for defining a solution for Novaky and Zemianske Kostoľany.

3.2 Recommendations

- JASPERS recommends that a decision-making process is agreed upon for the selection of the project. The participation of the local stakeholders (including DH end-users) is in JASPERS view essential – their views should have an important role in shaping the final decision.
- The analysis provided by JASPERS in the course of the assignment and in particular the multi-criteria table prepared annexed to this Note can be used to facilitate the process and reinforce its transparency.
- As part of the wider long term solution, JASPERS would emphasise the need for further investment also on the demand side, to improve the energy efficiency of the building stock, as well as in the heat distribution network.