

**Analyzing the Influence of Government Policies
on the Gasification in Astana, Kazakhstan**

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Executive Summary

Purpose

This study analyzes Astana's gasification efforts aimed at mitigating severe air pollution caused by coal heating. The primary objectives of this study is to:

1. Explore the factors contributing to the slow progress of gasification and specifically to the affordability of gas connection for citizens and recommend strategies to enhance accessibility of connection to central gas system.
2. Evaluate the effectiveness of current policies and programs in incentivizing citizens to switch from coal to gas in heating their homes.

Problem statement

Despite government's efforts, the number of households connected to gas system remains low and the pace of connection remains slow.

Research questions

In the study the following research questions were developed.

1. What factors prevent families from transitioning from coal to gas as the primary fuel source for space heating?
2. How do government policies shape the gasification rates in Astana?

Methods

The key stakeholders in Astana's gasification are KazTransGaz Aimak JSC (KazTransGaz), the Akimat of Astana, and private households. KazTransGaz, KazTransGaz is the largest supplier of natural gas to Kazakhstan and has pipelines in all gasified regions and major cities of the country including Astana. The Akimat coordinates and facilitates gasification by overseeing the development of gas supply networks, which are later maintained by KazTransGaz. Licensed private companies handle household connections.

A mixed-methods approach was used to examine gasification challenges and opportunities. The study explored and compared quantitative and qualitative factors that

may hinder or be associated with the transition from coal to gasification. The study incorporated 95 household surveys to evaluate the heating methods used by the respondents, the cost factor associated and their knowledge about the existing gasification policies. Additionally, 12 semi-structured interviews were conducted with representatives from the local government (Akimat), KazTransGaz, and private households, to explore more insights on their perception of the transition to natural gas.

The study used purposive sampling technique to select respondents affected by the shift from coal to gas, but adopted the technique of snowball sampling to also select other diverse groups including the marginalized households. The data analysis incorporated both statistical analysis, this as a way of identifying trends, and then coding as a way of identifying themes.

In our research the following three main working hypotheses (WH) were elaborated:

WH1: The main factor preventing residents from gasification is the price

WH2: The residents are aware about the gasification program

WH3: The residents are carbon literate

Findings and Discussions

The research revealed several major findings on the gasification of Astana, specifically, survey data showed that 52.6% of households use natural gas for heating, while 40% still rely on coal, despite 97% out of them recognize its health risks and express interest in transitioning to gas. Several significant challenges to the gasification process were pointed out such as financial constraints, with high upfront connection costs (up to \$4,156) that deters to the gas connections despite of availability of many options of loans and subsidies. Awareness problems were also prominent, where 73% of the respondents admitted that they have low awareness on the gasification policy, while, 9% claimed to have high awareness. Another obstacle in the gas supply and transition was technical incompatibility and inconsistency, showing that only 20% respondents view current policies as effective. In regards of environmental awareness, 96.8% respondents are aware about the negative effects of coal to the health and the environment, but they have limited access to carbon literacy campaigns and a lack of active communication from the Akimat's office are hindering progress. Additionally, the study reveals that natural gas is

15% cheaper compared to coal in the equivalent of heating metrics, there are additional savings on maintenance and labor costs, however, because of high initial costs many families could not afford gas heating system. In overall, the study outlines multi-dimensional barriers to gasification: financial, informational, and technical hurdles that limit the advancement of gasification in Astana.

In regards of working hypothesizes the following results were obtained:

- *Hypothesis 1 is confirmed:* The high cost of connecting to the central gas network is the main factor preventing residents from gasification in Astana. Besides the cost of connection difficulty, technical, bureaucratic, and information barriers that are beyond the control of residents also slow down the rates of gasification.
- Hypothesis 2 is refuted: The residents are not adequately aware of the gasification program. While some information on connection costs, fuel prices, and government subsidies is available, a significant portion of residents finds it inaccessible or only somewhat accessible. This lack of comprehensive and clear and information hinders the effectiveness of the gasification program.
- Hypothesis 3 is refuted. Residents are aware of the environmental impact, but the government does not use this knowledge to promote gasification.

Policy recommendations

The study recommends several strategies to address the barriers to gasification in Astana. The first step includes raising awareness among the population using the publicity campaigns and different methods of the address: door-to-door, social networks, and local meetings which should help to explain citizens the advantages of gasification and the further instructions concerning the financial incentives for that. These campaigns should therefore be implemented in line with measurable communication strategies that come with set performance benchmarks. Second, simplifying the range of financing options by implementing a single ‘one-window’ submission of documents for gas installation and cooperating with banks for interest-free loans with guarantees from the government will also make the transition easier on households. Third, stepping up infrastructure construction is necessary, such as increasing the pace of the extension of the gas networks to remote areas, and improving the quality of construction to avoid interruption of services to the households and institutions while at the same time recommending the retention of coal heating systems where necessary. Fourth, more financial guarantees for

policy support and subsidies for low-income groups, clear and efficient subsidies, transparent information on gas prices and subsidies can enhance acceptance. Lastly, supporting educational campaigns and efforts aimed at raising people's carbon literacy through training in schools and workplaces, as well as community programs, will enhance people's understanding of the positive impact of gasification on the environment and human health, and establish the broader public support needed for large-scale change.

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Abstract

This study investigates the current heating methods, attitudes towards the gasification (switching from coal to natural gas for heating) and related challenges faced by households in Astana, Kazakhstan. Two central research questions guide this study: ‘What factors prevent families from transitioning from coal to gas as the primary fuel source for space heating?’ and ‘How do government policies shape the gasification rates in Astana?’.

Utilizing mixed methods, including survey and interviews with key stakeholders, the research identifies significant trends and barriers in the adoption of natural gas for heating. The findings reveal a strong preference for natural gas due to its environmental benefits, convenience, and cost-effectiveness, with many households considering a switch from coal. However, significant obstacles include high upfront costs, technical barriers, and a predominant lack of awareness about government policies on gasification.

The study recommends enhancing public awareness of gasification benefits and government support programs, improving gas infrastructure reliability, and updating the payment model to alleviate the financial burden. By addressing these challenges, the government can facilitate a smoother transition to natural gas, improving environmental and public health outcomes in Astana.

Introduction

Background

The city of Astana, the capital of Kazakhstan, is a place of contrasts. Renowned for its futuristic architecture and ambitious development plans, each winter all its gloss washes off when thick smog settles over the city. In the cold months of the heating season, from October to the end of April, the presence of smog in the capital becomes distinctly visible. It is during these winter days that people residing in proximity to private housing sector find themselves unable to do something as basic as opening their windows (Abilmazhitova, 2023)

The smog issue in Astana is not merely an aesthetic concern. It is a severe public health and environmental challenge that has persisted for years. This situation has prompted significant concern among the city's inhabitants and has drawn attention of the country's leadership.

In 2021, the President of Kazakhstan encouraged to develop the gas industry where he emphasized the pressing need of gasification as a crucial step to address the smog problem (Akorda, 2021). Gasification, in this context, refers to the transition from coal-based heating systems to cleaner and more sustainable natural gas alternatives. It is widely believed that this transition is a key to mitigate the smog in the city (Association of Environmental Practitioners, 2021).

One of the main reasons for the smog is the combustion of high-ash coal within the city. Astana predominantly relies on ash coal with an alarming 42 percent. The combustion of such coal not only releases harmful pollutants into the atmosphere, but also contributes to the creation of fine particulate matter known as PM2.5. These fine particles are the main cause of smog and are associated with respiratory diseases, making the situation a public health concern (Association of Environmental Practitioners, 2021).

Astana embarked on the road to mitigate the smog problem in 2018, when gasification was identified as a key solution to the problem. Subsequently, the construction of 'Saryarka' gas pipeline brought natural gas to the city by the end of 2019, initiating the expansion of a gas network in the city. However, the process has been slower than initially anticipated. Only 8000 households were connected to the central gas system between June

2020 and January 2023 – a figure deemed insufficient by the President during the 31 January 2023 meeting on further development of the capital (Akorda.kz, 2023).

Our research venue is the Akimat of Almaty district of Astana. Established through the Presidential Decree No. 3942 on May 6, 1998, the Almaty district in Astana encompasses a territory of 15,471 hectares. Within this territory 303,000 people live in six distinct residential areas. In each of these residential areas there still exist private houses using coal for heating, as well as houses that have switched to gas. According to the data provided by the Akimat, access to gas has been provided to 12 thousand households with a population of about 200 thousand people (the total number of people subject to gasification is 300 thousand people). 10 thousand out of 12 thousand households are connected to gas. The Akimat is a key state institution within the administrative-territorial unit tasked with the mission of implementing national executive policies, harmonized with the development needs of Almaty district of Astana, which includes facilitating the gasification.

The government of Kazakhstan recognizes the urgent need to shift from coal to natural gas to address environmental and health concerns resulting from coal combustion. To facilitate this transition, the government has initiated several policies and incentives aimed at making gasification more *accessible* and *affordable* for its citizens. These measures include financial support programs, subsidies and interest-free loans to ease the financial burden on households connecting to the central gas system. For instance, the government's subsidies for natural gas never exceeded 1 billion USD during the period from 2010 to 2020. However, in 2021, these subsidies jumped to 3 billion USD and then surged to 8 billion USD in 2022 (International Institute for Sustainable Development [IISD] & Organisation for Economic Co-operation and Development [OECD], 2024), marking a significant shift in government policy and underscoring the importance of natural gas in Kazakhstan's energy strategy. Such a significant increase in subsidies corresponds with the launch of the gasification program, thus demonstrating the government's high interest in this program.

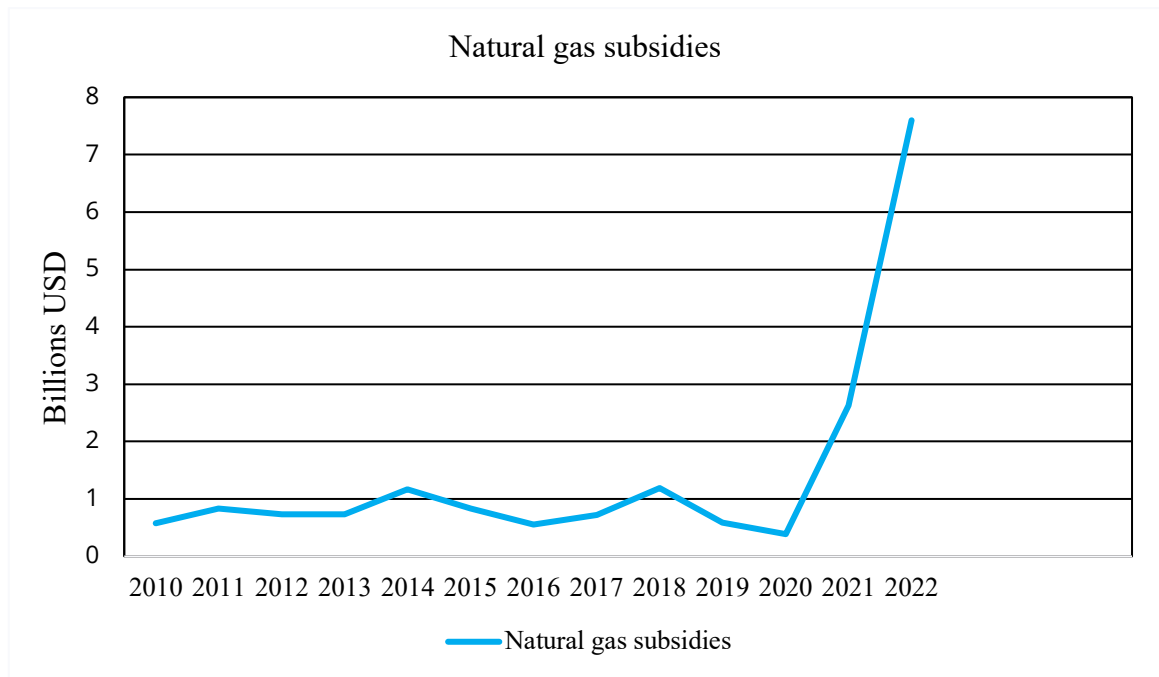


Figure 1. Natural gas subsidies in Kazakhstan (Billions USD per year). Source: International Institute for Sustainable Development [IISD] & Organisation for Economic Co-operation and Development [OECD], 2024.

The problem analyzed in this research is that the number of households connected to the gas system remains low and the pace of connection is slow. The President of Kazakhstan criticized the slow progress of gasification in Astana and called upon the authorities to expedite the process and address the issue of expensive gas connection fees.

The objective of this research is to explore the factors contributing to the slow progress of gasification and specifically to the affordability of gas connection for citizens and recommend strategies to enhance accessibility of connection to central gas system. Furthermore, the research aims to evaluate the effectiveness of current policies and programs in incentivizing citizens to switch from coal to gas in heating their homes.

Research questions

This study prioritizes understanding the dynamics of citizen transition from coal to gas heating in Astana. Our primary aim is to evaluate the factors influencing households in adopting or resisting the shift from coal to gas heating. The corresponding research question is: ‘What factors prevent families from transitioning from coal to gas as the primary fuel source for space heating?’.

Subsequently, we will explore the role of government policies and support programs. The related research question is: ‘How do government policies shape the gasification rates in Astana?’.

Working hypotheses

To guide our qualitative research, we developed working hypotheses in order to facilitate the connection between research questions and empirical evidence (Shields & Tajalli, 2006). To better illustrate the developed hypotheses, we will use a conceptual framework table.

Working hypotheses	Scholarly support
WH1: the main factor preventing residents from gasification is the price	
<i>WH1a: residents cannot afford connection to gas network</i>	Azhgaliyeva et al. (2021)
<i>WH1b: residents cannot afford the price of natural gas</i>	Kerimray et al. (2017)
<i>WH1c: residents cannot access low-interest loans and instalment payment plans</i>	Howie & Pak (2017); Howie & Atakhanova (2017)
WH2: The residents are aware about the gasification program.	
<i>WH2a: Information on the cost of connection is clearly provided and easily accessible</i>	Azhgaliyeva et al. (2021)
<i>WH2b: information on cost of fuel is clearly communicated</i>	Su et al. (2018)
<i>WH2c: Information on government subsidies and support for gasification is clearly communicated and effectively influences households' decisions</i>	Kerimray et al. (2017); Astbury & Tate (2012)
WH3: The residents are carbon literate	
<i>WH3a: The residents are exposed to carbon literacy programs</i>	Astbury & Tate (2012)

Figure 2. Conceptual framework table

To conclude, the smog issue in Astana is a critical public health and environmental challenge that has prompted action from both residents and the country's leadership. This research aims to analyze government policies and household-level factors affecting the transition from coal to gas, and provide suggestions to alleviate Astana's persistent smog problem.

Literature review

To the best of our knowledge, the topic of gasification of Astana has not been studied extensively. Our study represents the first investigation of people's incentives to embrace gasification and of the effectiveness of government incentives in this sphere. For this study we reviewed the existing literature on economic implications of gasification, people's incentives to switch from coal to gas, environmental consequences, public policies' influence on gasification, as well as carbon literacy campaigns.

Economic implications of gasification

Among some scholars there is an assumption that gasification inevitably leads to economic growth (Belinsky, 2019; Filimonova et al., 2020). We consider it important to evaluate such an assumption, since if proven to be true, it may be an important tool to encourage more active government measures. Development of natural gas distribution systems has been said to contribute to economic growth in 17 Russian regions, and suggests that gasification necessarily leads to economic growth (Belinsky, 2019). This finding is supported by the case study of Krasnoyarsky Kray region of Russia, conducted by Filimonova et al. (2020), where authors correlate availability of natural gas infrastructure to implementation of investment projects. Both studies appear to have heavily relied on correlation of data, rather than establishing a robust causal link between gasification and economic growth. Nevertheless, the studies consistently underscore gasification's significance in enhancing citizens' living conditions. This finding may be relevant for Astana's context, and continuous growth of its population.

People's incentives for gasification

As regards impact on the environment, numerous studies have been conducted in Europe to assess the effects of gasification on abatement of greenhouse gas emissions. Löffler & Hecking (2016) emphasize the significance of individual household decisions and cost considerations for German individual heating market. In our research we will analyze

whether there is a correlation between the household income the choice of heating methods.

Moreover, gasification policy has to take into account attitudes to ecology, economic considerations and impacts of the regulation (Decker, 2016; van den Broom, 2019). It underscores the need for policies tailored for specific context of each community to address differences in energy consumption among households (Su et al., 2018). The study by Perrier et al. (2019) highlights the challenge of striking the right balance between environmental concerns and economic growth, as well as the potential impact of population growth on reduction of emissions.

Azhgaliyeva et al. (2021) examined the patterns of household heating and trends of coal consumption in Central Asia. The authors were provided concrete data on coal reliance by conducting national household surveys in 2018 for 21,000 households in Kazakhstan. The findings indicate that rural houses were more reliant on coal due to lack of access to central heating (only 2.3% had access). The study implicates that having access to the gas pipeline does not guarantee a switch to gas. This is confirmed by absence of a complete switch to gas in Astana in 2020-2021, despite having access to the main gas pipeline.

Studies by Decker & Menrad (2015) and Jansma et al. (2020) highlight the main point of difference between scholarly research in the multitude of subjective reasons and attitudes to gasification. Jansma et al. (2020) provided review of concerns from homeowners and tenants in the Netherlands regarding transition from natural gas to sustainable heating solutions. One of the main concerns was financial, highlighting the need for transparent and inclusive policies.

Public policies' influence on gasification

Exploring the international practice of switching from one fuel source to another, we studied the research conducted by Araposthatis et al. (2013). The authors examined historical transitions in the UK, studying the evolution of the gas industry in the periods of 1877-1914 and 1948-1977. The study provides an extensive analysis of how the market competition shaped the gas industry in Britain. Further, we studied the experience of Danish shifting market dynamics in the sphere of sustainable energy sources (Siddique et al., 2023). In addition, we looked for insights in the gas system of India, to use it as a comparison against China and Russia. The study by Mathur et al. (2022) revealed the existing relationships between technology limits, geopolitics, and local economies.

Emphasizing the best practices in subsidy measurement and estimation is a way to identify the problems and the things that can be done in the energy sector (Sovacool,2017). In the same vein, Su et al. (2018) examined the heating solutions in Chinese residential buildings which provided a new angle of looking at the drivers that affect the decision-making process which range from environmental issues to governmental incentives. The study highlights the importance of various issues regarding local climate and resource availability in order to successfully use the best heating technologies.

Relating the research to Kazakh realities, we relied on the research by Howie&Pak (2017) who studied the dynamics of switching from coal to natural gas, as well as insulating private houses in Kazakhstan against the possible elimination of fossil fuel subsidies. As a country that allocated \$5.3 billion to fossil fuel subsidies in 2014, Kazakhstan's context underlines the different sides of the subsidy removal. Contrarily, the government's intention of substituting fossil fuels with renewable energy sources would fail if the necessary infrastructures such as insulation and energy-efficient technologies are not provided for the households. This research raises two important issues. One issue consists of household energy needs, while the other issue represents the governments' energy obligations. Hence, the government's energy policy must be two-fold: one concerning punishment and the other one reward. There should also be a major investment in energy-efficient technologies and social education programs to show households how they can benefit from going green, supporting them during the transition.

Based on the Household Living Conditions Survey, Kerimray et al. (2017) found that 40% of households are heavily relying on coal as the main fuel. The situation becomes more contradictory if we look at the subsidized energy prices in Kazakhstan, and yet, 28% of households spend a significant part of their income on heating.

Howie & Atakhanova (2017) suggest that reforming the energy subsidies could bring considerable reductions of coal demand, with an abrupt elimination of 60% coal subsidy expected to result in a drop of 30-36% in coal demand and a subsequent 30% increase in household coal expenditures. The authors suggest a more gradual approach of removing the subsidies during a 10-year period, which would result in a decline of yearly coal demand of 8.2%, eventually leading to a 58% decrease after a decade, although 30% of rural households re expected to maintain their reliance on coal.

Environmental implications of gasification

Li et al.(2023) and Son et al. 2023) examine advancements in air quality monitoring, highlighting modern, cost-effective technologies that could be relevant to improving air quality in Kazakhstan. In line with Li et al.'s findings, Henneman et al.(2017) stress the growing importance of the field in informing stakeholders and advocate for advanced planning, incorporation of new data sources, and ongoing evaluation of methods to enhance investigations into the long-term impact of air quality regulations. The importance of citizens' involvement is touched upon in Shahbazi et al.'s (2022) examination of Tehran's emission inventory, which addresses the intricate relationship between greenhouse gas reduction goals and air quality objectives, advocating for integrated policies.

The need of considering both the short-term emission reductions and long-term consequences of gasification was highlighted by Gürsan&de Gooyert's(2021), confirming the findings of Jerrett et al. (2005), who emphasized the need for energy source transitions being done gradually.

Jin et al. (2017) evaluated social, economic, and environmental impacts of gasification of power plants and households done to address the goals of China's Coal Consumption Cap (CCC) policy. By using the benefit-cost analysis, the study reveals that the reduction of coal usage does not lead to a fixed number of net benefits because the outcomes vary across households. This view is supported by Liu et al. (2022), who advocate prioritizing coal reduction in households over conventional policy-focused sectors like power plants. The study shows the significant health improvements associated with cleaner air. Implementing these policies leads to a substantial reduction in pathogenic cases and premature deaths linked to air pollution, particularly respiratory illnesses like asthma and chronic bronchitis.

Environmental literacy campaigns

The article by Satchwell (2013) explores the concept of 'carbon literacy' by examining how children's understanding and practices regarding climate change, influenced by both school and home environments, relate to their literacy practices and environmental behaviors, advocating for the adoption of 'carbon literacy practices' as a framework to enhance their comprehension and application of knowledge about the carbon cycle (the movement of carbon through living organisms, the atmosphere, oceans and the Earth's

crust). Satchwell (2017) explains the notion of ‘carbon literacy practices’ as a sum of two parts: ‘carbon literacy’ and ‘literacy practices’, highlighting climate change acknowledgement as an issue is not equal to doing something about it.

The findings of Schleich et al. (2024) further Satchwell’s notion of ‘carbon literacy’ by breaking it down into ‘carbon knowledge’ and ‘carbon engagement’. For Schleich et al. (2024), carbon knowledge is the factual understanding of individuals about greenhouse gas emissions produced by their daily activities. Meanwhile, carbon engagement is individuals’ willingness to actively engage with and update their understanding of climate-related knowledge. The study indicates that people with high carbon engagement usually have small carbon footprints, *ceteris paribus*.

Based on the research of Dósa & Russ (2019) that highlights the necessity of using communication and educational strategies specific to various subpopulations, an increased effectiveness of sustainable energy use promotion can be achieved. The study by Chapple et al. (2020) demonstrates how personal history shapes attitudes and behavior toward sustainability, which arguably relates to social learning, highlights importance of personal relevance and engagement instead of simply the transfer of information.

We used the analysis of the Manchester Carbon Literacy program conducted by Astbury & Tate (2012) who demonstrated the benefits of using the ‘cascade’ approach and peer-to-peer training when realizing carbon literacy programs. For Kazakhstan it could be recommended to adopt a similar uniform standard like the Manchester Carbon Literacy Standard to ensure that Kazakhstan’s carbon literacy program is uniform. For our research we plan to use similar semi-structured interviews targeted at different levels of the program and stakeholders to assess effectiveness of the program.

Summary

The literature review reveals three key topics relevant to the gasification of Astana. Firstly, while financial concerns are significant, other factors such as environmental and health concerns also influence individuals’ decisions regarding heating fuel choices. Secondly, the importance of informational campaigns and carbon literacy programs is highlighted, suggesting that increased awareness can lead to more sustainable behaviors. Thirdly, the role of public policies and subsidies is crucial, as effective policies and

targeted support measures are necessary to encourage the adoption of gasification and energy-efficient technologies.

Our research will assess the current weight of these factors within the government's gasification policy and provide recommendations accordingly. By doing so, we aim to create suggestions for a more effective and comprehensive gasification program that addresses economic, environmental, and informational needs of the population, ultimately supporting the Akimat in achieving a successful transition of the city to natural gas.

Methodology

Research setting

In this study, the key stakeholders involved in the gasification of Astana are KazTransGaz Aimak JSC (hereinafter - KazTransGaz), the Akimat of Astana, and private households. KazTransGaz is the largest gas supply company in the Republic of Kazakhstan, operating distribution gas pipelines and providing gas in all eleven gasified regions and three cities of republican significance, including Astana. The Akimat (local administrative body) plays a crucial role in coordinating and facilitating gasification within Astana. Its responsibilities include overseeing the development and implementation of gas supply networks, which are later transferred to KazTransGaz for maintenance and operation. The connection to the gas system is carried out by private gas companies licensed for such operations. These companies are included into the official list published at the website of the Akimat of Astana.

Methodological approach

To answer our research questions, which are: 'What factors prevent families from transitioning from coal to gas as the primary fuel source for space heating?' and 'How do government policies shape the gasification rates in Astana?', we used both quantitative and qualitative methods (Matthews & Ross, 2010). Specifically, we conducted a survey aimed at individual households and received 95 responses. Additionally, we carried out interviews with both organizations – the Akimat of Astana and KazTransGaz– as well as with individual households.

Measures and indicators

In our research we identified key measures and indicators to understand influencing factors of shifting from coal to gas for heating purposes. Our research will be based on quantitative variables such as household income and the number of tenants in a household, which would serve as measures of economic capacity and the social dynamics that affect the potential shared decision processes within each household. We will also explore the cost of connection to understand financial considerations associated with gasification. At the same time, our indicators offer qualitative dimensions to our study. We will also explore how much individuals consider ecological factors in their energy source choices by using environmental awareness as an indicator (Bryman, 2012).

Sampling strategy

We used purposive sampling to select research participants to ensure that the respondents represent the relevant subpopulation living in private houses and having access to connection to natural gas network. For our interviews and survey, we chose purposive sampling to ensure a targeted and purposeful selection of respondents. While purposive sampling does not allow generalization to a broader population, its nature aligns with our specific research objectives by providing in-depth insights into the experiences and perspectives of a key subset of population as related to gasification (Bickman & Rog, 2008).

In addition, we used snowball sampling to ensure that our interviews involved people with relevant experiences. For this, we identified initial participants based on our predetermined criteria of living in a private house and having an opportunity to connect to gas system, and then leveraging these people's networks to identify additional relevant participants (Browne, 2005). We specifically inquired if the initial participants knew any of their neighbors with disabilities, or who are single parents, parents with more than four children, senior people, from low-income groups, etc. We uncovered nuanced insights regarding personal reasons behind switching or not switching from coal to gas made by people of the above-mentioned categories.

Research methods

Interviews and survey were used to understand behavior and incentives of individual households within the context of gasification. The qualitative design of our research focused on points of view of residents of Astana. We were concerned with understanding

people's reasons for switching or not switching from coal to gas in light of their specific household contexts and situations. Inductive research was chosen for this part of our research while we form a certain theory justifying people's attitudes to gasification after having made our observations (Bryman, 2012).

Semi-structured interviews were conducted with key stakeholders such as Akimat and KazTransGaz (Appendix 1) and residents of private houses (Appendix 2). We conducted 12 semi-structured interviews, following a common set of questions divided into topics relevant for each group. The participants were informed of the possibility to answer the questions with their own words and share personal opinions (Matthews & Ross, 2010).

The survey targeted individual households and allowed deep exploration of the varying perspectives forming people's choices about the connection to gas networks. The survey was distributed through social media and administered among residents of private houses within residential areas of Astana who either had switched to gas or considered doing so. The survey focused on their perceptions of the adequacy of ongoing gasification policies. The survey questions focused on revealing heating sources, demographic information, household preferences and concerns regarding gasification, government policies and gasification rates (Appendix 3). We codified the results of the survey and used them in data analysis to explore relevant correlations (Bryman, 2012).

Data analysis methods

To analyze qualitative data, we organized and classified it through coding. After that, we used Microsoft Excel to improve the efficiency of data processing. To achieve this goal, we identified an annotation scheme that includes codes adapted to our research objectives. During the coding process, our team used these codes manually to determine the appropriate characteristics of the data, ensuring the stability and accuracy of the data set.

We passed the communication analysis with Microsoft Excel to measure the strength of the linear relationship between gas tariffs and public policy, as well as gas tariffs and people's personal preferences.

Ethical considerations

In our research, we were committed to upholding the ethical standards to protect the rights of our research participants. We adhered to the ethical standards set out in the Handbook: A Guide to Conducting Human Subject Research adopted by the Institutional Research

Ethics Committee (IREC) of Nazarbayev University (IREC, 2017). All the terms of informed consent have been followed both in survey and interviews. (Bryman, 2012)

Findings

In the Findings section, interviewees will be designated as H1 (Household 1), H2 (Household 2), and so on. The Akimat will be labeled as O1 (Organization 1), and KazTransGaz as O2 (Organization 2).

Based on the data from the interviews with households and stakeholders, and survey of households, our team has come up with the following findings:

Current heating methods and attitudes towards switching to gas

The survey results revealed a diverse distribution of heating methods among the 95 respondents of the survey. The majority of respondents, 52.6% (50 households), used natural gas as their primary heating method. This indicates a significant adoption of gas for heating purposes. Coal was the second most used heating method, used by 40% (38 households) of respondents. Additionally, 4.2% (4 households) used electricity for heating, and 3.2% (3 households) used central heating. This shows that despite many households' switching to gas, coal heating remains a significant heating method.

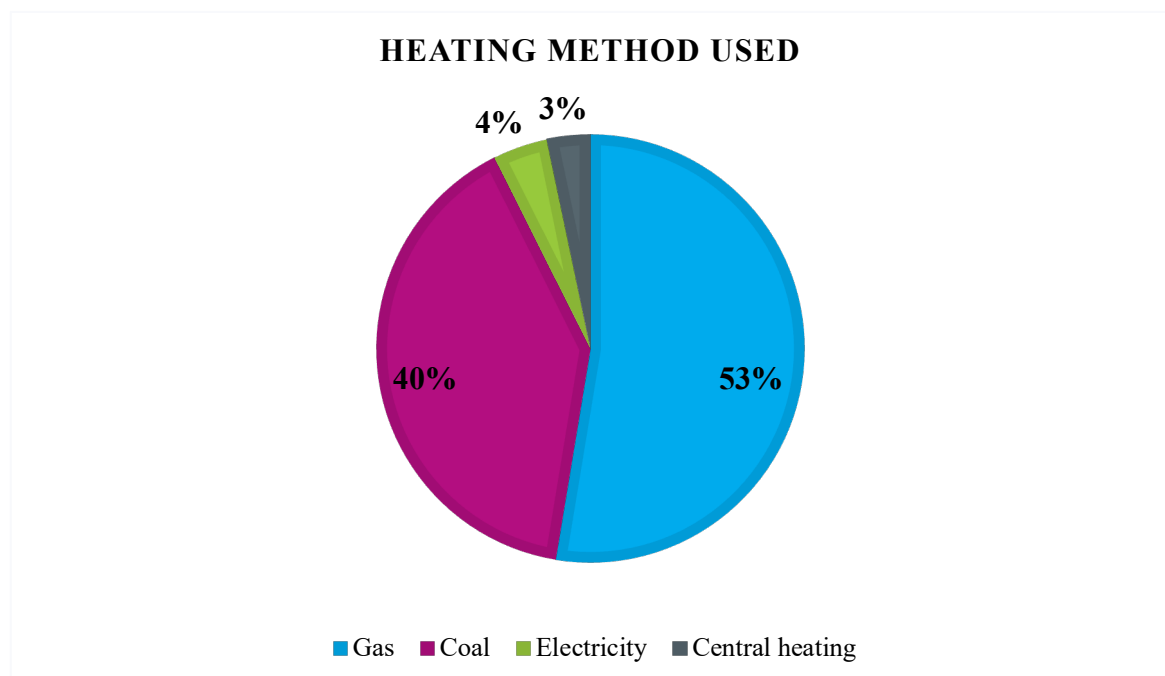


Figure 1. Distribution of current heating methods among survey respondents

According to the cross-tabulation of the survey data, the proportion of households already using gas or considering switching to gas is significant. Out of the 38 respondents currently using coal for heating, 37 individuals have at some point considered switching to gas, and 48 have already switched to gas as their primary source of heating. This leads to a total of 85 respondents – comprising both those currently using gas and those considering a switch – out of a total of 95 respondents. This indicates a strong preference and trend towards adoption of gas heating among the surveyed households.

Type of heating	Considered switching to gas				Grand Total
	I'm not sure	I've already switched to gas	No, I haven't considered switching to gas	Yes, I was considering switching to gas	
Central heating	0	1	1	1	3
Coal	1	0	0	37	38
Electricity	0	0	0	4	4
Gas	0	48	1	1	50
Grand Total	1	49	2	43	95

Figure 2. Cross-tabulation of heating methods and consideration to switch to gas

The survey data shows that a significant majority of households are either already using gas as their primary heating source or considering switching. Specifically, 51.6% (49 households) have already switched to gas, and 45.3% (43 households) have considered switching. A small percentage, 2.1% (2 households), have not considered switching to gas, while 1.1% (1 household) remains unsure. This data further illustrates the trends from Figure 3, highlighting the strong preference for gas heating among the respondents.

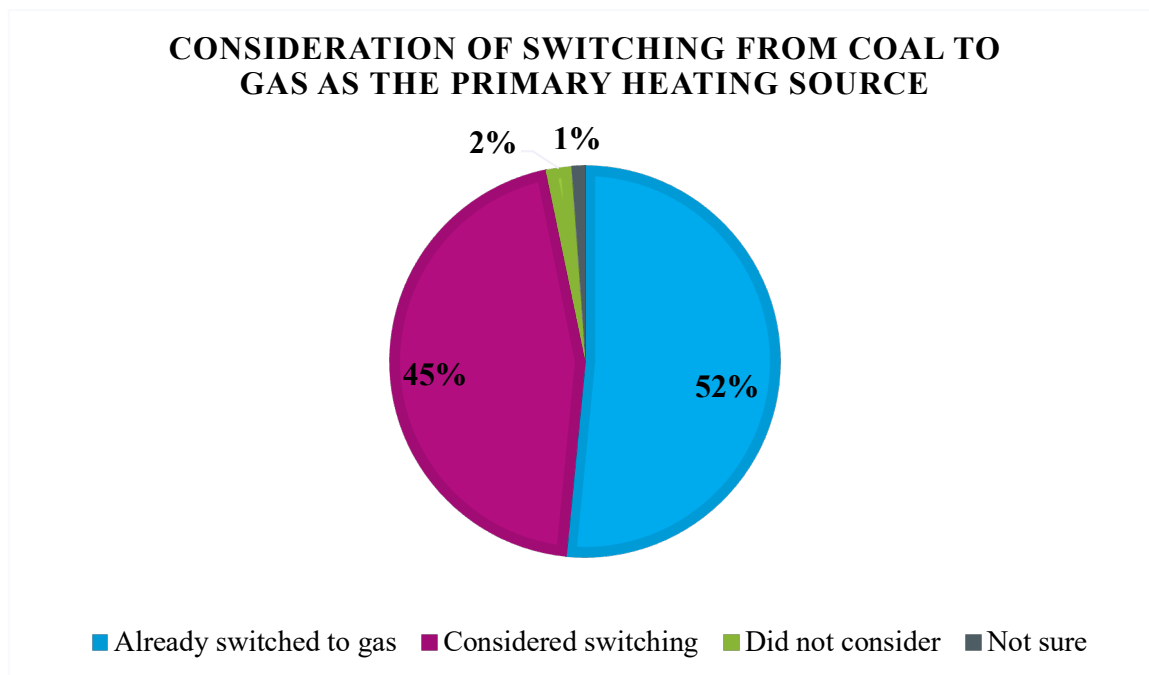


Figure 3. Consideration of switching from coal to gas as the primary heating source

Advantages and disadvantages of gasification

Figure 4 highlights the primary advantages of gas heating as perceived by the respondents. A significant 80% (75 households) cited environmental benefits as a major advantage, while 73.7% (70 households) appreciated the convenience of gas heating. Additionally, 50.5% (48 households) found gas heating to be economical, and 41.1% (39 households) noted its energy efficiency.

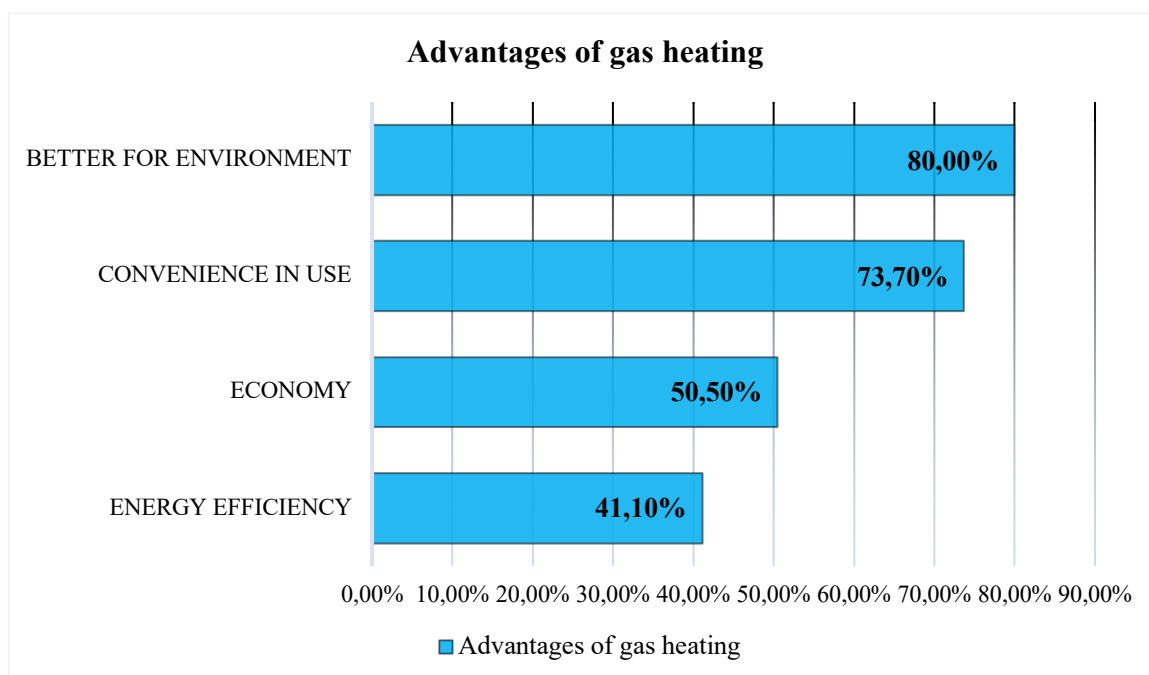


Figure 4. The main advantages of gas heating according to the respondents of the survey

Similar key themes emerged during the interviews with 9 households when asked about advantages of gasification. From the conducted interviews, it is noteworthy that all the interviewees who made a switch from coal to gas reported that it is more convenient than heating with coal. For instance, H4 highlighted that using gas is much simpler since there is no need to constantly watch over the boiler and manage coal supplies. Additionally, H5 emphasized the cost-effectiveness of gas, noting that while coal heating used to cost them around 300,000 KZT per winter, gas heating reduced this expense to approximately 200,000 KZT per winter. Similarly, H6 reported significant savings, with the most expensive gas bill being only 18,000 KZT in a harsh winter month. Moreover, H8 mentioned that gas is not only more convenient and economical but also environmentally cleaner compared to coal.

The cessation of coal use was directly linked to better respiratory health and improved living conditions in their neighborhoods. However, some challenges were noted, such as the inconsistency of gas supply mentioned by H5, H6, and H9, who experienced gas outages and low-pressure issues.

H9 shared her positive experience of transitioning from coal heating to gas, highlighting that this switch allowed her to find employment. She stated, "It simplifies life. I was able to return to work; there's no need to stoke the stove." By connecting to gas, she was relieved of the duty to constantly stoke coal into the coal heater and watch over it. The interviewees cited the necessity to do so as disturbing their sleep at night, and also requiring them to stay at home all day to keep the house heated.

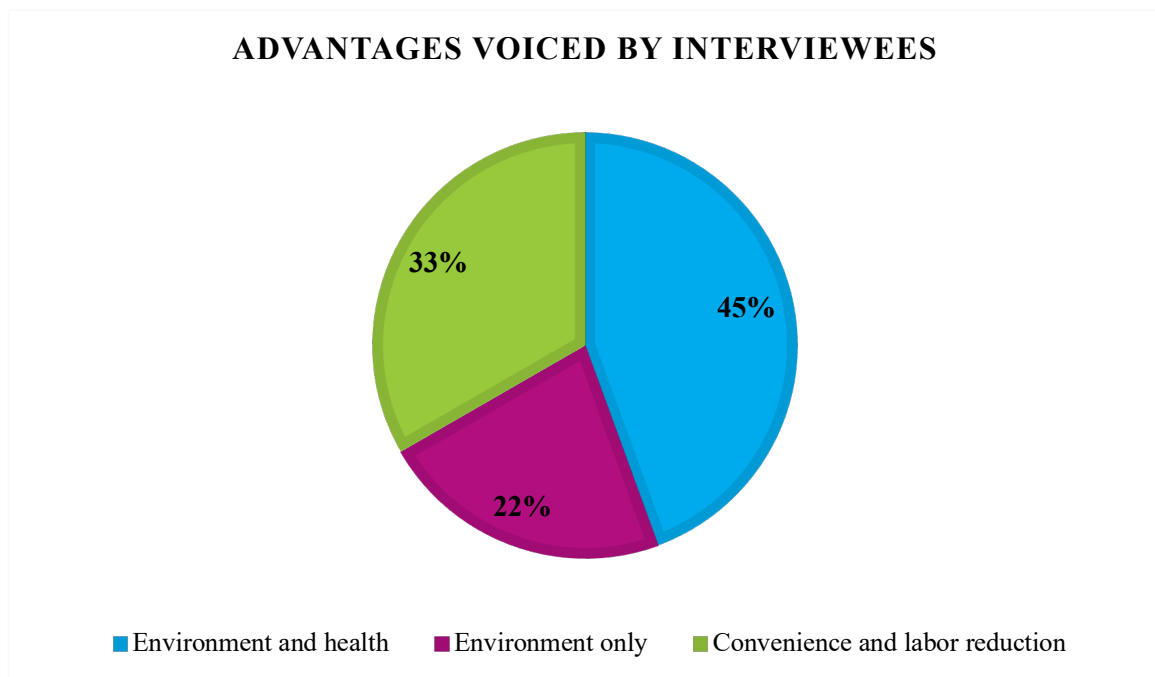


Figure 5. The main advantages of gas heating according to the interviewees

The cross-tabulation analysis reveals a strong consensus regarding the health implications of coal heating among the surveyed population. Notably, every individual who relies on coal as a heating source believes it poses health risks. Furthermore, of the 48 out of 50 respondents utilizing gas for heating, think that coal is harmful for health. In total, approximately 97% of the respondents identified coal as a health hazard.

Type of heating	Do you think coal is bad for health?		
	No	Yes	Grand Total
Central heating	0	3	3
Coal	1	37	38
Electricity	0	4	4
Gas	2	48	50
Grand Total	3	92	95

Figure 6. Cross-tabulation of heating type and perception of coal's health risks

Main obstacles to gasification

Many households face considerable barriers to connecting to the gas network, mainly due to the high upfront costs, which affect 57.4% of 95 respondents. Additionally, the perceived high cost of the gas itself poses a challenge for 36.8%. Technical barriers have been chosen by 30.9%. And additional obstacles, notably, the lack of information about gasification, concerns over availability of gas, the lack of government subsidies were mentioned by 10-20 respondents, that adds to the financial hurdles preventing households from switching to gas heating.

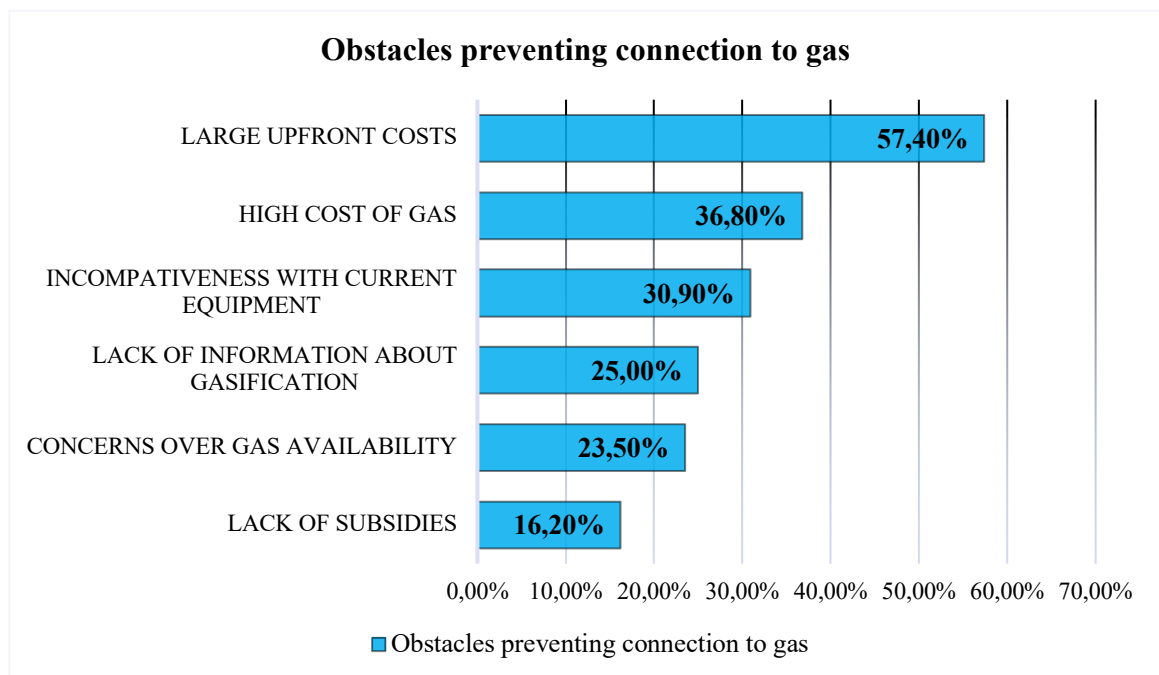


Figure 7. Main obstacles preventing connection to gas

Out of the 9 households interviewed, 5 cited financial challenges as their main obstacle to gasification. This includes difficulties related to the high cost of installation of equipment and paying for the connection to the central gas network. H3 mentioned the lack of access to the gas network as a significant barrier, highlighting the ongoing issues with extension of the gas network. H4 reported bureaucratic and organizational challenges, indicating complications with obtaining documentation and technical standards during installation. Technical and operational issues were noted by H4 and H5, who pointed out inconsistent gas supply and pressure problems. Finally, H9 indicated they encountered no obstacles during the gasification process.

The cross-tabulation analysis reveals a clear relationship between income levels and the decision to connect to gas heating. Among the 94 respondents who reported their income levels, those with below-average income show a notable interest in switching to gas. Respondents with medium income levels exhibit a strong inclination towards gas. Additionally, among those with the above-average income, 15 have switched to gas heating, and 4 are considering it. Only a small number of respondents have not considered switching to gas, with 1 below-average and 1 medium-income respondent indicating this.

Movement to Gas Heat	Income			
	Below average	Medium	Above average	Grand Total
Already Switched	11	22	15	48
Consider switching to gas	21	18	4	43
Haven't considered	1	1	0	2
Don't know	1	0	0	1
Grand Total	34	41	19	94

Figure 8. Cross-tabulation of monthly income and connection to gas

The survey data indicates that the majority of households have not received government aid for gasification. Specifically, 89.4% of all respondents reported not receiving any aid. A small percentage of respondents, 5.3% confirmed receiving aid from government for this purpose. Another 5.3% were unsure whether they had received any government aid. This highlights a perceived gap in the provision of governmental support for gasification efforts.

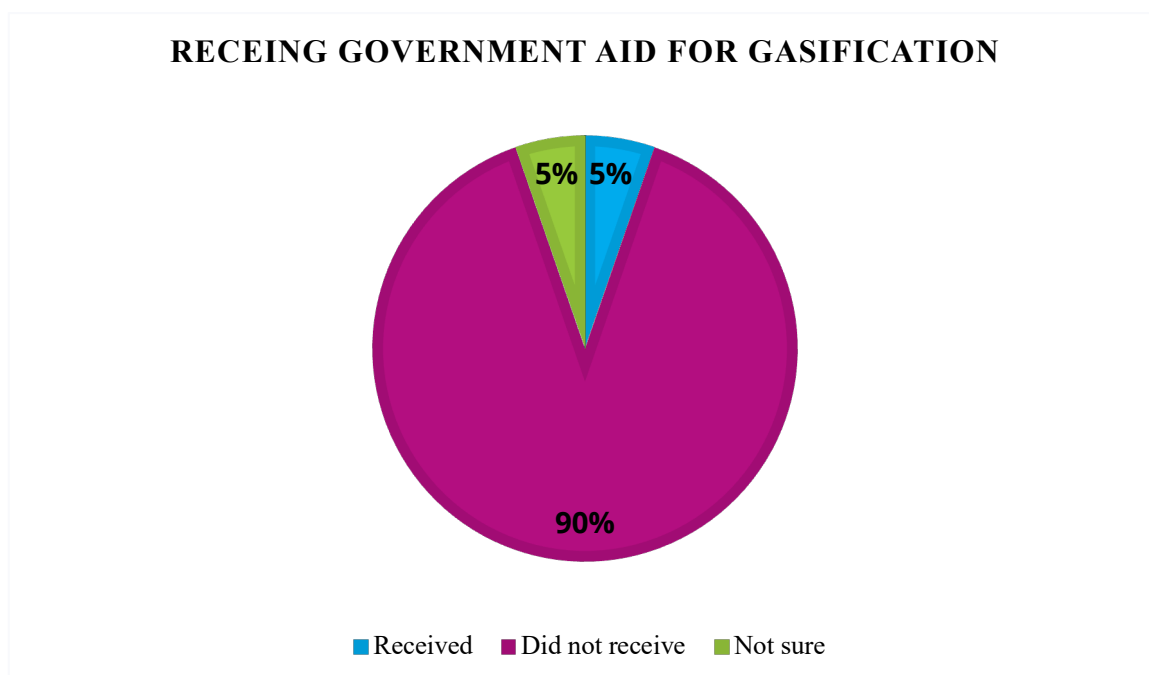


Figure 9. Distribution of households receiving government aid for gasification

Low awareness of government's policies

Survey data reveals important insights regarding the awareness of government policies on gasification, such as the General Gasification Scheme of Kazakhstan for 2023-2030, relevant provisions of the Law on Gas and Gas Supply, and Rules for providing social aid for needy families, and their impact on respondents' decisions or willingness to switch from coal to gas. Figure 7 reveals that a significant majority of respondents (73%) are unaware of gasification policies, while 18% are partially aware and only 9% are fully aware.

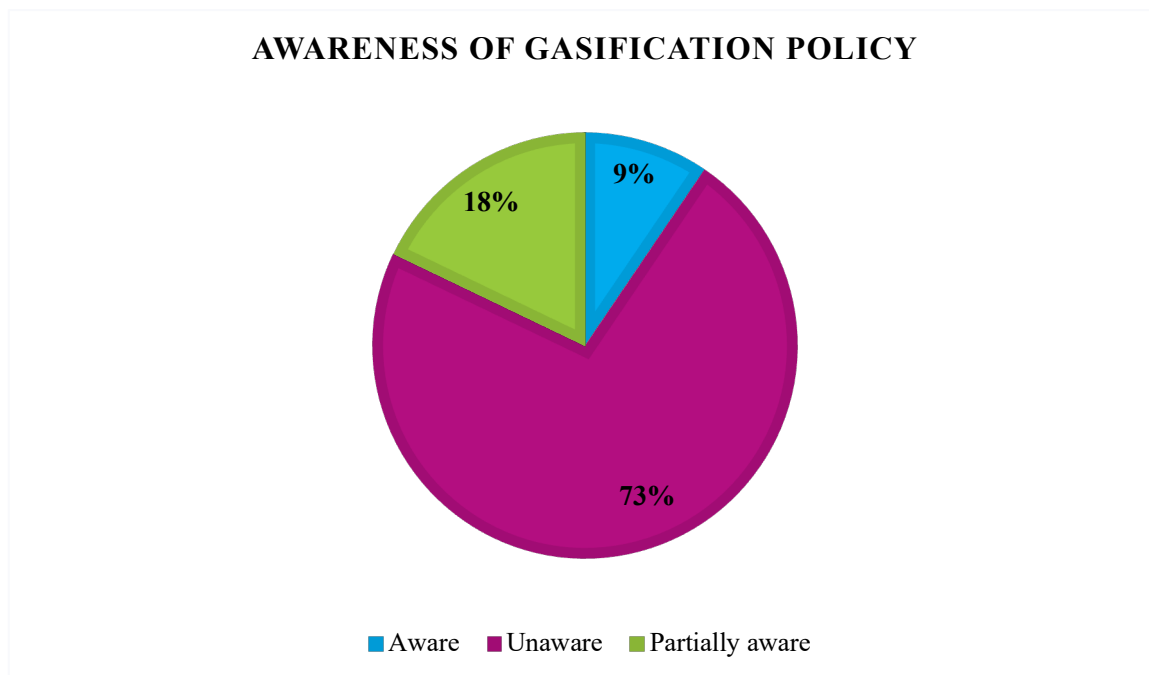


Figure 10. Distribution of respondents’ awareness of gasification policy

Out of 95 respondents, 15 indicated that they were partially aware of some government policies. Among these, 1 reported that the policies had a significant impact, while 5 reported no impact, and 9 stated they were influenced to some extent by the policies.

In contrast, as it is shown in figure 11, 69 respondents indicated that they were not aware of any policies. 9 respondents claimed to be fully aware of the policies. Within this subgroup, 6 reported a significant impact, 2 noted no impact, and 1 indicated some extent of influence from the policies.

These results highlight a predominant lack of awareness regarding government gasification policies, with the majority of respondents reporting no impact experienced from them.

Did state policies have an impact on your decision or willingness to switch from coal to gas?				
Are you aware of governmental policies in gasification?	Had significant impact	There was no impact	To some extent influenced	Grand Total
	a			

I am partially aware of some government policies	1	5	9	15
No	1	63	5	69
Yes	6	2	1	9
Grand Total	8	70	15	95

Figure 11. Cross-tabulation of respondents' awareness of government gasification policies and their perceived impact on switching from coal to gas

Figure 9 reveals respondents' perceptions of the effectiveness of gasification policy in promoting a transition to alternative heating sources among 95 participants. Among coal users, 26 viewed the policy as ineffective, 4 found it somewhat effective, and 8 considered it effective, indicating significant scepticism about the policy's impact. Electricity users had limited representation, with 4 categorizing the policy as ineffective. In contrast, gas users had a more favourable perspective, with 22 stating the policy was ineffective, 17 viewing it as somewhat effective, and 11 considering it effective. Central heating users showed a mixed response, with one indicating the policy ineffective and 2 considering it somewhat effective.

Type of heating used	Is gasification policy effective at encouraging people to switch?			
	No	Somewhat effective	Yes	Grand Total
Central heating	1	2	0	3
Coal	26	4	8	38
Electricity	4	0	0	4
Gas	22	17	11	50
Grand Total	53	23	19	95

Figure 12. Cross-tabulation of respondents' views on the effectiveness of gasification policy in encouraging a switch to alternative heating sources.

The interviews conducted with 9 households reveal a significant gap in awareness about the government's efforts to promote natural gas as a cleaner alternative to coal for heating in Astana. 3 out of 9 interviewees reported familiarity with government policies on

gasification. The majority, indicated a lack of familiarity, often highlighting their limited information about the gas connection process.

None of the interviewees were aware of how the gas price is formed for Astana residents and how heavily the gas price is subsidized. 4 interviewees indicated that awareness of such information would have affected their decision to connect to gas.

This lack of awareness is closely intertwined with a broader issue of trust in government policies. Specifically, H9 remarked, “I have no idea how the government sets these gas prices; it feels like a secret”. H6 stated, “If I had known the subsidies were in place, I might have considered connecting earlier”. These statements highlight a prevailing skepticism about government’s commitment to facilitating a smooth transition to natural gas.

Additionally, 36% of respondents believe information about the cost of connection to gas is not accessible, 49% find it somewhat accessible, and only 15% deem it accessible (Figure 13).

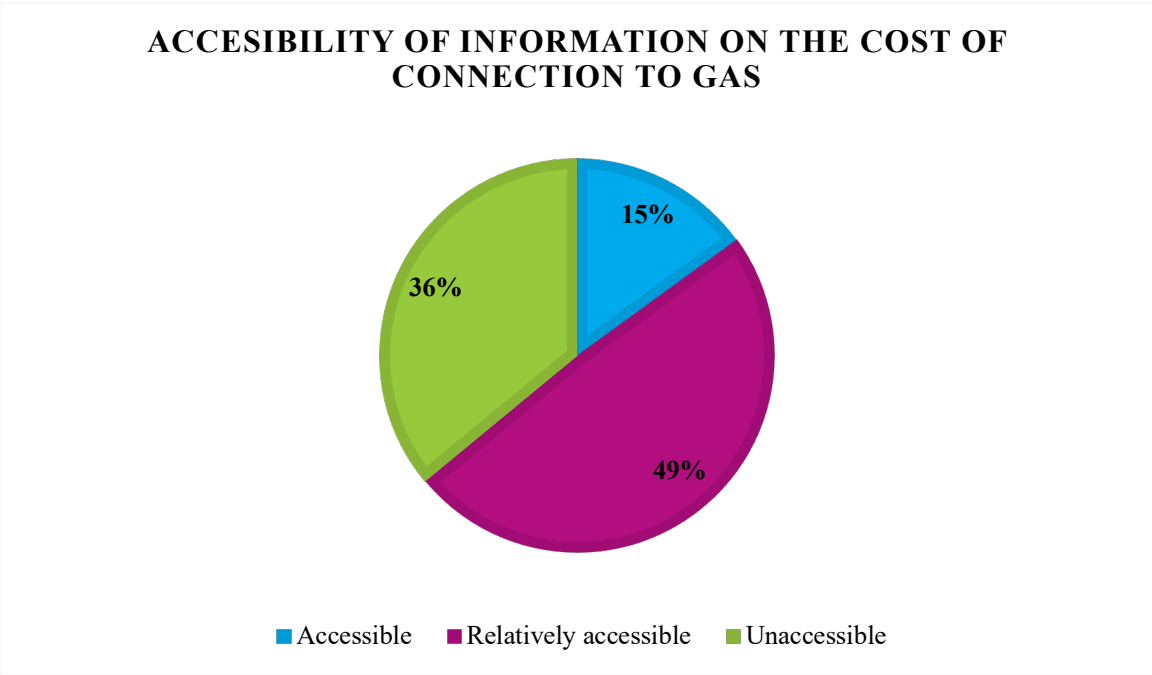


Figure 13. Distribution of opinions regarding accessibility of information on the cost of connection to gas

Figure 14 illustrates the accessibility of information regarding gas prices among the surveyed households in Astana. The data shows that only a small proportion of

respondents (19%) find the information on gas prices to be fully accessible. This indicates a significant gap in the dissemination of crucial pricing information, which could impact decision-making regarding the switch to natural gas.

A larger segment of the respondents (45%) reported that information on gas prices is only partially accessible. Which means, that while some information is available, it may be incomplete or unclear leading to confusion or misinformation among potential users.

Lastly, a considerable part of participants (36%), indicated that information on gas prices is completely inaccessible to them. This high percentage underscores a critical issue in the communication and transparency of gas pricing.

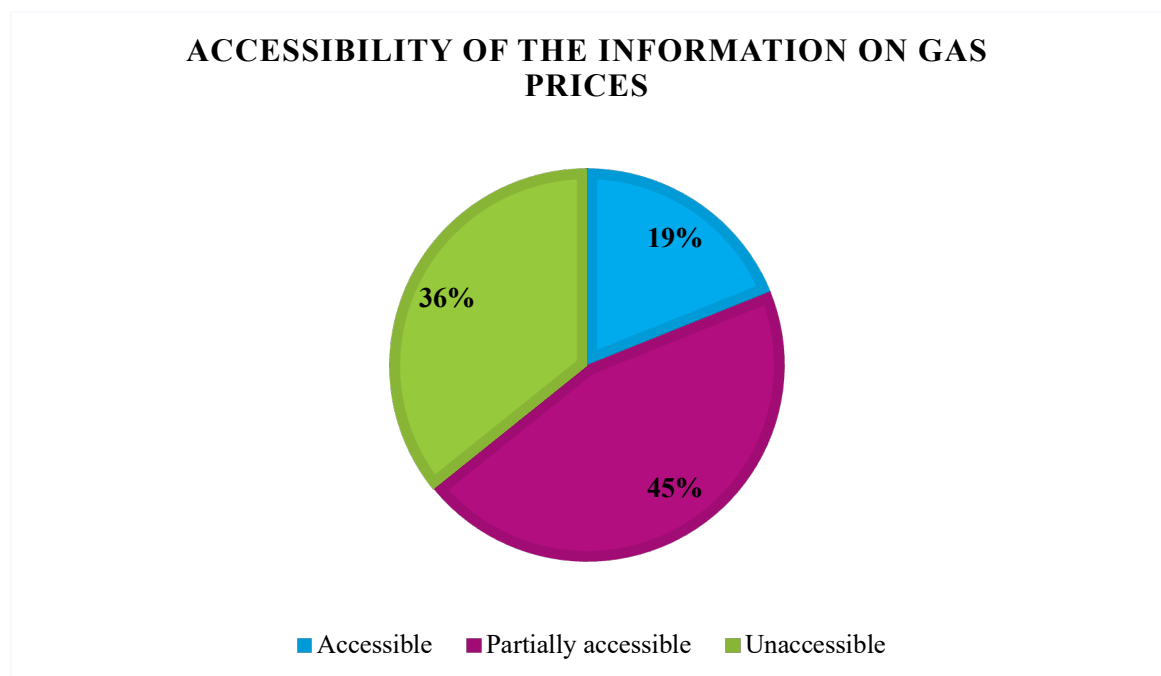


Figure 14. Distribution of accessibility of information on gas prices

Figure 15 shows a significant correlation between awareness of government subsidies for gasification and the receipt of financial support to switch to gas. Out of the total 95 respondents, 18 were unsure about both the awareness and receipt of financial support. A majority of respondents (65) were not aware of any government subsidies, and none of these respondents received financial support from the government. Conversely, among the 12 respondents who were aware of the government subsidies, 4 received financial support, while 8 did not. This suggests that while awareness of subsidies increases the likelihood of receiving financial support, it does not guarantee it, indicating potential barriers or gaps in the subsidy distribution process.

Awareness of government subsidies for gasification	Receiving financial support from the government to switch to gas			
	I'm not sure	No	Yes	Grand Total
I'm not sure	4	14	0	18
No	3	62	0	65
Yes	0	8	4	12
Grand Total	7	84	4	95

Figure 15. Crosstabulation of awareness of government subsidies and receiving financial support for gasification

Furthermore, the perception that the financial burden of connecting to gas would ultimately fall on homeowners was evident, with H5 expressing concern: “It sounds good, but I worry about the costs. What if they don’t help us?”. This skepticism reflects a perceived disconnect between the government’s initiatives and the lived experiences of the residents.

Discussion

In this section, we discuss the findings presented above to understand the dynamics of citizen transition from coal to gas and answer the following research questions of this study.

1. ‘What factors prevent families from transitioning from coal to gas as the primary fuel source for space heating?’,
2. ‘How do government policies shape the gasification rates in Astana?’.

To facilitate a clear connection between the research questions and empirical evidence, we will discuss the findings through the prism of working hypotheses, presented in the Introduction.

Hypothesis 1: the main factor preventing residents from gasification is the price

There are currently 32,000 detached houses in Astana, with only 8,000 connected to gas. From the very start of our research on gasification, the main explanation for these low rates of connection to gas was the high cost of connecting to the central gas network.

Numerous media reports and articles highlighted the unaffordability of the price of connection to gas network. Companies connecting households to the central gas system estimate that the price may reach 843,000 tenge (1,751 USD), while the President suggests that the price is around 2 million tenge (4,156 USD).

To address these affordability concerns, we placed great significance on related questions both in our survey and interviews. Our findings are categorized according to our sub-hypotheses.

Sub-hypothesis A: residents cannot afford connection to gas network

The findings confirm this sub-hypothesis, revealing that a significant number of households face considerable financial barriers to connecting to the gas network. Although many residents express a strong desire to switch to gas, they frequently cite high upfront costs as a primary obstacle. This can be observed from Figures 2,3, and 7 provided above.

Interviewees reported having to take out loans or save up money for up to a year to afford the connection. Additionally, the lack of government subsidies further exacerbates these financial challenges, leaving many families unable to make the switch despite their willingness. Although there is a widespread inclination towards gas heating, affordability of connection remains a critical issue.

Sub-hypothesis B: residents cannot afford the price of natural gas

This sub-hypothesis is refuted by the findings, indicating that the natural gas is actually more affordable than coal in terms of equivalent heating value. In Kazakhstan, coal costs around 15,000 KZT per ton, whereas the same energy output from natural gas would cost approximately 12,771 KZT, making natural gas about 15% cheaper. In addition to the price advantage, coal presents additional challenges, such as transportation, ash disposal, and temperature fluctuations leading many households to view natural gas as a more economically attractive option – even before considering the lower efficiency typically associated with coal-burning stoves.

For instance, one resident noted that while heating with gas costs around 200,000 KZT during winter, using coal would amount to approximately 300,000 KZT over the same period due to the need for multiple trips to buy coal and paying the stoker. Therefore, the

overall perception leans towards gas being a worthwhile investment for its convenience and lower price.

Sub-hypothesis C: residents can access low-interest loans and instalment payment plans

This sub-hypothesis is confirmed, as financial institutions such as Halyk Bank and Kaspi offer interest-free loans specifically for gas connections. For instance, Halyk Bank provides a payment plan for connecting gas to residential homes in Astana with several advantages:

- 0% interest rate;
- No collateral required;
- Up to 18 months for repayment.

Additionally, social support mechanisms exist for vulnerable populations in Kazakhstan, where the government offers assistance to cover installation costs for those whose average income does not exceed three times the living wage. This includes low-income families, large families, and pensioners, among others.

Respondents' perceptions of financial instruments for gas connections are marked by skepticism. While some respondents mentioned options like installment plans or interest-free loans, many expressed uncertainty about their accessibility. One household respondent remarked, "Honestly, I haven't heard about installments", while the other said, "It would be good if there were interest-free loans, I don't think they exist". This indicates a widespread sentiment of doubt regarding available financial options, highlighting the need for clearer communication and guidance from authorities and banks.

Other factors preventing gasification

Our hypothesis was that the primary obstacle to gasification were the high cost. This hypothesis was confirmed as the most significant barrier. However, our research revealed additional factors that contribute to the low gasification rates. Technical difficulties, such as incompatibility of current heating equipment with gas, were noted by 30.9% of households. Bureaucratic challenges, in the process of obtaining proper documentation were significant barriers as well. Interviews with households and Akimat and KazTransGaz representatives highlighted that some households struggle with incomplete documentation, complicating the gasification even more. Additionally, a lack of

information about gasification was a major factor, influencing 25% of households, combined with concerns over the availability of gas in the region.

This indicates that not all obstacles to gasification are within the households' control, as ineffective government information campaigns and the lack of subsidies also play crucial roles in hindering the gasification process. Therefore, while financial constraints are a major factor, the responsibility for low connection rates is shared by both households and the government.

Hypothesis 2: the residents are aware about the gasification program

Based on our literature review, we hypothesized that low connection rates might be due to lack of awareness about gasification policies. Consequently, we designed survey and interview questions to assess how informed the residents are about the gasification policies.

Working hypothesis 2 is crucial as it directly addresses our Research Question 2: "How do government policies shape the gasification rates in Astana?". By exploring the residents' awareness and understanding of the gasification program, we aim to uncover potential gaps in communication that may be affecting the transition rates. Our sub-hypotheses explore information on connection costs, fuel prices, and government subsidies.

Sub-hypothesis A: Information on the cost of connection is clearly provided and easily accessible

According to the information provided by media an average cost for all expenses, including costs for supply companies service, construction, installation work, and gas equipment is 884,914 KZT (Table 1). Moreover, as there is a requirement that gas supply companies should have a license, there is a risk that these organizations that work directly with families, may turn out to be scammers or unauthorized entities.

Type of service or designation	Price in KZT
Executive documentation	25,000
Project development for gasification	30,000

Gas pipeline laying - 30 meters	130,000
Installation of gas valves - 3 pieces	30,480
Installation of gas analyzer CH ₄ +CO - 1 piece	24,990
Installation of CO gas analyzer - 1 piece	11,340
Installation of supports - 1 piece	18,000
Installation of gas meter - 1 piece	13,350
Boiler installation	31,800
Chimney hole	22,300
Chimney installation	5,900
Boiler equipment with materials: valves, filters, pipes, etc.	119,700
Ventilation hole and installation	22,000
Gas boiler of South Korean production	350,000
Coaxial chimney - 1 piece	23,000
Flexible gas hose - 2 pieces	8,400
Commissioning works by KazTransGaz Aimak JSC	18,654
Total	884,914

Figure 16. Cost estimate (Abilmazhitova, 2023)

As expenses pose obstacles to the implementation of gasification there are minor help campaigns from local banks. An example is the “100 Good Deeds” campaign, dedicated to the 100th anniversary of Halyk Bank. In total, in 2023, it was planned to use the bank’s funds to fully finance the connection to gas of about 230 residential buildings of low-income families in Almaty and Astana.

As it is shown in Figure 13, there is a disconnect between the availability of information as claimed by the authorities and the residents’ perception of its accessibility. Despite

assurances from the Akimat and KazTransGaz that the information is readily available online, many residents feel it is insufficient.

Several interviewees shared experiences that highlight this gap. Two respondents only learned about their neighbourhood's connection to gas when they observed construction work outside their homes. Additionally, the information on connection costs often came from gas companies, which, as for-profit entities, may not always provide the most transparent details. This situation indicates a need for the government to take a more proactive role in disseminating accurate and detailed information before the connection process starts. Consequently, residents could prepare financially and logistically, ensuring a smoother transition to gas heating.

One notable concern raised was the spread of misinformation, such as a rumour in a neighbours' WhatsApp group about fines for not connecting to gas. This underscores the importance of clear and authoritative communication from the government to prevent the spread of misinformation.

Sub-hypothesis B: information on cost of fuel is clearly communicated

Figure 14 shows that only 18.9% of respondents found the information on gas prices accessible, while majority think otherwise. This indicates that a significant portion of residents may not be receiving clear and comprehensive information about gas prices.

Interview data further underscore this point. While all interviewees who switched from coal to gas appreciated the convenience of gas heating, they also emphasized its cost-effectiveness. For instance, Respondent 5 highlighted the financial savings, reporting a decrease in winter heating costs from approximately 300,000 KZT with coal to about 200,000 KZT with gas. Similarly, Respondent 6 mentioned that even during a harsh winter month, their highest gas bill was only 18,000 KZT, which represents substantial savings.

Despite these positive experiences, the lack of clear and detailed information on the cost constrains more connections to gas. Neither of the interviewees was aware of how the gas price is formed for Astana residents and how heavily the gas price is subsidized. Some interviewees indicated that awareness of such information if it had been available would have affected their decision to connect to gas.

Sub-hypothesis C: Information on government subsidies and support for gasification is clearly communicated and effectively influences households' decisions

The analysis of survey and interview data highlights significant gaps in awareness and communication regarding government subsidies and financial support for gasification, which influences households' decisions about adopting gas heating. Despite government efforts to promote gasification, our survey reveals that majority are unaware. Among those partially aware of government policies, a small proportion reported significant impact.

These findings indicate that the current communication strategies regarding government subsidies and support for gasification are insufficient. A significant portion of the population remains unaware of the available financial incentives, which diminishes the effectiveness of these policies. Enhancing public awareness and ensuring that the information about subsidies is clearly communicated could improve the transition rates.

Hypothesis 3: The residents are carbon literate

Discussions with the stakeholders helped us to state that the level of carbon literacy is an important factor to consider when studying gasification. Representatives of the Akimat of Astana were vocal about the lack of “carbon literacy” among the population. This ignorance of the environmental and health benefits of gas was said to hinder the overall process of coal-to-gas conversion. At the same time, we have not been able to find any research on the topic of carbon literacy programs in Kazakhstan. Therefore, we decided to conduct analysis of data on the topic of carbon literacy levels of the residents of Astana.

Sub-hypothesis A: The residents are exposed to carbon literacy programs

Initially, we hypothesized that the government tried to connect environmental and health issues into the discussion about gasification to persuade people to switch to gas. This approach is indicated as a good practice in our literature review. Moreover, the government lamented the lack of carbon literacy, saying that people did not know what is best for them.

Our findings, however, revealed that many people are aware that burning coal is detrimental to health and the environment. For example, in response to the survey question, “Do you think burning coal is detrimental for the health of Astana residents?”,

96.8% answered positively. This clearly shows that people are aware of the detriments of burning coal.

Furthermore, for the importance of health and environmental indicator for their decisions more than half of respondents said it was very important. This indicates that citizens have an environmental and health perspective in mind when considering switching to gas.

Nonetheless, despite this awareness, none of the respondents reported that the Akimat had communicated with them about environmental issues. This suggests that the Akimat is missing an opportunity to leverage this common understanding to convince people to switch to gas.

Conclusions from the discussion

This study has effectively addressed the research questions regarding the dynamics of citizen transition from coal to gas in Astana.

Regarding the Research Question 1, we confirmed that while high connection costs are regarded as the primary obstacle to gasification, additional factors also play a significant role. There are technical limitations of the existing heating equipment, bureaucratic barriers in receiving necessary permits, and a lack of information about gasification policies, that contribute to the low gasification rates.

Regarding the Research Question 2, our findings indicate that many residents are unaware of the gasification program, connection costs, and available subsidies, which affects their decision-making.

Overall, our study highlights the need for improved communication strategies and increased public awareness regarding the benefits of gasification and available financial support. These insights can help policymakers refine their approaches to enhance gasification rates in Astana, ultimately contribute to accelerate the switching from coal to gas process.

Recommendations

Based on these findings, our team has come up with the following recommendations:

Increasing awareness campaigns

It is necessary to implement comprehensive information campaigns to educate households on the benefits of gasification and the steps involved in switching to gas.

According to the findings from the survey and interviews, most of the residents are not aware of any gasification information campaigns conducted by the government. Respondents to the interviews indicated that they were never contacted by anyone from the Akimat learned about the gasification of their neighborhood through informal channels such as talking to neighbors and construction workers. Because they were informed about the gasification late, some respondents report not being financially ready for it. However, the Akimat maintains that they conduct meetings with citizens to discuss gasification. This clash highlights a gap between the Akimat's actions and citizens' perceptions of these actions.

To bridge this gap, it is important to create information campaigns with measurable inputs, outputs, key performance indicators (KPIs), and outcomes. Currently, there is no publicly available plan for communication with citizens on the topic of gasification, preventing assessment of the Akimat's actions. A comprehensive program implementation evaluation of the information campaign on gasification is needed. This program should be designed to ensure that the information is effectively disseminated and should include mechanisms for regular assessment based on data. By establishing clear and transparent communication strategy, the Akimat can enhance public awareness, trust, and participation in the gasification program.

Our team came up with a draft Logic Model for information campaign on gasification, which can serve as a foundation for developing a similar tool for the Akimat.

Inputs	Activities	Outputs	Short-term Outcomes	Long-term outcomes
Funding for campaign materials	Develop multi-channel campaigns targeting the neighborhoods about gasification process start	Number of multi-channel campaigns developed	Increased awareness of gasification benefits and procedures	Enhanced public trust and cooperation with the Akimat

Human resources (campaign planners, employees, volunteers)	Conduct targeted outreach through local mass media, and community events	Number of outreach events conducted	Improved understanding of the steps and documentation required	Increased Adoption of Gas Heating
Collaboration with local media and community leaders	Create informative brochures on the steps for switching to gas, the documentation required, and the potential benefits.	Number of households reached through campaigns		
	Utilize local influencers and community leaders	Number of local influencers and community leaders engaged		
	Organize door-to-door campaigns with trained volunteers			

Inputs		
What	Value	Comments
Budget for campaign	50,000 USD	Including materials, outreach, and staff
Staff (communications specialists)	5 FTE	Full-time equivalents

Volunteer support	50 volunteers	For door-to-door campaigns and community events
Materials (brochures)	10,000 units	Design and printing costs
Digital platforms	Various	Web-site, social media, email, WhatsApp, SMS newsletters

Activities		
What	Intended outcome	How is it measured?
Develop Multi-channel Campaigns	Increase in awareness about gasification	Number of campaigns conducted
Door-to-door Information Dissemination	Improved understanding of gas benefits	Number of households reached
Create and Distribute Informative Brochures	Clear knowledge of gasification steps	Number of brochures distributed
Utilize local influencers and community leaders to disseminate information	Increase in awareness about gasification	Number of influencers engaged
Outreach through digital platforms	Increase in awareness about gasification	Number of visitors of the web-site, number of posts in social media, number of email, WhatsApp, SMS newsletters

Outputs	
What	Value
Number of Campaigns Conducted	20
Number of Households Reached (Door-to-door)	5,000
Number of Brochures Distributed	10,000
Number of Community Events Held	10

Number of Digital Engagements (Website Hits, Social Media Interactions)	50,000
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Short-term outcomes		
What	Value	Comments
Increased Awareness about Gasification	70%	Percentage of population aware of gasification
Improved Understanding of Gas Benefits	60%	Percentage of population understanding benefits

Long-term outcomes		
What	Value	Comments
Increased Adoption of Gas Heating	30%	Increase in households using gas heating
Enhanced Public Trust in Akimat's Initiatives	20%	Increase in public trust in local government

Figure 17. Logic Model for the information campaign on gasification

To summarize, the Akimat ought to improve its current information campaigns to educate households on the benefits and procedures of gasification, as well as financing options and potential disadvantages of gasification. Despite current efforts, many residents remain uninformed, often learning about gasification through informal channels, leading to financial unpreparedness. Effective, transparent communication is crucial particularly for upcoming gas connections in new districts, to ensure residents are well-prepared and the transition is smooth. By applying lessons learned and addressing past issues, the Akimat can ensure increased gasification rates.

Introducing a streamlined payment method

To enhance the gasification process, it is crucial to introduce a system that consolidates all services related to gas installation under one provider, simplifying the payment structure for citizens. Our research findings suggest that a significant impediment to connecting to the gas network is the high upfront cost. This barrier was clearly indicated in both the survey and the interviews conducted with the households.

Currently, the process is fragmented, involving multiple stakeholders, which can lead to higher overall costs and confusion. By implementing a model like telecom companies providing equipment with monthly payments, we can alleviate the financial burden on households and simplify the process.

Proposed actions:

- 1. Unified service offering.** Establish partnerships with private gas companies to offer a unified service that handles all aspects of gasification in one window, ensuring that citizens can complete the process seamlessly.
- 2. Financing structure.** Introduce a financing structure where the installation cost is divided into manageable monthly payments, included into the monthly heating bills. This approach allows for interest-free installment payments for citizens, reducing the upfront financial burden.
- 3. Regulatory framework.** Create a regulatory framework to facilitate this public-private partnership (PPP) model, ensuring that gas companies, banks, and the government collaborate effectively.
- 4. Promotion of financing options.** Launch targeted programs promoting interest-free loans or subsidized installation costs for low-income households.

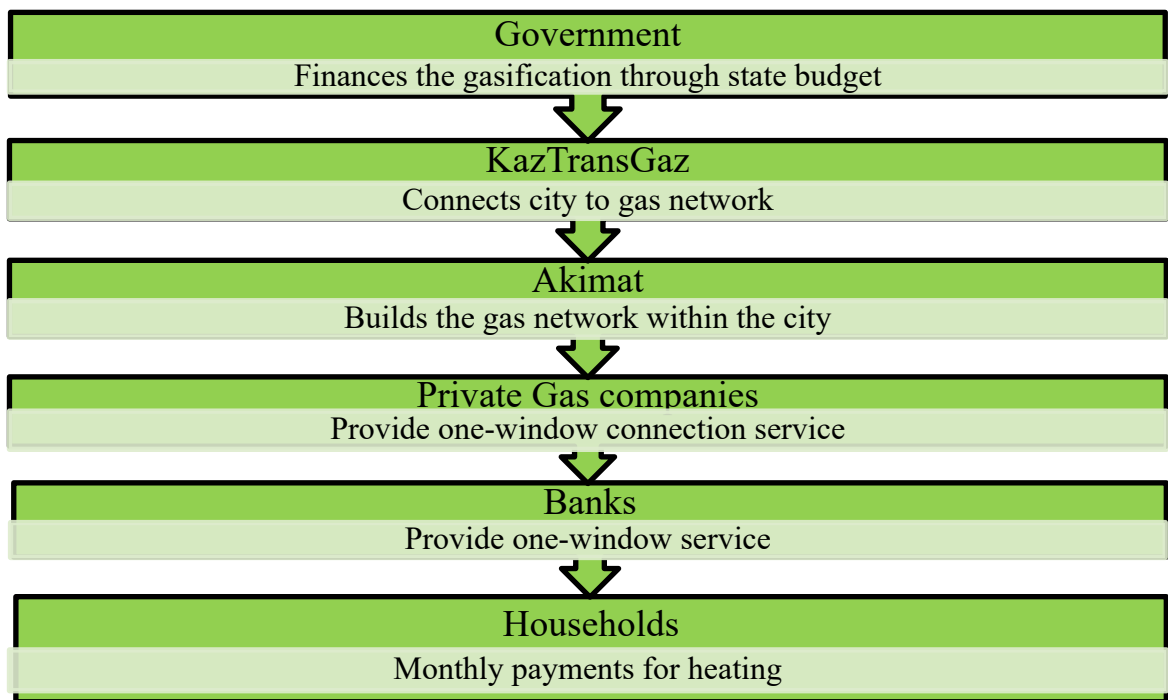


Figure 18. Proposed concession model

The proposed model falls under the Concession type of a PPP, where private companies are responsible for the delivery of public services (gas installation) and are reimbursed through user payments (monthly installments for gas services). Involving the government as a guarantor and creating a regulatory framework by the government ensure the financial sustainability and accessibility of the service for citizens.

Similar to the decision of renting versus buying an Internet router, the gasification process can be made more affordable and accessible by spreading out the cost over time. A streamlined payment method for gas installation spreads out the financial burden, making it manageable for more households.

Additionally, a single-window service simplifies the entire process, reducing confusion and ensuring a smoother transition to gas. This combination of affordability, increased participation, and convenience can significantly enhance the effectiveness of the gasification program.

The reality confirms the validity of this recommendation, as evidenced by developments during the second half of 2024. As we already mentioned, number of gas connection companies have already started cooperation with banks (Halyk Bank, Kaspi) to provide interest free loans. This trend demonstrates that the recommendation is both practical and feasible and should be seriously considered by the government. Despite these initiatives

by individual companies, the entire process could be more effectively streamlined through government intervention. Currently, there are still market failures, as not all citizens can access these loans. However, if the government acted as a guarantor before the banks, the process could be expedited, ensuring broader accessibility. Households will pay for heating in any event, so slightly increasing the monthly bill to cover gas installation costs would not be a significant burden. Since most heating payments are now made through banking applications, involving banks in this process is logical and would simplify the transition for households.

Quality infrastructure development

Gas infrastructure in many neighborhoods is a significant barrier to household connections. The Akimat has confirmed that numerous citizens are still waiting for their areas to be connected to the gas network. Although only a few districts remain without access to gas, the process must be expedited, particularly concerning the quality of the existing infrastructure. Early adopters of our interviewees noted that during the initial phase of connections, they encountered issues such as water condensation in gas pipes and inconsistent temperatures, demonstrating a first-mover disadvantage due to low connection rates.

To address these challenges, we recommend implementing awareness campaigns and streamlined payment options to mitigate the issues of limited awareness and high upfront costs. Consequently, the number of initial connections will increase, thus negating the first-mover disadvantage.

Furthermore, the government must ensure the sufficiency of gas and reliability of gas infrastructure, as several interviewees reported instances of gas being turned off for three days due to repairs. This underlines the need for high-quality construction to prevent such disruptions. If households that transitioned from coal to gas face prolonged heating outages, they may regret their decision and consider reverting to coal heating, especially if they still have their coal equipment. To prevent this, the government should ensure that citizens who have embraced gasification do not have cause for regret.

Additionally, the official stakeholders should advise residents to keep their coal heating equipment as a contingency plan in case gas becomes unavailable. Kazakhstan heavily subsidizes its domestic natural gas, with local prices at roughly one-third of the export

price. This subsidy ensures affordable energy for residents but reflects a significant reduction in potential state revenue compared to market rates.

Conclusions

Our study analyzed two key issues on gasification in Astana: obstacles of households of switching from coal to gas and how government policies affect. Through a mixed-method approach, we revealed that gas energy is preferred most due to its cost benefits, convenience, ecological advantages. Eventually, there are significant obstacles that cause slow transition, which are financial issues, technical hurdles, bureaucratic obstacles, and insufficient gas supply, especially lower-income families.

Key findings of the research are the lack of public awareness of gasification program, prices and available subsidies. The findings highlight gaps in public awareness of gasification programs, fees, and subsidies, inflamed due to weak communication between government and citizens. Therefore, smoother transition demands collaborative action from both government and households.

The study's conclusion emphasizes the need for inclusive policies that take address people-centered strategy by recognizing various socioeconomic contexts and encourages fair access to greener energy sources, specifically in full gasification goal of Astana.

Limitations to the research

This study has a number of constraints that could affect how reliable and generalizable the results are.

Firstly, although the sample size is adequate for gaining initial understanding, it might not accurately reflect the range of viewpoints held by all Astana families. Additionally, because participants may overstate their knowledge of the gasification program or underreport their difficulties, the use of self-reported data from surveys might be biased. Despite their value, the qualitative interviews could also represent individualized experiences that are not generally relevant.

Additionally, the study's brief duration makes it difficult to evaluate long-term patterns in gasification rates and households' coal-to-gas migrations. The emphasis on certain

neighbourhoods may obscure the differences in experiences among Astana's various socioeconomic groups.

Furthermore, as the gasification program develops, the dynamic character of governmental regulations and financial incentives may make certain conclusions obsolete. Finally, the study's findings may have been impacted by the failure to account for external factors like changes in energy prices and general economic conditions.

These restrictions imply that more investigation is required to examine the intricacies of gasification in Astana and to confirm results among a larger and more varied population.

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Interview protocol: Exploring perspectives on gasification initiatives in Astana

Interview of stakeholders: KazTransGaz Aimak, Akimats of Astana's districts, private gas service companies

Introduction:

Hello, thank you for agreeing to participate in this interview. The purpose of this interview is to gather insights into the perspectives, challenges, and experiences related to the transition from coal to gas for heating purposes in Astana, specifically from the standpoint of stakeholders involved in gasification initiatives. The interview will take approximately 20-30 minutes. Please remember that you are free to withdraw from this interview at any moment in time without any consequences for you.

Interview details:

Date:

Interviewer:

Stakeholder's name and position:

Confidentiality:

Your responsibilities will remain confidential and will be used solely for research purposes. Any identifiable information will not be disclosed without your explicit consent.

Data collection:

I will be taking hand-written notes during interview.

Interview questions:

1. Can you provide an overview of your organization's involvement in gasification initiatives in Astana?

Follow-up question: What specific roles or responsibilities does your organizations have in promoting the transition to natural gas?

2. What challenges or obstacles has your organization encountered in implementing gasification projects in Astana?

Follow-up question: How have these challenges affected the progress of effectiveness of the initiatives?

3. How would you describe the level of collaboration and coordination between your organization and governmental bodies in facilitating the transition to natural gas?

Follow-up question: Are there areas where you believe improved collaboration could enhance the success of gasification efforts?

4. What are the key factors contributing to the success or limitations of gasification initiatives in Astana, from your organization's perspective?

Follow-up question: Are there any particular policies, regulations, or external factors that have significantly impacted these initiatives?

5. In your opinion, what strategies or measures could be adopted to address the challenges and promote a more effective transition to natural gas for heating purposes in Astana?

Follow-up question: Do you have any recommendations for enhancing the outcomes of gasification projects?

6. How do you foresee the future of gasification initiatives in Astana, and what potential improvements or changes do you anticipate in this field?

Follow-up question: Are there any emerging technologies or approaches that could revolutionize the gasification process?

Closing remarks:

Thank you for your valuable insights, time and openness in discussing the various aspects of gasification projects in Astana. Your input will significantly

contribute to understanding the perspectives and challenges faced by stakeholders in the gasification initiatives in Astana.

Interview protocol: Exploring household perspectives on the transition to natural gas in Astana

Interview of individual householders

Introduction:

Hello, thank you for agreeing to participate in this interview. The purpose of this interview is to gather insights into your household's perceptions, challenges, and considerations regarding the transition from coal to natural gas for heating purposes in Astana. The interview will take approximately 20-30 minutes. Please remember that you are free to withdraw from this interview at any moment in time without any consequences for you.

Interview details:

Date:

Interviewer:

Respondent's Name:

Location:

Confidentiality:

Your identity will remain confidential and will be used solely for research purposes. Your identity and personal information will not be disclosed without your explicit consent.

Data collection:

I will be taking hand-written notes during interview.

Interview questions:

1. Could you briefly describe the current heating method used in your household during the winter season?

Follow-up question: What factors influenced your decision to use this particularly method?

2. Are you familiar with the government's efforts to promote natural gas as a cleaner alternative to coal for heating in Astana?

Follow-up question: How do you perceive these initiatives, if at all?

3. What challenges, of any, do you face in considering a transition from coal to natural gas for heating purposes?

Follow-up question: Can you elaborate on any specific concerns or obstacles hindering this transition?

4. In your opinion, what advantages do you foresee in switching from coal to natural gas for heating your household?

Follow-up question: Are there any potential disadvantages or drawbacks you anticipate in making this switch?

5. How do you believe the transition to natural gas could be made more accessible or beneficial for households in Astana?

Follow-up question: Do you have any suggestions or recommendations to improve the transition process?

6. What additional information or support would you require to consider transitioning to natural gas for heating purposes?

Follow-up question: Are there specific resources or assistance that you feel would be beneficial for households like yours?

Closing remarks:

Thank you for your valuable insights, time and openness in discussing the various aspects of gasification projects in Astana. Your input will significantly contribute to understanding the perspectives and challenges faced by stakeholders in the gasification initiatives in Astana.

Draft survey questions to be addressed to individual households of Astana

Section 1: Understanding household heating sources

1. What is the primary source of heating for your household during the winter months?
 - Coal
 - Gas
 - Other (please specify)
2. Have you ever considered transitioning from coal to gas as your primary heating source?
 - Yes
 - No
 - Not sure
3. If you haven't transitioned to gas, what are the main reasons for not doing so?
(Select all that apply)
 - Cost of transitioning equipment
 - Lack of information about the benefits of gas heating
 - Concerns about gas availability in the area
 - Lack of government incentives or subsidies
 - Other (please specify)
4. Are you aware of any governmental policies or initiatives aimed at promoting the use of gas as a heating source in Astana?
 - Yes
 - No
 - Partially
5. If yes, have these government policies influenced your decision or willingness to transition from coal to gas?

- Significantly influenced
- Somewhat influenced
- Not influenced at all

Section 2: Government policies and gasification rates

1. How would you rate the accessibility of information about government policies promoting gasification in Astana?
 - Very accessible
 - Moderately accessible
 - Not accessible
2. Have you received any financial incentives or support from the government to switch to gas heating?
 - Yes
 - No
 - Not sure
3. Do you believe the current government policies are effective in encouraging households to switch from coal to gas for heating purposes?
 - Very effective
 - Somewhat effective
 - Not effective at all
4. What improvements or additional measures do you think the government could implement to increase the adoption of gas heating in households?

Section 3: Household preferences and concerns

1. In your opinion, what are the main advantages of using gas as a heating source compared to coal? (Select all that apply)
 - Cleaner emissions
 - Higher efficiency
 - Convenience in usage
 - Cost-effectiveness

- Lower maintenance requirements
 - Other (please specify)
2. What are the major challenges or concerns you foresee in transitioning from coal to gas for heating system? (Select all that apply)
- Higher initial costs for connecting
 - Lack of gas infrastructure
 - Reliability or availability concerns with gas supply
 - Lack of information or awareness about gas benefits
 - Environmental concerns related to gas usage
 - Cultural or traditional attachment to coal
 - Technical compatibility issues with existing systems
 - Other (please specify)
3. Would you be more inclined to switch to gas heating if there were further incentives or support from the government?
- Yes
 - No
 - Maybe
4. What type of incentives or support from the government would most influence your decision to switch to gas heating?
- Financial subsidies
 - Tax benefits
 - Equipment installation
 - Other (please specify)
5. How much of financial incentive do you think would make a significant impact on your willingness to transition to gas heating?
- 500 USD
 - 600 USD
 - 1000 USD
 - 2000 USD
 - 4000 USD

- Other (please specify)
6. How important is environmental impact in your decision-making process regarding the choice of heating source for your household?
- Very important
 - Somewhat important
 - Not important

Section 4: Demographic information

1. What is the size of your family?
 - 1-2 members
 - 3-4 members
 - 5 or more members
2. What is the approximate annual income range of your household?
 - Below average
 - Average
 - Above average
3. What is the approximate age range of the primary income earner in your household?
 - 18-30 years
 - 31-45 years
 - 46-50 years
 - Over 60 years
4. What is the highest level of education completed by the primary income earner in your household?
 - Primary education
 - Secondary education
 - Bachelor's degree
 - Master's degree

- Other (please specify)

5. What is the primary source of income for your household?

- Employment/Salary
- Business/ Entrepreneurship
- Investments/Assets
- Government assistance
- Other (please specify)

AI Tool used	Prompt used	Brief account of the outcome of the AI prompt used
ChatGPT	Can you check my grammar in the next sentences	The AI suggested minor corrections to the grammar in the sentences where it was requested
ChatGPT	Can you check the spelling of words in the next sentence	The AI suggested correct spelling of words in the sentences where it was requested