GAZBİR-GAZMER

NATURAL GAS DISTRIBUTION ACTIVITIES AFTER THE EARTHQUAKES ON FEBRUARY 6, 2023

GAZBİR-GAZMER R&D COMMISSION

MAY 2024

GAZBİR-GAZMER R&D COMMISSION

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ACKNOWLEDGMENTS

We would like to express our gratitude to the officials of the Ministry of Energy and Natural Resources, Energy Market Regulatory Authority, GAZBİR, GAZBİR-GAZMER, Natural Gas Distribution Companies who contributed to the preparation of this report.

We wish God's mercy to all the citizens who lost their lives in the earthquake disaster that occurred on February 6, 2023 and affected 11 provinces, and wish our country a speedy recovery.

10 YEARS OF WORK IN 10 DAYS !

First 48 hours;

- Sufficient fuel for rescue operations, logistics and critical uses started to be delivered to the region.
- Fuel needs were met with generators for hospitals, nursing homes for the elderly and other critical points, while LNG and CNG tankers were delivered to the region as alternative fuel for places using natural gas.
- Major damages to natural gas transmission lines, especially under heavy snow and at high altitudes, were repaired, preventing a shortage in natural gas supply.
- More than 10,000 technical teams and sufficient equipment from the energy sector were dispatched to the region.

Within 10 days;

- In electricity and natural gas distribution, in harmony and coordination with the coordination centers established by AFAD in the region, the inventory of destroyed buildings and regions and heavily damaged areas was taken immediately and energy supply in other areas was maintained.
- Among the provinces of Kahramanmaraş, Gaziantep and Hatay, where natural gas supply was completely stopped as a precautionary measure, natural gas supply was started to be provided to residences in Gaziantep, where the rate of destruction was less. 335,000 houses were visited one by one and natural gas was made ready for use through security checks. This process was completed within 10 days.

10 YEARS OF WORK IN 10 DAYS !













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1. SUMMARY

On February 6, 2023, Turkey was shaken by the 7.7 and 7.6 magnitude earthquakes centered in Kahramanmaraş and affecting 11 provinces. 14 million citizens in an area of 120 thousand square kilometers were directly affected, while 53 thousand 537 people lost their lives. Due to the earthquake, Turkey issued a level 4 alert, including international assistance, and national mourning was declared for 7 days across the country. As of March 6, 2023, as a result of the damage assessment of 1 million 712 thousand 182 buildings, 35 thousand 355 buildings were demolished, 17 thousand 491 buildings were decided to be demolished urgently, 179 thousand 786 buildings were heavily damaged, 40 thousand 228 buildings were moderately damaged and 431 thousand 421 buildings were slightly damaged.

Figure 1: Earthquake zone

While explosions and malfunctions occurred at 20 different points on natural gas transmission lines belonging to the Pipelines and Petroleum Transportation Corporation (BOTAŞ), natural gas distribution lines and facilities in the region were also damaged.

The direct damage caused by the earthquake disaster in the energy sector was estimated at 600 million dollars. According to the calculations made in the preliminary examinations made after the earthquake, TEİAŞ incurred 717 million TL (38 million dollars), privately owned electricity distribution facilities 7.867 million TL (416.7 million dollars), 517.5 million TL (27.4 million dollars) in electricity generation facilities owned by EÜAŞ, 52.5 million TL (2.8 million dollars) in electricity generation facilities owned by the private sector, and 355 million TL (18.8 million dollars), 180.5 million TL (9.6 million dollars) in natural gas transmission lines and facilities, and 646.4 million TL (34.2 million dollars) in natural gas distribution lines. The total damage to the energy sector during the earthquake amounted to TL 11,243.4 million (USD 595.5 million), of which TL 2.3 billion (USD 123 million) was incurred by public sector companies and TL 8.9 billion (USD 472.5 million) by private sector companies.

This report describes the situation before and after the earthquake in the region affected by the February 6 earthquake. The activities during and after the earthquake, the activities of the distribution companies, the emergency action procedure and the board decisions taken after the earthquake are explained. Graphs and tables clearly show the effects of the earthquake.

2. EARTHQUAKE STUDIES

2.1. Situation in the Region Before the Earthquake

The eight natural gas distribution companies operating in the region started their investments in 2005 in the cities of Malatya (Aksa Malatya) and Kahramanmaraş (Arsan Armadaş). In 2008, Aksa Çukurova (Aksa Natural Gas) obtained its license in the Çukurova region, which covers the cities of Adana, Mersin, Osmaniye and Hatay, and the tender process for the region was completed. Gazdaş, Diyargaz, Aksa Elâzığ and Akmercan Adıyaman received natural gas distribution licenses from EMRA in 2006 and 2007, respectively. As a result of these investments, natural gas was being used in 87 settlements in a total area of 2,600 km2 and 67 of these settlements were supplied with piped gas while the remaining 20 were supplied with LNG/CNG. Figure 2 shows the gas distribution companies operating in the earthquake zone.

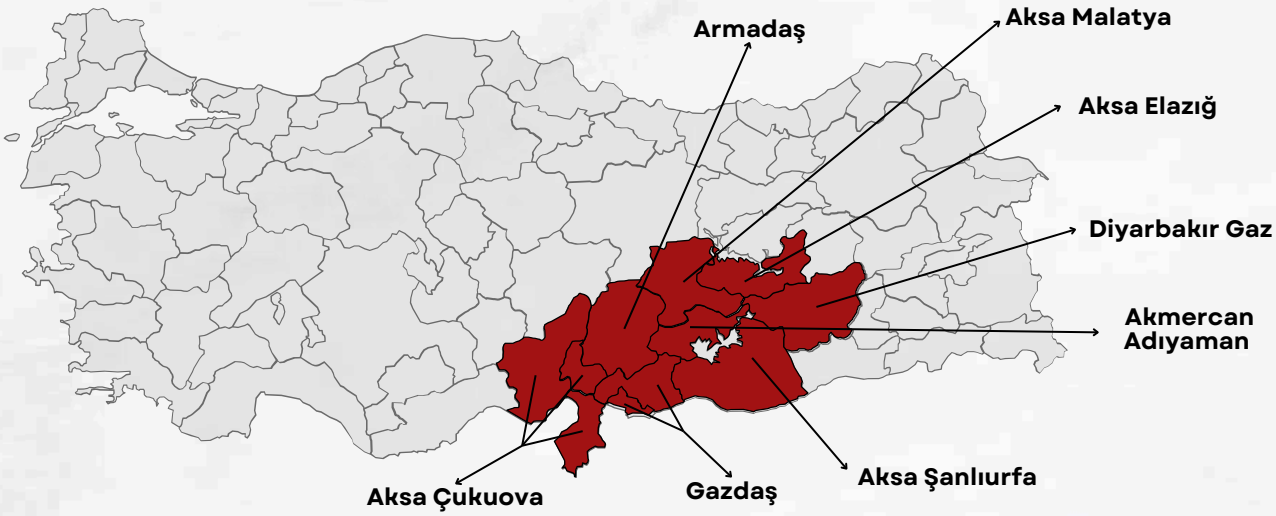

Figure 2: Gas distribution companies operating in the earthquake zone

Before the earthquake, natural gas distribution companies in the region served consumers at 59 subscriber centers, and all these subscriber centers were also used as emergency response locations. Table 1 shows the number of subscriber centers and emergency response locations by natural gas distribution companies.

Table 1: Number of subscriber centers and emergency response locations by province

Natural Gas Distribution Companies	Number of Subscriber Centers	Number of Emergency Response Locations
Akmercan Adıyaman	4	4
Arsan Armadaş	8	8
Aksa Çukurova	16	16
Aksa Elazığ	6	6
Aksa Malatya	5	4
Aksa Şanlıurfa	5	5
Diyargaz	5	7
Gazdaş	10	9
Total	**59**	**59**

While 8 natural gas distribution companies served consumers in 11 provinces with 2,023 personnel, 38% of these personnel were technical services personnel responsible for maintenance-repair, emergency response, internal installation and construction-project works. Table 2 shows the number of personnel. All these personnel were working in accordance with our emergency action plans at specified periods of the year.

Table 2: Number of personnel of natural gas distribution companies

Natural Gas Distribution Companies	Technical Services Staff	Total Personnel
Akmercan Adıyaman	45	115
Arsan Armadaş	86	228
Aksa Çukurova	263	699
Aksa Elazığ	49	155
Aksa Malatya	58	178
Aksa Şanlıurfa	73	189
Diyargaz	72	189
Gazdaş	113	270
Total	**759**	**2023**

Before the earthquake, there were already 367,000 buildings using natural gas. The province with the highest number of buildings using natural gas was Gaziantep with 78,255 buildings, while in Kahramanmaraş, the epicenter of the earthquake, natural gas supply was provided to 48,484 buildings. Table 3 shows the number of buildings.

Table 3: Number of buildings by province

Provinces	Number of Buildings (units)
Adana	46.674
Adıyaman	38.576
Diyarbakır	33.673
Gaziantep	78.255
Hatay	32.879
Kahramanmaraş	48.484
Kilis	7.030
Malatya	38.707
Osmaniye	16.449
Şanlıurfa	25.620
Total	**366.347**

Of the 16.5 million citizens affected by the earthquake, 51% (6.9 million) were active natural gas users. Figure 3 shows the population using natural gas in the earthquake region. The natural gas distribution network length of the 11 earthquake-affected provinces is 21,649 kilometers, 12% of the total network length in Turkey. The network lengths of distribution companies are given in Figure 4.

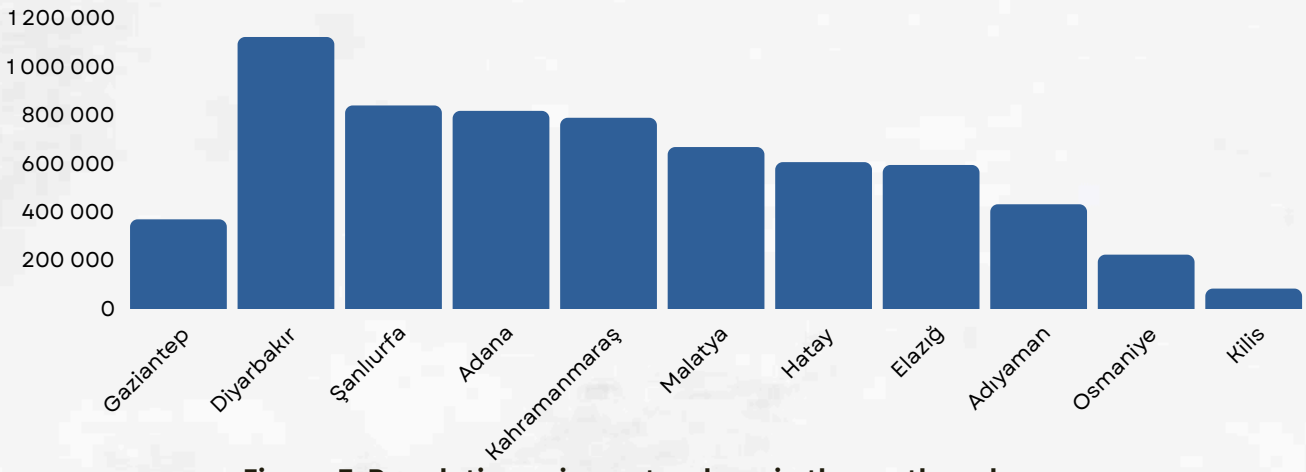

Figure 3: Population using natural gas in the earthquake zone.

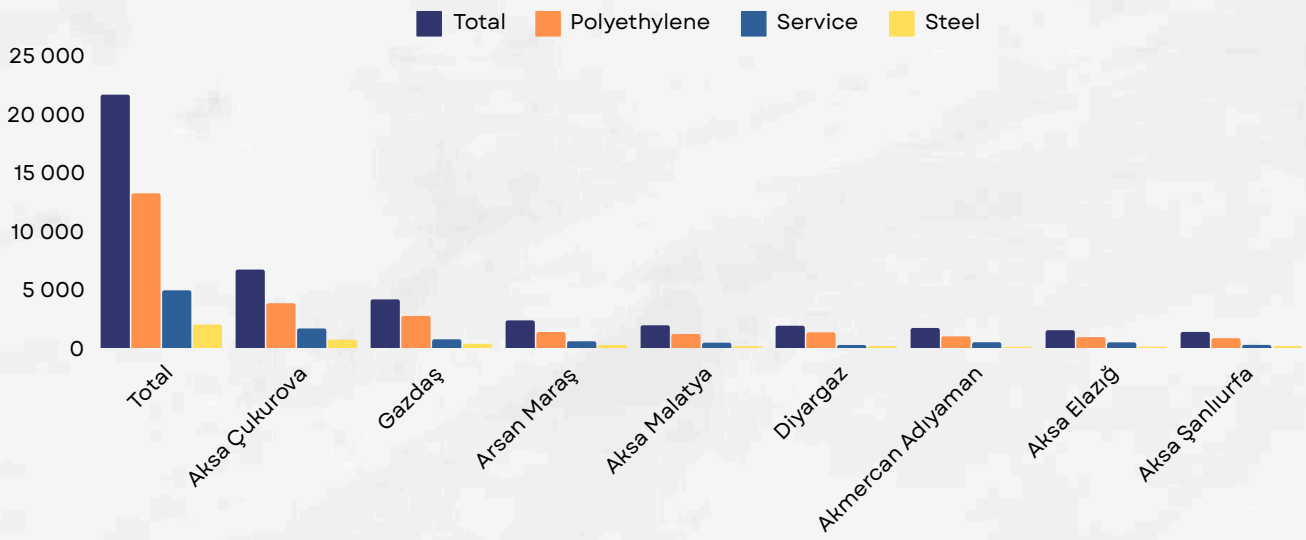

Figure 4: Network lengths of natural gas distribution companies (km)

Before the earthquake, 8 distribution companies were serving more than 2 million subscribers in the region. The number of subscribers in the region was about 10% of the total number of subscribers in Turkey. Approximately 2 million of these subscribers were residential subscribers and 40-50 thousand were eligible consumers. The city with the highest number of subscribers in the region was Gaziantep with 350 thousand subscribers, while the number of subscribers in Hatay, one of the cities where the earthquake caused the most damage, was around 170 thousand. Table 4 and Figure 5 show the number of residential and eligible consumer subscribers.

Table 4: Number of subscribers in natural gas distribution companies.

Natural Gas Distribution Companies	Number of Residential Subscribers	Number of Eligible Consumers	Total Number of Subscribers
Akmercan Adıyaman	105.299	3.521	110.820
Arsan Armadaş	209.940	4.916	214.856
Aksa Çukurova	548.797	5.216	554.013
Aksa Elazığ	154.585	6.937	161.522
Aksa Malatya	183.348	7.478	190.826
Aksa Şanlıurfa	149.314	2.664	151.978
Diyargaz	228.028	4.944	232.972
Gazdaş	391.020	8.374	399.394
Total	**1.972.331**	**44.050**	**2.016.381**

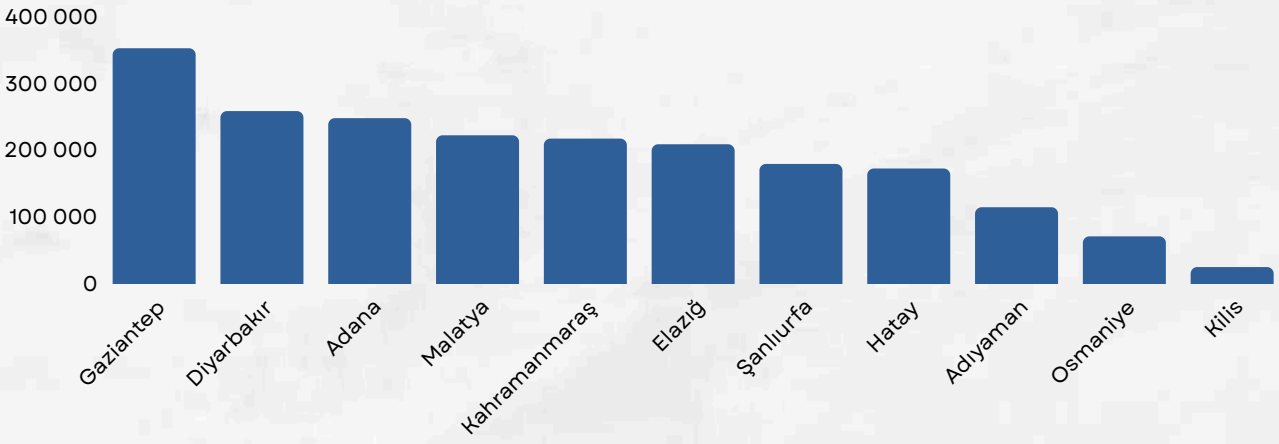

Figure 5: Number of subscribers by province (Residential + Eligible consumer)

Before the earthquake, the region's total natural gas demand was around 4.5 bcm. While about 8-9% of Turkey's total natural gas demand came from the 11 provinces in the region, the annual natural gas demand was over 1 bcm in Hatay, which has a dense industry and iron and steel sector. The natural gas consumption amounts of the 11 provinces in the earthquake region are given in Figure 6.

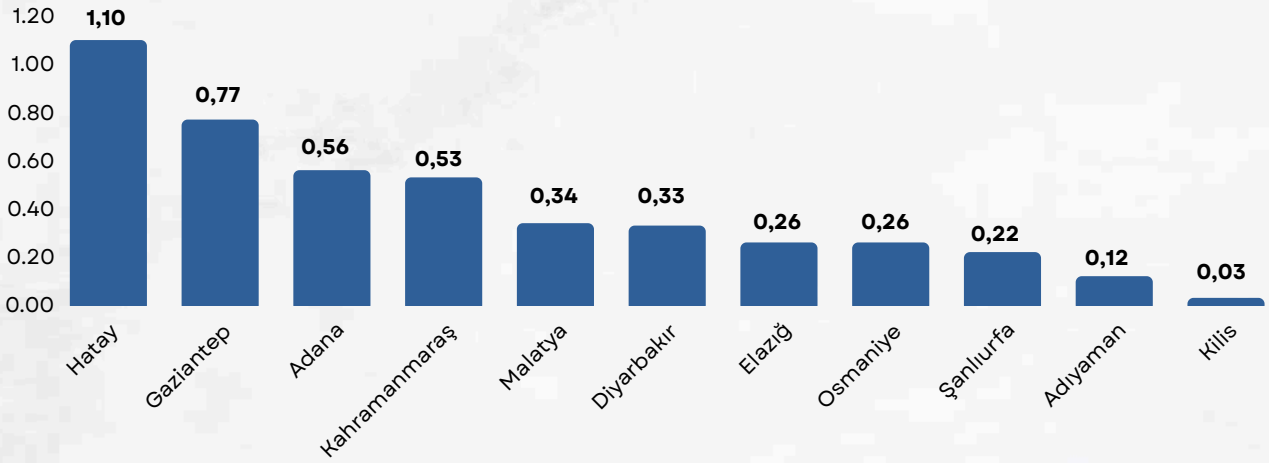

Figure 6: Natural gas consumption in the earthquake region (bcm)

2.1.1. Natural Gas Supply and Predictable Problems

Consumers in all 87 settlements in 11 provinces in the region were safely using natural gas in their homes and workplaces. Natural gas distribution companies were delivering natural gas to end consumers in 11 provinces with 60 city entry stations, 1,900 km of steel lines and 19 thousand km of polyethylene + service lines.

Thanks to young and modern network investments, there were no problems in natural gas supply in the region before the earthquake, except for some local problems. In only 1-2 of the 20 settlements supplied with CNG/LNG other than piped gas, natural gas supply was provided to a population of over 7.5 million using natural gas in the region, except for short-term disruptions due to geographical conditions, especially in winter.

In the recent period, there have been no interruptions caused by the distribution company, except for the interruptions due to third party damage to the network during the construction of a multi-level intersection in Mersin, and the inability of LNG/CNG tankers to enter the cities due to the closure of the Tarsus-Adana-Gaziantep (TAG) highway.

Prior to the earthquake, natural gas distribution companies were periodically evaluating potential hazards that would affect natural gas supply or the use of natural gas by end consumers. Considering the geographical conditions and geological structure of the region, studies were being conducted on the potential risks of disasters such as landslides and landslides, in addition to the fact that the earthquake zone had been dormant for a long time.

In 2019, all natural gas distribution companies in the surrounding provinces participated in the 7.5 magnitude earthquake drill centered in Kahramanmaraş Pazarcık under the coordination of AFAD, and the possible risks that may occur in the natural gas distribution network were evaluated both on a company basis and across the sector.

The main foreseeable problems were ruptures in the transmission and distribution network in the region, damage to steel and polyethylene lines. In addition, in the event of an earthquake, damages to the lines crossing over the fault line and the stations in the region being buried under debris were problems that could directly affect the supply of natural gas. In addition to all these, geological and geophysical analyses conducted in the region revealed that some cities and vital structures in the cities were located near or on the fault line in the region. In order to ensure uninterrupted natural gas supply to such critically located and important buildings in all disasters, especially earthquakes, various solutions such as CNG were within the plans of our distribution companies in the region.

In the aftermath of a disaster, disruption of service due to damage to customer service buildings or employees being affected by the earthquake, and damage to emergency and maintenance and repair vehicles due to earthquakes were factors that were expected to affect natural gas indirectly. Due to the urban planning in some settlements, the location of subscriber centers under buildings (under buildings located on the ground floor or under buildings located in the form of pocket entrances) were identified as potential risk points in case of a destructive earthquake.

It was foreseen that after the disaster, there might be difficulties in access to the network due to damage to maintenance-repair and emergency response vehicles at subscriber centers and various points of settlements, and therefore partial interruptions in natural gas supply might occur. This potential risk was planned to be eliminated in accordance with the cooperation protocol between natural gas distribution companies.

In addition, it is aimed that the personnel will be on duty quickly by determining the living points in order to meet the basic needs such as shelter and food after a possible disaster, especially the natural gas distribution personnel and their relatives and families. In this way, all personnel will be immediately organized to ensure uninterrupted natural gas supply by minimizing the post-disaster effects.

2.1.2. GAZBIR Emergency Plan

As GAZBIR, under the coordination of the Ministry of Energy and Natural Resources, possible disaster situations are evaluated through Emergency Crisis Management Center meetings involving all sector stakeholders. In this context, Disaster Cooperation Protocols have been signed between Natural Gas Distribution Companies and what the companies will do in the process before/during/after the disaster has been determined.

In this context, according to the protocol between natural gas distribution companies;

Depending on the emergency code of the disaster, especially the neighboring natural gas distribution companies within the scope of AFAD Plans, the companies with which protocols are signed will be deployed to the disaster area,
To carry out preparations at all levels against all disasters and emergencies,
Providing teams and equipment for the repair and uninterrupted service of the natural gas infrastructure in the disaster area has been determined as the primary duties of all natural gas distribution companies.

Technical operational processes included in disaster emergency action plans are the most important processes for potential disaster situations. There are 8 basic processes planned to be followed and realized. These processes are; line capping, emergency notification management, commissioning, maintenance and repair, pneumatic test and control, service box and building control, leakage screening and GIS processes. Bureaucratic processes and administrative works included in the action plans come into play in order for the technical operational processes to progress and be completed quickly. Provincial/district disaster coordination officers and bureaucratic and administrative affairs officers follow these processes.

It covered technical operational processes, bureaucratic processes and administrative affairs, reporting and analysis management, solution center management, material procurement and stock process for all possible disasters not only in the earthquake zone but also throughout the country. In this context, the inventories of Natural Gas Distribution Companies for disasters and emergencies were periodically shared with MENR.

Furthermore, within the scope of AYDES (Disaster Management and Decision Support), which is being conducted by AFAD, it is aimed to complete the training of the representatives of natural gas distribution companies and to ensure effective information sharing online in case of a possible disaster. In addition, e-mail and instant messaging groups including representatives of MENR, EMRA, EMRA, BOTAŞ and Natural Gas Distribution Companies have been established and it is planned to ensure communication through these channels in all pre/post-disaster situations as long as the telecommunication infrastructure is available.

As GAZBİR, meetings were held with AFAD Headquarters and Provincial Disaster Coordination Centers and studies were carried out to determine the possible effects of all disasters, especially earthquakes, within the scope of Turkey Disaster Response Plan (TAMP) and Provincial Disaster Risk Reduction Plan (IRAP), and to determine the activities to be carried out to minimize these effects, responsible persons and possible risks.


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2.2. Moment of Earthquake (First 24 Hours)

In the first hours of the earthquake, it was thought that natural gas supplies in 10 provinces might have been damaged, but as a result of damage assessment studies, it was realized that natural gas networks in 11 provinces were affected by the earthquake. In the first 24 hours following the earthquake, natural gas flow was stopped in many regions of 11 provinces in order to identify potential malfunctions and damages in natural gas lines as the earthquake could damage natural gas lines. After the earthquake, the number of active subscribers dropped from 2.2 million to less than 1 million.

In the first hours of the earthquake, around 50% of buildings and residences in 10 cities were not supplied with natural gas. Natural gas supply was suspended in almost all of Kahramanmaraş, Adıyaman, Hatay and Gaziantep (Table 5). Over 1 million subscribers in the earthquake region did not have access to natural gas immediately after the earthquake.

Table 5: Percentages of houses and buildings without gas supply in the first 24 hours of the earthquake.

Provinces	Building without Gas (%)	Housing without Gas (%)
Adana	0,2	0,8
Adıyaman	98,3	99,6
Diyarbakır	0,3	0,5
Gaziantep	99,6	99,7
Hatay	66,5	82,6
Kahramanmaraş	97,1	97,6
Kilis	0,1	0,1
Malatya	20,7	24,0
Osmaniye	9,1	11,2
Şanlıurfa	1,5	1,8
Total	**48,7**	**48,5**

Although the effects of the earthquake on a total of 50 buildings in a total of 20 settlements, including Adana Çukurova, Malatya Center, most of Şanlıurfa and Diyarbakır Center, were less than in other cities, partial interruption was applied to determine possible damages in the distribution network.

Natural gas supply was not provided to the regions/sectors determined as a result of the initial determination of the teams in the field against the possibility that collapsed buildings or collapsing structures could break or break natural gas lines. Due to these interruptions, half of the 450 thousand buildings in the region could not be supplied with natural gas. Figure 7 shows the status of natural gas supply to the region before and after the earthquake.

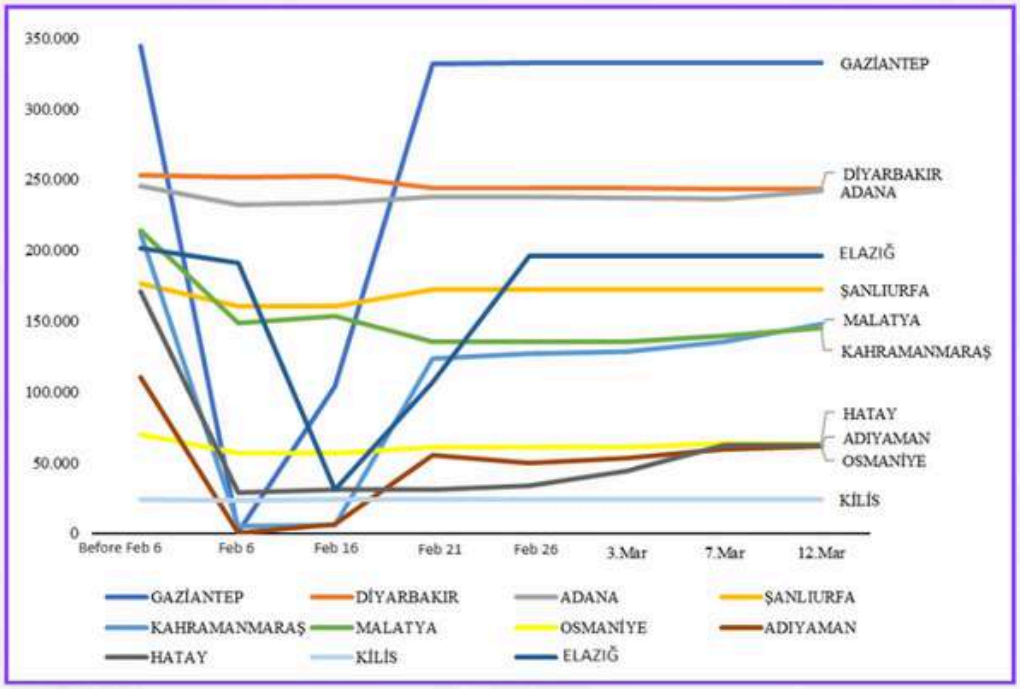

Figure 7: Natural gas availability before and after the earthquake.

Due to the disruptions in transportation in the region, especially on highways, it was almost impossible or limited for support teams from neighboring provinces to reach the region in the first 24 hours. Therefore, on the first day of the earthquake, there were some setbacks in the due diligence processes. In order to prevent such situations, natural gas flow was interrupted and natural gas was gradually flowed to priority locations. In addition, since disasters such as earthquakes can cause damage to natural gas storage and distribution facilities, damage to storage tanks or natural gas stations caused difficulties in natural gas flow to the region.

Within the scope of the Emergency Action Plan made between natural gas distribution companies and the protocols put into practice, a total of 446 personnel with 233 emergency response, maintenance and repair vehicles were sent to the region in the first stage under the coordination of MENR, EMRA and GAZBİR. In addition, Mr. Fatih Dönmez, Former Minister of MENR. In addition, an Emergency Crisis Desk was established under the chairmanship of Mr. Fatih Dönmez, Former Minister of MENR, and in this context, all authorized institutions, especially AFAD, and law enforcement officers gathered at predetermined emergency gathering centers (City Entrance Stations). In the first 24 hours, some problems were experienced in the processes carried out in order not to interrupt the natural gas supply in critically important places such as hospitals, bakeries, etc., which are supplied with CNG/LNG.

2.2.1. Natural Gas Supply During Earthquake

Damages to the transmission and distribution network are the main factors affecting natural gas supply. In addition, sectoral shutdown of natural gas supply as a precautionary measure, damages caused by the collapse of service boxes under collapsed buildings, road closures, problems in the prioritization of natural gas vehicles are among the factors affecting natural gas supply during and after the earthquake.

Gas-Stop, earthquake valve and sensor applications, which are among the network security measures, halted natural gas supply in almost 1 million residences after the tremor. In addition, due to the high number of collapsed and heavily damaged buildings, damage to the highway and damage to the airport runway in Hatay, natural gas supply took longer than expected due to the late arrival of support teams to the region. In addition, the vehicles of natural gas distribution companies were delayed in reaching some regions due to damage to the highway and problems with priority passage, and the first response time was longer than expected.

Damage occurred to sections of the natural gas transmission network operated by BOTAŞ in the region, which supplies Gaziantep, Hatay and Kahramanmaraş. By February 9, most of the transmission damage in the region had been repaired.

Since the elements of the distribution network are more elaborate and numerous compared to the transmission network, the distribution network was relatively more affected than the transmission network during the earthquake. With the Gas-Stop application in the network in the region, possible explosions, flashes and fires were prevented with the Gas-Stop application after line rupture, collapse or damage.

Other factors affecting natural gas supply during earthquakes include damage to natural gas storage facilities, power outages, maintenance and repair, and transportation difficulties. Negative changes in these factors may prevent the transmission and distribution of natural gas.

2.2.2. GAZBIR Crisis Management and Response Strategy

By evaluating the security risks, demand priorities, infrastructure damages and consumer needs within the existing resources immediately after the earthquake, our priority as GAZBIR and distribution companies was to provide natural gas supply to emergency services and critical facilities with vital functions.

First of all, immediately after the earthquake, after making sure of the health status of the employees and their relatives, natural gas distribution companies moved to the region as quickly as possible. Since the first moment, more than 1000 personnel have been involved in both natural gas supply and search and rescue activities in the region, while the number of personnel in the region has exceeded 1500 with the support teams. In addition, 240 support vehicles and over 500 personnel from all distribution companies in Turkey were dispatched to all cities affected by the earthquake, particularly Kahramanmaraş, in the first 72 hours (Figures 8 and 9).

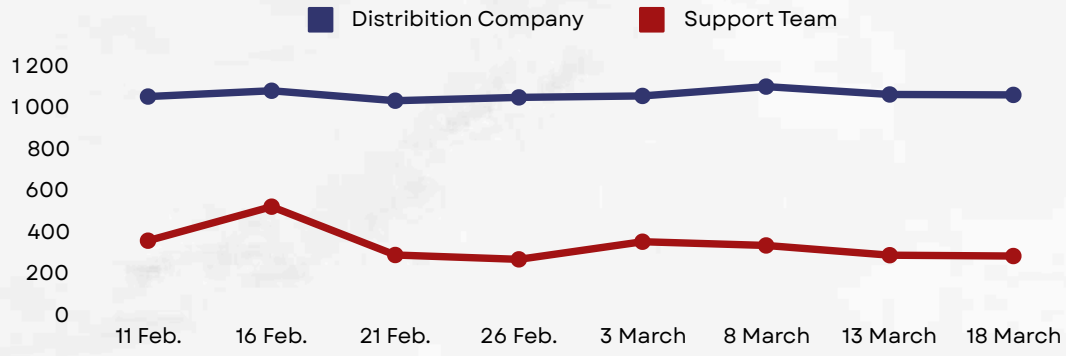

Figure 8: Number of personnel instantly present in the earthquake zone

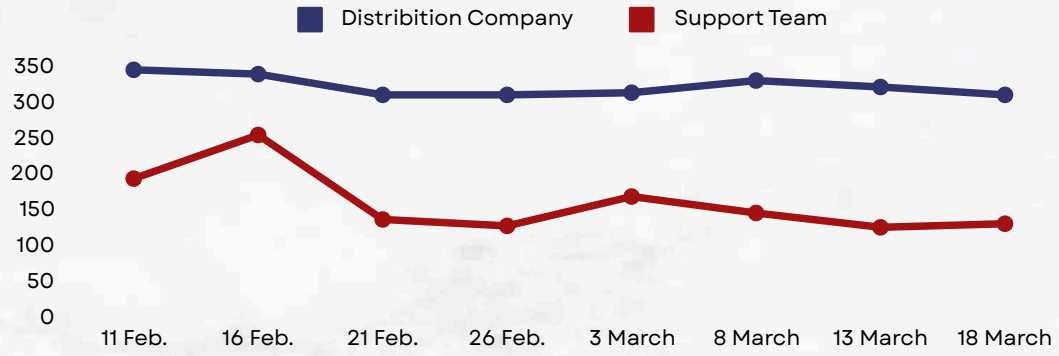

Figure 9: Number of vehicles in the earthquake zone instantaneously

The provinces with the highest number of personnel were Kahramanmaraş, Hatay, Adıyaman, Gaziantep and Malatya, where the earthquake had the highest impact. Damage assessment works in the region were initiated immediately and GAZBİR shared the current situation with all public institutions, particularly the Ministry of Environment, Urbanization and Climate Change, MENR and EMRA.

While determining the priority natural gas supply requirement, the situation of the region affected by the earthquake and our coordination processes with distribution companies and information sharing with local governments were effective in determining our priorities. In addition, working in coordination with authorized government agencies such as MENR, EMRA and AFAD enabled us to expand our natural gas supply area.

2.2.3. Call Centers Notification Information

Between February 17 and March 16, 203 thousand calls were received by the call centers of natural gas distribution companies. Gas interruption and gas start-up requests (55%) accounted for 112 thousand of the calls. If the building condition is favorable, the rate of fulfillment of requests for gas start-up from consumers after in-flat installation leakage checks and other safety checks is 99%. Figure 10 shows the distribution of calls received by call centers.

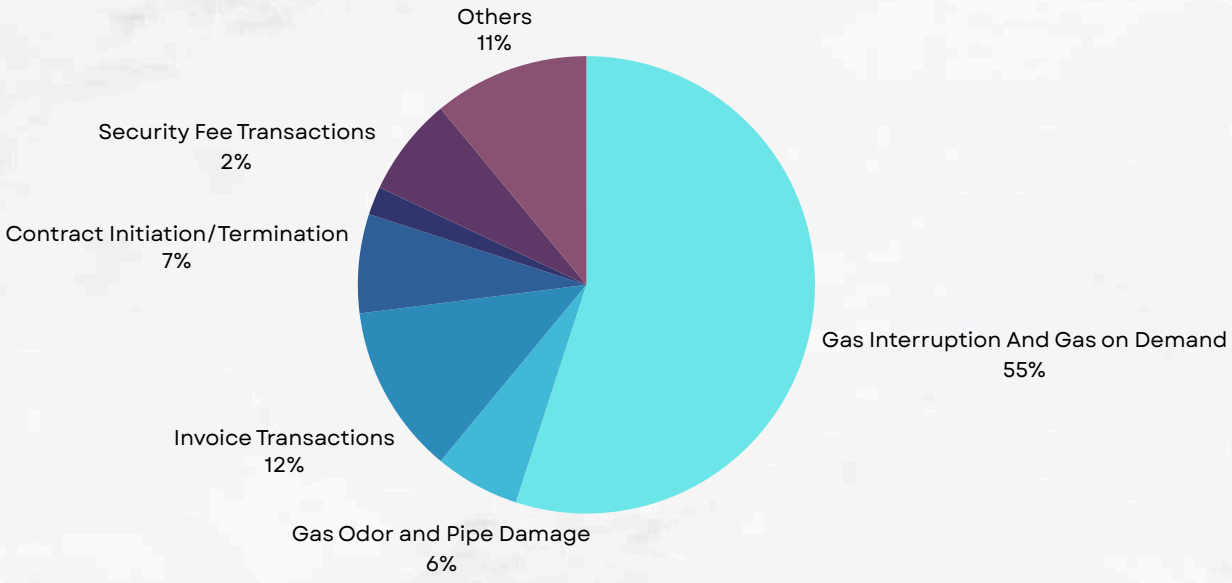

Figure 10: Distribution of call center notifications

2.3. Post Earthquake (First 72 Hours)

Since the impact area of the earthquake was over 30,000 km² and the tremor had a very strong momentum in terms of magnitude, meeting humanitarian needs was the main agenda item in the first 72 hours. The biggest problem we experienced in the first 72 hours following the earthquake disaster was the lack of clear information about the damage and the disruptions in communication with the region.

Distribution companies took part in all 11 provinces with a total of 1,500 regional and support personnel and over 500 vehicles within 72 hours. With the deployment of personnel and teams to the field, our damage assessment work started to be carried out quickly. As mentioned above, according to the first determinations, natural gas could not be supplied to half of the buildings in the region, while natural gas was being used uninterruptedly in almost all of the cities of Adana, Osmaniye, Şanlıurfa, Diyarbakır and Kilis.

Among the effects of the earthquake was not only the interruption of natural gas supply but also the housing problems of the people in the region, especially the natural gas distribution company personnel. Settlements consisting of tents and containers were established for the personnel and their families in the region. All processes were instantly monitored at the crisis management centers established under the coordination of the Ministry of Interior. All supply, damage and other problems communicated to the coordination center were dealt with.

For the people of the region affected by the earthquake, distributions were made through logistics centers to provide basic needs after the earthquake, and uninterrupted service continued to be provided to natural gas subscribers through mobile branches. Uninterrupted natural gas supply with CNG was provided to all critical points such as hospitals, governorships and crisis management in the region.

In cases where gas supply was interrupted due to damage to the transmission network and security reasons, distribution companies provided natural gas supply with LNG and CNG, prioritizing life-critical facilities (hospitals, bakeries, soup kitchens, gathering areas, etc.). This enabled citizens to meet at least some of their basic needs. Apart from natural gas, the region faced major problems in the first 72 hours in terms of both search and rescue activities and the delivery of humanitarian aid due to very limited transportation and communication.

2.3.1. Natural Gas Resources Damage Repair and Reconstruction

In the settlements in the region where there was no line damage after the earthquake, supply was already in place after the necessary controls were carried out.

In the regions where damage was detected, natural gas flow was ensured until the entrance of the city entrance stations by repairing the damages in the transmission lines as a priority after the earthquake. After the maintenance and repairs of the city entrance stations (RMS-A) were completed, natural gas flow to the stations was allowed. After RMS-A, natural gas was started to be supplied by checking the steel lines. As a result of the control of the regional stations (BRs) connected to the steel lines to which natural gas was supplied, the appropriate BRs were gassed. After the BRs, polyethylene lines and valve groups were checked for leaks. As a result of the determinations made in places where debris and heavily damaged structures were found, the process of blinding the polyethylene lines in the region was started. In the cities of Kahramanmaraş, Hatay, Adıyaman, Gaziantep and Malatya, where the destruction was high, the blinding process lasted for days.

When natural gas subscriber buildings were reached, building service lines and boxes were checked one by one. After the in-building columns and lines were also checked, if there was no dangerous situation, natural gas installations and burning devices were checked and natural gas was put into use. Figure 11 shows the percentage of natural gas supply after the earthquake.

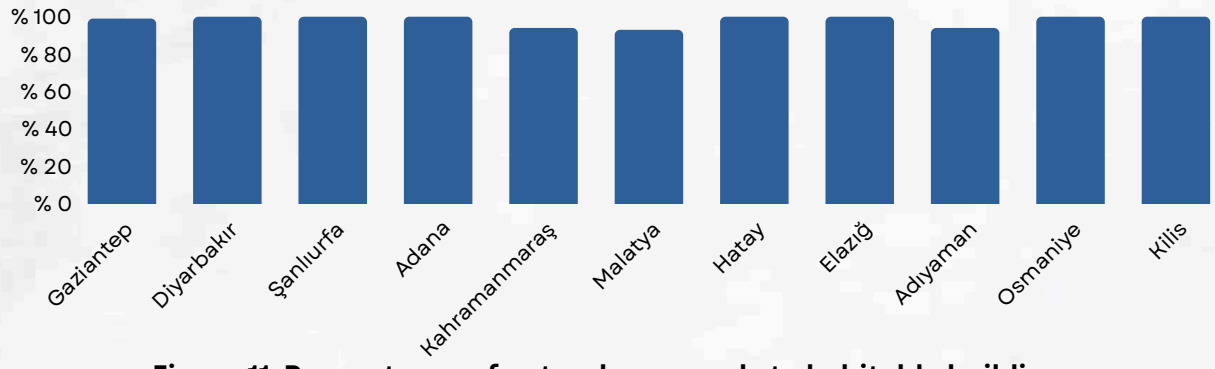

Figure 11: Percentages of natural gas supply to habitable buildings

Thanks to all distribution company employees who actively took part in the region after the earthquake, the reconstruction process was carried out quickly, reliably and successfully. In addition to the work carried out to restore natural gas supply, all damage assessment works have been completed in the region as of today. With the start of the reconstruction process of the cities, work is underway for natural gas infrastructure investments in the determined regions.

2.4. Natural Gas Outlook Before and After the Earthquake

2.4.1. Number of Residential Subscribers

Before the earthquake, there were 2 million 65 thousand natural gas subscribers in the provinces in the region. After the earthquake, the number of subscribers in the region decreased by 336 thousand (17%) to 1 million 686 thousand. Figure 12 shows the change in the number of residential subscribers in the provinces affected by the earthquake.

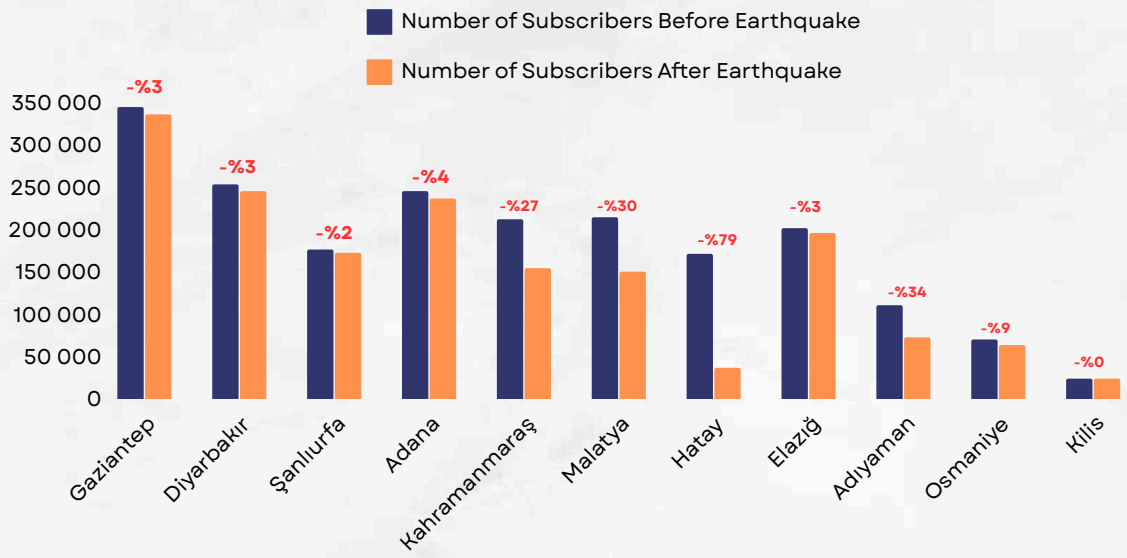

Figure 12: Change in the number of residential subscribers before and after the earthquake

It is estimated that approximately 85% of the decrease in the number of subscribers is due to uninhabitable houses and the remaining 15% is due to migration. The 3 provinces with the highest subscriber loss are Hatay with 134 thousand subscribers, Malatya with 64 thousand subscribers and Kahramanmaraş with 57 thousand subscribers.

In 11 provinces affected by the earthquake, 1 million 686 thousand subscribers continue to use natural gas. In these provinces, 579 thousand subscribers were re-supplied with natural gas after the earthquake. Figure 13 shows information on residential subscribers in buildings in the earthquake zone.

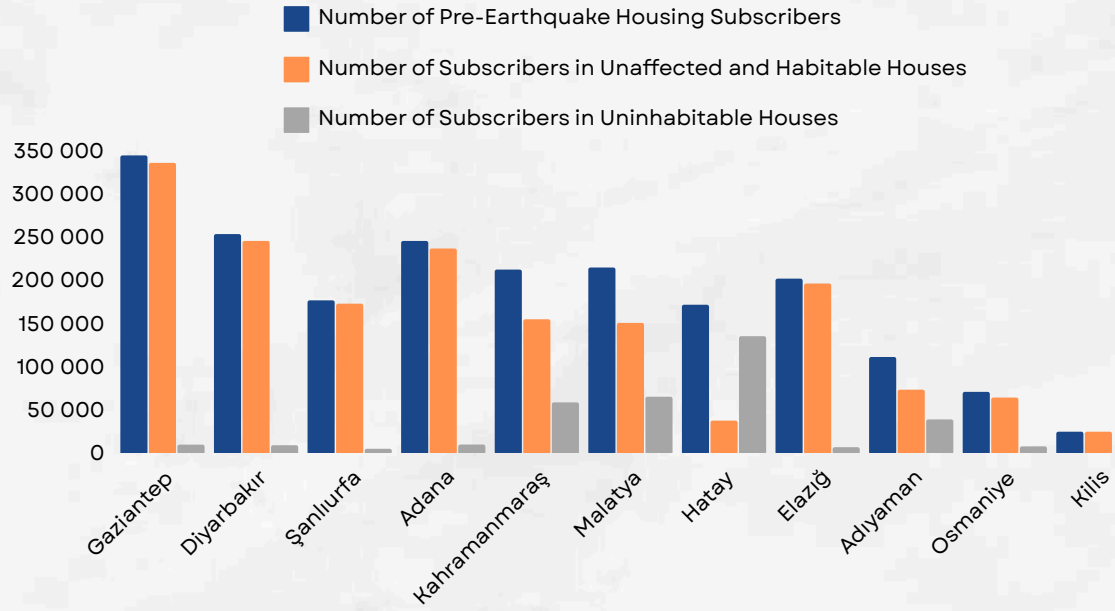

Figure 13: Number of residential subscribers in habitable and uninhabitable buildings in the earthquake zone

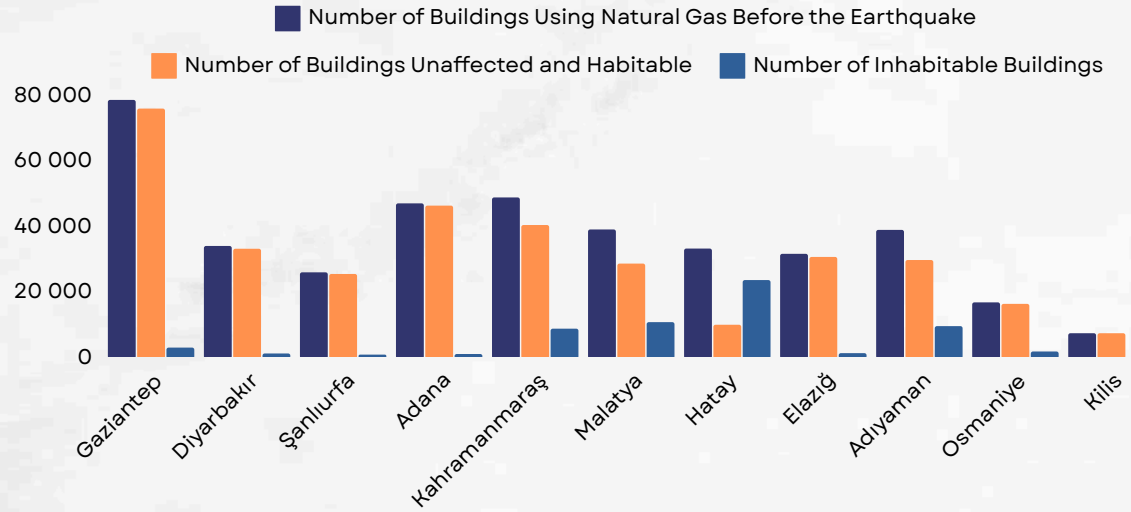

Figure 14: Information on buildings using natural gas in the earthquake zone

As can be seen in Figure 16, 98% of slightly damaged and undamaged (habitable) buildings were re-supplied with natural gas. In 7 provinces, natural gas supply was restored to all habitable buildings, while works in the remaining 4 provinces were completed with a delay. In 11 provinces affected by the earthquake, 59 thousand buildings out of a total of 398 thousand buildings using natural gas were uninhabitable, and the works to supply natural gas to the remaining 339 thousand buildings were completed rapidly. Approximately 148 thousand buildings in these provinces were re-supplied with natural gas after the earthquake.

2.4.2. Regasification Rates of Natural Gas Networks (Steel/Polyethylene)

While 98% of the steel lines in 87 settlements (provinces/districts/municipalities) that use natural gas in the earthquake-affected regions were gasified after the earthquake, in 2 districts in the region (İslahiye and Nurdağı), there was a partial interruption in steel lines due to debris works and natural gas supply was ensured in the process (Figure 15).

Polyethylene line gasification rate was 88% after the earthquake. In 10 districts in the earthquake zone (İslahiye, Nurdağı, Antakya, Dulkadiroğlu, Onikişubat, Pazarcık, Türkoğlu, Battalgazi, Yeşilyurt, Doğanşehir), there was a partial interruption in polyethylene lines due to debris works and natural gas supply was ensured in the process (Figure 16).

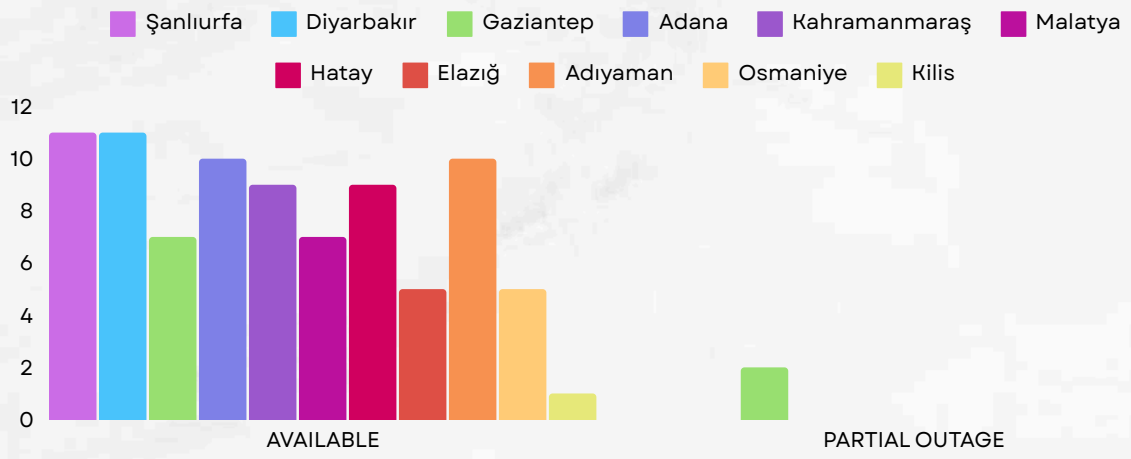

Figure 15: Steel line gassing status (number of districts/municipalities)

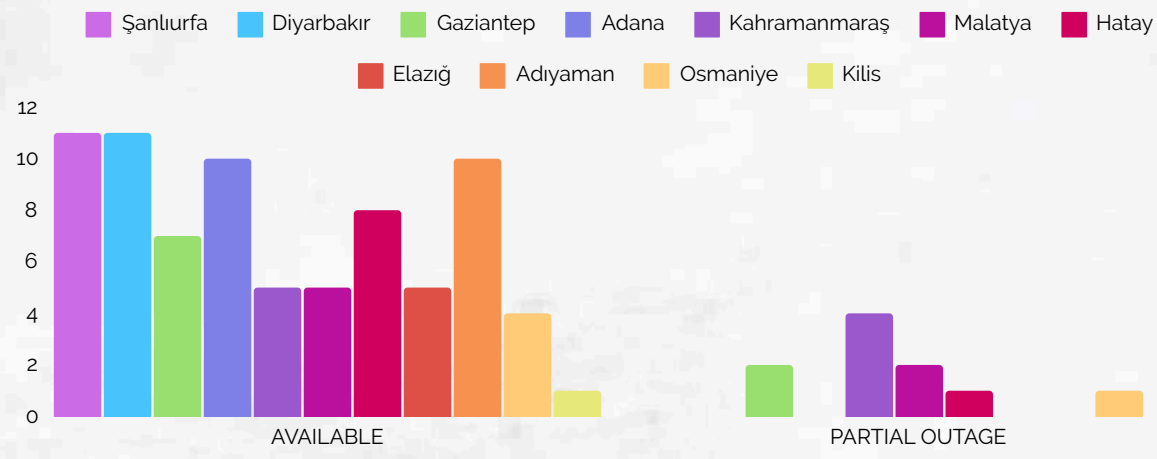

Figure 16: Polyethylene line gassing status (number of districts/municipalities)


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2.5. Natural Gas Distribution Network Regasification Procedure

During the re-gasification of natural gas networks, the entire gasified network is checked with leak detection tools and handheld devices simultaneously with the gas supply to the network after the damages are repaired. Figure 17 shows the journey of natural gas from source to home. The pipe damages at the RMS-A outlets after the earthquake are shown in Figure 18 with photographs.

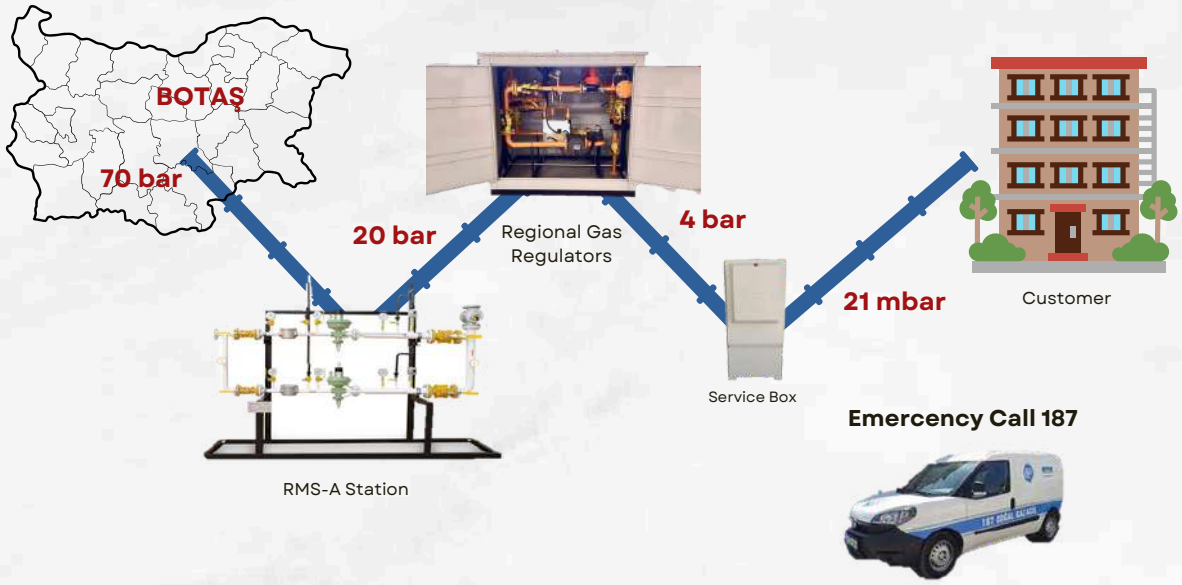

Figure 17: Natural gas from source to home

Figure 18: Post-earthquake pipe damages at RMS-A outlet

At every stage of the works, leakage search activities are carried out repeatedly in natural gas networks and internal installations, and natural gas is put into use after making sure that there is no leakage. Stages of restoring natural gas supply after the earthquake:

Repairing the damages on the transmission lines and ensuring gas supply until the entrance of the city entrance station

Ensuring all controls of the city entrance station (RMS-A), completing the necessary maintenance and repair works and starting to receive gas to the station

Control of steel lines after RMS-A and start of gas supply to the steel line

Control of regional stations (BRs) connected to steel lines and gassing of BRs

Control of PE lines and valve groups after the regional station

Capping of PE lines in areas with debris

Supplying gas to the PE network and checking the lines by searching for leaks on the streets

Building service lines and boxes are checked one by one and gas is supplied

Control of in-building column lines and gas supply to the building

Checking the installation and burning devices in the apartment and opening the gas for use

Initiation of safe natural gas use

Post-earthquake natural gas emergency action plans implementation processes are listed below.

- After the earthquake, natural gas distribution companies started to work immediately within the scope of Emergency Action Plans. Possible fires, explosions and gas leaks were prevented with the actions taken in provinces requiring urgent intervention.
- No natural gas related explosion or fire occurred in the region during and after the earthquake.
- Thanks to the design and construction of the natural gas distribution network in accordance with international standards, there was minimal damage to stations and the natural gas network in the provinces affected by the earthquake.
- Partial network damages were observed in cities located on the fault line in the earthquake zone. Other than that, there were no major problems in natural gas networks in general.
- After the necessary damage assessment, repair and leakage control works in all settlements in the earthquake zone, natural gas was safely resupplied to eligible buildings.

The stages of re-gas supply to buildings after natural gas network controls are given above. Procedure stages processed in this process:

- Buildings that are not allowed to be occupied by the Ministry of Environment, Urbanization and Climate Change are strictly prohibited.
- Building service box valve and building inlet valve (main shut-off) are closed.
- First of all, a visual check is made on the entire column line starting from the service box and outlet and all outlet valves (meter valves) are turned to closed position.
- If there is no damage on the column line, gas is supplied to the column line with all meter valves in the closed position and gas leakage is checked with gas measuring devices on the column line from the service box outlet.
- If there is a user at home in individual-use apartments, the device valves are closed and the in-flat installation is first visually checked and gas is supplied if there is no damage. Leakage control is performed with gas measuring devices, if there is no leakage, the devices are activated and gas use is started.
- If there is a leak, the certified installation company is contacted and the meter valve is closed and sealed.
- If no one is home, the meter valve is closed and sealed. A note is left on the meter valve stating that gas is supplied and that it is closed because no one is at home. It is stated to call Emergency 187 or the call center for gas opening.


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2.6. Earthquake Related Problems and Solutions

A. RMS (City Entrance) Stations

Problems:

- Leaks have occurred in the isolation joints at the station outlets
- Leaks occurred in the valves inside the station

Solutions:

- Leaks were intervened quickly.
- Valve leaks were eliminated.
- Meter connection areas were inspected.
- All gaskets were renewed.
- Isolated joints with leaks were replaced.

B. Distribution Networks

Problems:

- Ruptures at welding points in steel lines
- Rupture of pipes in places where landslides occur in polyethylene lines
- Damage to regional stations

Solutions:

- Breaks and interruptions in steel lines were eliminated.
- Deformed pipes were replaced.
- Displacement operations were carried out where necessary.

C. Building and Apartment Interior Installations

Problems:

- Leaks in seals at meter connection points
- Leaks in flexible connection elements (stove flex, boiler flex)
- Failure of some earthquake valves to fulfill their functions
- Disconnecting the waste gas chimneys of combi boiler devices from the connection point

Solutions:

- Faults requiring simple repair were fixed by gas distribution personnel.
- Installation based problems were solved by directing time-consuming operations to authorized internal installation companies.
- There is a need to update the product standard by examining the issue of earthquake valves not being activated.

2.6.1. Damages to Natural Gas Distribution Networks Due to Earthquake

Table 6 shows the damage assessments and cost calculations of the natural gas distribution network in 11 provinces in the region after the February 6 Earthquake.

Table 6: Damage assessment table for natural gas distribution network in 11 provinces affected by the earthquake.

Provinces	Distribution Company	RMS/A (City Entrance Stations)	Steel Line (m)	RMS-B (Regional Regulators)	PE Line (m)	Service Line (m)	Service Box (unit)	Total Amount
Kahramanmaraş	Armadaş	4	110	1	91.435	83.565	18.270	₺ 186.140.300
Gaziantep	Gazdaş Gaziantep	4	-	18	189.435	72.410	6.813	₺ 417.795.519
Kilis								
Diyarbakır	Diyarbakır Gaz	3	-	-	100	140	21	₺ 320.000
Elazığ	Aksa Elazığ	-	-	-	114	14.176	1.218	₺ 11.633.637
Şanlıurfa	Aksa Şanlıurfa	-	-	-	389	4.097	428	₺ 4.992.574
Malatya	Aksa Malatya	-	-	-	8.247	122.498	13.132	₺ 124.731.109
Adana	Aksa Çukuova	-	15	3	12.462	130.650	15.753	₺ 156.479.463
Hatay								
Osmaniye								
Adıyaman	Akmercan Adıyaman	4	4.000	-	53.000	147.000	13.234	₺ 140.365.135
TOTAL		**15**	**4.125**	**22**	**355.617**	**574.536**	**68.869**	**₺ 1.042.457.737**

*Since the Nurdağı and İslâhiye districts of Gaziantep province are planned to be rebuilt in other locations due to the high destruction caused by the earthquake, the cost calculation was made assuming that all of the polyethylene network and service lines installed within the existing borders of these two districts will be abandoned.

2.6.2. Activities of Support Teams from Other Provinces

As of February 6, 2023, the first day of the earthquake, the personnel and vehicles of all natural gas distribution companies operating in 81 provinces were made ready to be dispatched to the region under the coordination of EMRA. The progress of the work in the region was monitored and support teams were dispatched to the region one by one as needed under the coordination of AFAD (Figure 19).

Teams Arriving for Support:

- Other Gas Distribution Company Personnel
- GAZBIR-GAZMER Staff
- Authorized Interior Installation Company Personnel
- DOSIDER Member Company Personnel
- Control/Consultant Company Personnel
- Meter Reading Company Personnel

Figure 19: Activities of teams coming to the earthquake zone from other provinces

2.6.3. Field Coordination Activities

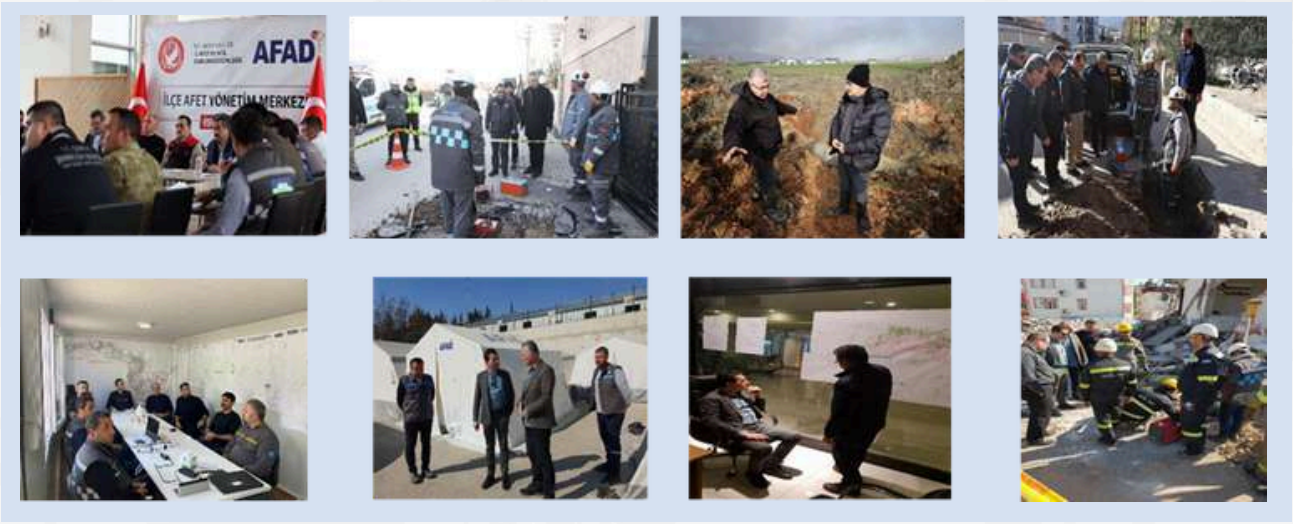


Figure 20: Field coordination activities carried out by MENR and EMRA

Our former Minister of Energy and Natural Resources Mr. Fatih DÖNMEZ, together with the accompanying officials, arrived in the region from the first day of the earthquake and coordinated the work carried out on site. (Figure 20)

At the crisis management center established in Ankara by EMRA Natural Gas Market Department, coordination was carried out on a 24-hour basis, and from time to time, field operations were examined on site.

2.6.4. Natural Gas Distribution Network Leak Search and Capping Activities

Natural gas distribution companies operating in the provinces in the earthquake zone and support teams from other provinces carried out network controls, capping works on PE lines, leakage search activities, building and apartment internal installation controls meticulously. Thanks to these works, buildings were safely re-gasified (Figure 21).

Figure 21: Natural gas distribution companies' leak detection and capping activities

2.6.5. Activities on Gas Burner Devices

Companies that are members of the Natural Gas Industrialists' Association (DOSIDER) identified earthquake-related failures in gas appliances and provided spare parts and repairs free of charge.

By managing all services from a single center, DOSIDER member companies were able to respond more quickly to the problems of subscribers of combustion appliance manufacturers and importers.

7,200 service points were provided with device maintenance and parts replacement for 3,500 subscribers. Direct material support amounting to 15 million TL was provided by GAZBIR-GAZMER and DOSIDER.

Figure 22: Gas burner device studies.

2.6.6. Gas-Stop (Check Valve) Application in Natural Gas Networks

Systems called Gas-Stop or Check Valve (Figure 23) are one-way safety valves that prevent the fluids passing through an installation from moving in one direction and returning back, thus enabling the system to operate more efficiently. Thanks to this system used in natural gas service lines, when a pressure drop occurs in the gas flow in the network for any reason, the system automatically activates and automatically stops the gas flow after the service box. The Gas-Stop application, developed to increase safety in natural gas lines, ensures safety by shutting off the gas flow in case of sudden flow rate changes in the subscriber connection lines of natural gas networks.

In addition to earthquakes, this technology also ensures the safety of the service line against threats such as landslides, floods, excavation works, service box damages, service box fires that threaten network safety. On February 6, 2023, earthquakes caused ruptures/punctures in the service lines of collapsed buildings, but secondary disasters (explosions/fires) were prevented thanks to the activation of Gas-Stop systems in the service lines.

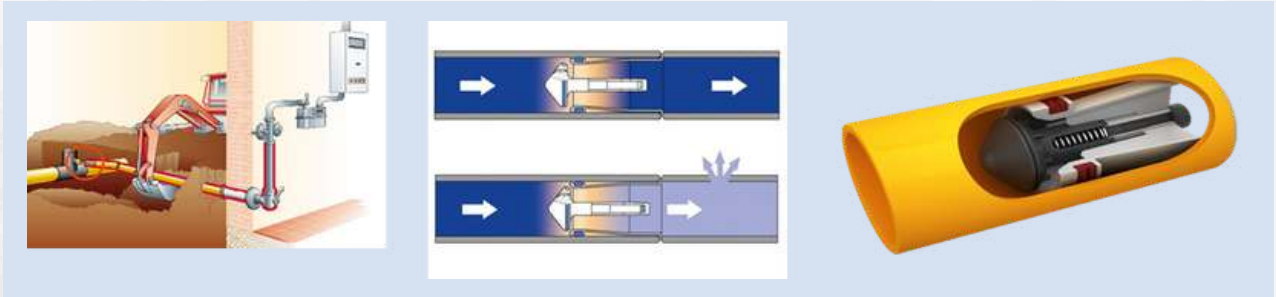


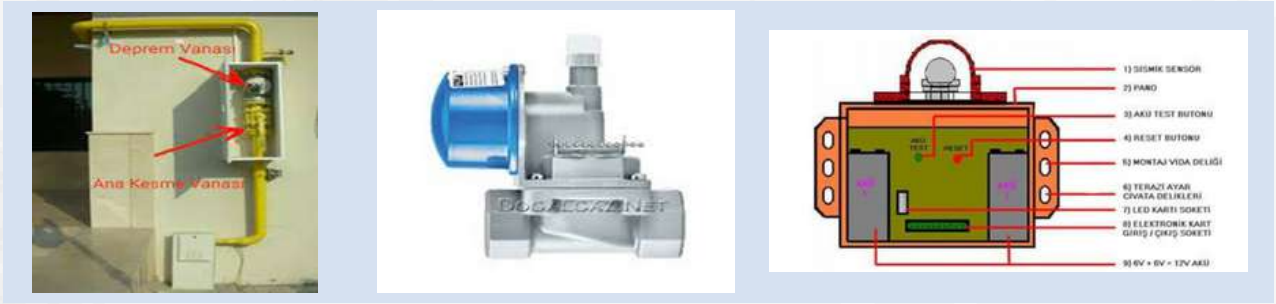
Figure 23: Gas-Stop equipment

2.6.7. Earthquake Valve and Earthquake Sensor Applications in Building Interior Installations

The earthquake valve (Figure 24b) automatically shuts off the gas flow through its gas cut-off mechanism when seismic movements with the magnitude of acceleration and frequency values specified in the TSE (Turkish Standards Institute) standard occur and are detected by the sensing device.

Earthquake Sensor (Figure 24c), (Gas cut-off device) detects earthquake motion in case of tremors at the acceleration values specified in the TSE standard and automatically cuts off the natural gas by sending a signal to the gas cut-off safety valves (Solenoid Valve) mounted on the column lines of the buildings where natural gas is used.

During the February 6, 2023 earthquakes, it was observed that some earthquake valves were not activated and did not cut off the gas flow to the buildings, the issue will be technically examined and initiatives will be taken before the Ministry of Environment and Urbanization and TSE to update the relevant standard.



(a) (b) (c)

Figure 24: (a) Installation representation, (b) Earthquake valve, (c) Earthquake sensor

2.6.8. Post-Earthquake Field Determinations

Table 7: Strengths and weaknesses of natural gas distribution networks:

Strengths	Weaknesses
• No explosion or fire caused by natural gas during and after the earthquake, • Despite more than 3 meters of soil movement, the resilience of the network to this fracture, • Gas-Stop equipment that provides instant gas interruption in case of service line breaks in demolished buildings has performed its duty, • Instant consumption, pressure and all similar data can be monitored from Dispatch Control Centers	• Observation of leaks in threaded connections in old indoor natural gas installations, • Reviewing the functions of earthquake valves and updating the relevant standard, • Consideration of geological surveys when determining steel pipeline routes, • Review of isolated joints with low flexibility and high fracture,

2.6.9. Practices Supporting Earthquake Victim Consumers

With Presidential Decree No. 137 published in the Official Gazette on March 21, 2023, the past due natural gas bill debts of consumers whose homes or businesses have been destroyed, will be destroyed, or have sustained severe and moderate damage due to the earthquake have been forgiven.

With the Presidential Decree No. 6974 published in the Official Gazette dated March 21, 2023, the accrual and collection procedures regarding the natural gas consumption of subscribers in the provinces of Adıyaman, Hatay, Kahramanmaraş, Malatya and the districts of İslahiye and Nurdağı in Gaziantep province were postponed until 31/5/2023.

With the Board Decision taken by EMRA, consumers who certify that they have been affected by the earthquake in 11 provinces within the scope of the State of Emergency are not charged an assurance fee for new natural gas subscriptions to be made throughout Turkey.

2.6.10. EMRA's Board Decisions on Natural Gas Activities During the Process

With the Board Decision dated February 9, 2023;

- CNG/LNG license holders are to prioritize the supply of gas to critical facilities of vital importance (such as soup kitchens, bakeries, hospitals, public buildings, etc.).

With the Board Decision dated February 16, 2023;

- Companies holding internal installation certificates and companies holding construction/service certificates can apply to the distribution companies in the State of Emergency (SoE) and disaster zones and operate in the earthquake zone,

- Consumers who certify that they have been affected by the earthquake can make subscription transactions without an assurance fee.

With the Board Decision dated March 2, 2023;

- Distribution companies can receive services from certificate holders for internal installation modifications in order to ensure that customers can safely turn on gas,

- Distribution companies in the SoE region can benefit from the call centers of other distribution companies and establish joint call centers with other distribution companies,

- Free of charge natural gas connections of facilities operating within the scope of disaster management,

With the Board Decision dated March 23, 2023;

- Suspension of meter reading activities in the provinces most affected by the earthquake and suspention of gas cut-offs due to debt,

3. SOLUTIONS AND SUGGESTIONS

The disaster emergency action task plan and other action scenarios determined before the earthquake were professionally implemented thanks to the authorized state institutions and dedicated distribution companies. During the repair and reconstruction of the damage to the natural gas network, leakage search activities were carried out repeatedly in natural gas networks and internal installations at every stage, and natural gas was put into use after making sure that there was no natural gas leakage.

Due to the partial supply interruption in the areas identified as moderately and less damaged after the earthquake, heating and hot water problems and cooking problems negatively affected the people of the region. The inoperability of heating systems in homes and workplaces made it difficult for people to live in cold weather conditions. The interruptions caused natural gas stoves to stop working and limited cooking possibilities.

Although natural gas is a flammable substance, there have been no natural gas-related explosions or accidents in the region as a result of the dedicated work of natural gas distribution companies and the construction of the network in accordance with all safety regulations. In this way, at least no natural gas-related fear was caused in the people of the region.

In addition to all these, with the fast and devoted work of public and private sector cooperation, the people of the region were informed and ensured that they did not panic. In the same process, controls were carried out to ensure the supply of natural gas without delay or pause. Thanks to continuous communication and emergency planning, social unrest was minimized.

Especially in the aftermath of the 1999 earthquakes in Gölcük and Düzce, Turkey has had to amend existing laws and regulations, introduce new taxes such as the earthquake tax, and impose various protective obligations both before and after the earthquake.

In 2002, the “Natural Gas Market Internal Installation Regulation” entered into force. This regulation aims to ensure the safety of natural gas internal installations and to subject them to inspection, while at the same time making it compulsory for the design, construction and commissioning of internal installations to be carried out in accordance with standards such as TS, EN and ISO. Earthquake insurance was made compulsory. Amendments were made to zoning laws. Following the earthquake, earthquake resistance principles and inspection rules of buildings were changed.

Internal installation controls in undamaged and slightly damaged buildings;

- Generally, no negative conditions were found in combustion appliances and chimney connections,
- Leaks have occurred in some of the connection fittings,
- A negative situation affecting the chimney connections and sealing was detected.

The construction of the natural gas distribution network design using the most advanced technologies at international standards played an important role in the rapid detection of the damage and the elimination of outages in the affected areas as soon as possible.

Turkey has had an earthquake early warning system for 21 years. In 2002, Boğaziçi University Kandilli Observatory and Earthquake Research Institute decided to establish an “Earthquake Emergency Response and Early Warning System” with the decision of the Council of Ministers and established it.

Gas-Stop application ensures safety by shutting off the natural gas flow in case of sudden flow/pressure changes in subscriber connection lines during an earthquake. Natural gas service lines are installed without excavation to make them safer. In addition to earthquakes, the Gas-Stop application ensures that the service line is safe in case of floods, landslides and damage to the network by third parties. In addition, thanks to the earthquake valve and earthquake sensors applied in the internal installations, it cuts off the natural gas flow by sending a signal to the gas shut-off safety valves installed on the column line in the first seconds of the tremor.

In natural gas networks, earthquake valves are used as pin, pull and side-mounted. While 75 out of every 100 earthquake valves in total fulfill their duties, it was determined that this rate decreased to less than 70% for side-mounted earthquake valves. In this context, negotiations are ongoing with the relevant institutions for earthquake valve revision.

After the earthquake, natural gas distribution companies decided to strengthen their structures for sustainability and safety. In order to ensure uninterrupted gas supply, they have planned studies to design city entrance stations and regional stations as redundant and to have backup lines. Work is also underway to design steel lines and polyethylene lines as ring networks. In addition, care will be taken to ensure that the materials used in the natural gas network have high flexibility and that the network is controlled by valves at the maximum level in order to minimize the areas where natural gas cuts will be made in case of possible disasters.

It is important for energy companies to strengthen their infrastructure against earthquakes. Companies should take the necessary measures to ensure that energy transmission lines, gas pipelines, storage facilities and other infrastructure elements are resistant to earthquake impacts. The use of earthquake-resistant materials should be a priority consideration during the design and construction of infrastructure. Companies should also have a detailed plan for post-earthquake emergencies. These plans should include the mobilization of emergency teams, damage assessment and repair, resource management and communication strategies. Organizing emergency drills and training personnel can help ensure a quick and effective response.

Also important to quickly recover and repair energy infrastructure after an earthquake. Energy companies should use technological solutions and collaborate to speed up damage assessment and repair after a disaster. It is also important to build stocks of spare parts and equipment to ensure rapid replacement and repair.

Reliable and uninterrupted energy supply plays an active role in post-earthquake scenarios. Reliable and uninterrupted energy supply can ensure uninterrupted operation of communication lines and communication systems after an earthquake. This facilitates the effective coordination of rescue teams and the provision of assistance to disaster victims.

Hospitals, health centers and emergency medical equipment require electrical energy. Injuries following disasters such as earthquakes create urgent medical needs. Reliable energy supplies ensure the uninterrupted operation of medical devices and equipment and help deliver emergency medical services efficiently.

After an earthquake, many people seek safe shelter because of damaged buildings. Shelters, temporary housing and refuge areas require electrical energy. Ensuring energy supply makes it possible to provide lighting, heating, cooling and other basic needs in shelters.

Energy plays a vital role in meeting basic needs such as water supply, wastewater treatment, food storage and preparation, sanitation. Energy disruptions can affect these essential services. A reliable energy supply sustains the fulfillment of basic needs and supports the health and welfare of the population.

In the aftermath of an earthquake, it is important to take safety measures and ensure overall security. Lighting is essential for illuminating public spaces, temporary shelters and safety zones. At the same time, surveillance cameras and other security systems also require electrical energy.

Reliable and uninterrupted energy supply increases the effectiveness of post-earthquake relief and recovery efforts and ensures that people's needs are met. Therefore, it is important to strengthen energy infrastructure, diversify energy sources and carry out contingency planning in earthquake-prone areas.

In the event of a possible disaster, the following measures will be taken for the employees of the gas distribution company to ensure sustainable natural gas systems.

- Meeting the basic living needs such as shelter, food and energy of all personnel and their families of Natural Gas Distribution Companies (Example; Sahara tents and sufficient number of containers in RMS-As)
- Establish a backup crisis management center for the management of Distribution Companies.
- Provide an organization to carry out catering services.
- Obtain support from companies identified in Emergency Action Plans.

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