Netherlands

Let’s grow our future together!

Bulgarian Greenhouse Production. Potential for Implementation of Geothermal Energy

LVVN Attaché Netwerk

Commissioned by the Netherlands Agricultural Network
2024

Nikolay Valkanov
INTELIAGRO | SOFIA, BULGARIA

Foreword

Knowledge and network are key factors for success when targeting foreign markets. As agricultural counsellor of the Netherlands for Bulgaria, Romania and Moldova I try to stay on the top of local sector developments and to signal business opportunities to Dutch companies. And, as a civil servant for the Dutch Ministry of Agriculture, Fisheries, Food Security and Nature, I do this in the context of international and EU agreements and policy aims, we as the Netherlands are and have committed to.

Geothermal energy, for me, is an important key driver to reach various UN Sustainability Goals at the same time, being particullary (7) Affordable and clean energy, (9) Industry innovation and innovation, (12) Responsible consumption and production and (13) Climate action.

Bulgaria has this green energy treasure in hands for a more sustainable food production and for more resilient food systems. On the other hand, over the last decades, the Netherlands has developed more specific knowledge, experience and businesses in the use of geothermal and terrestrial heat in the agrifood production, amongst others in greenhouses. This is where I see a role for me and my team, to let both worlds meet and benefit from each other.

It is against this background and based on the received most frequently asked questions of the Dutch entrepreneurs over the last years - on the policy and legal context and business opportunities for their greenhouse products and services related to the geothermal energy in Bulgaria - that we assigned IntelAgro to provide us with an in-depth study and 'SWOT' analysis.

I believe this report provides Dutch companies and individual entrepreneurs with helpful and comprehensive information and opportunities for investments. I trust you will find it useful and remain open for your questions and feedback.

Sophie Neve

Agricultural Counsellor for Bulgaria, Romania and Republic of Moldova

LVVN Attaché Netwerk

Table of Contents

1. Introduction

Greenhouse production in Bulgaria has been developing on an industrial scale for the last 50 years, providing off-season vegetables to both domestic and international markets. Like other agricultural sectors it deteriorated in the beginning of 21st century and during the pre-accession period to the EU, due to lack of capital investments, opening to competitive produce from neighbouring markets and energy costs. Despite of that, greenhouse production of vegetables still has a significant role in meeting local demand for fresh produce and has a good growth potential.

Today, the demand for sustainably produced agricultural products is on the rise, particularly in Europe. Geothermal energy offers a sustainable, low-carbon energy source, which aligns well with the growing consumer preference for environmentally friendly products.

Besides that, geothermal energy provides a stable and potentially lower-cost heating option for greenhouses, which can significantly reduce operating costs, especially during the colder months. This cost advantage can make products more competitive both locally and in export markets.

Utilizing geothermal energy can enable year-round greenhouse production, allowing farmers to produce out-of-season crops, which can fetch higher prices in the market. Bulgaria's proximity to key European markets makes it an attractive location for greenhouse production, especially for exporting high-value crops like tomatoes and cucumbers during off-peak seasons in other parts of Europe.

Bulgaria, as an EU member, has access to various funding mechanisms and incentives aimed at promoting renewable energy use, including geothermal energy. These funds could help offset the initial capital costs associated with developing geothermal heating systems for greenhouses.

Also, Bulgaria has specific regulations regarding the exploration and use of geothermal resources. Companies interested in using geothermal energy will need to comply with national laws that govern resource extraction, environmental impact assessments, and land use. To develop a geothermal project, businesses will need to secure the necessary permits and licenses. This process involves both local and national authorities and may include environmental reviews, water usage rights, and land use permits.

The integration of geothermal energy into greenhouse production in Bulgaria presents significant market opportunities due to cost efficiency, sustainable production methods, and potential for governmental support. However, navigating the legal landscape, particularly regarding environmental regulations and obtaining the necessary permits, will be crucial for the successful implementation of such projects.

2. Overview of greenhouse sector in Bulgaria

Large-scale greenhouse production in Bulgaria was introduced during the 1970s, primarily as part of the country's agricultural modernization efforts during the socialist era. The focus was on increasing vegetable production to meet the growing domestic demand and to enhance export capacity. During this period, Bulgaria invested in modern agricultural infrastructure, including large (glass) greenhouse complexes that allowed year-round production of vegetables like tomatoes, cucumbers, and peppers.

The state played a significant role in the development of these facilities, focusing on collective and cooperative farming structures. Greenhouses became essential for extending the growing season and increasing yields, particularly for export to other countries within the Soviet bloc. Some of these facilities were planned and executed with technology and under the guidance of French and Dutch specialists[1]. During the general economic decline of the 1990’s, a number of these greenhouses were abandoned and/or damaged by abeyance and adverse climate conditions. What part of these facilities has been renovated afterwards, and what part is still deviating from normal working condition is a matter of dedicated research that is not in the scope of the current report.

Today, greenhouse production is struggling to find its way in a highly competitive market. It is pressured by increasing energy costs (one of the highest in the region), cheap imports from neighbouring countries, lack of labour and the need for significant investments in modernization. With the challenges in greenhouse production and the decline in field-grown vegetable production, Bulgaria is becoming more and more reliant on imported vegetables.

2.1 Production

Bulgarian greenhouse production has averaged around 107,000 tonnes per year for the 2017-2023 period (with a deviation of about 10%). Currently greenhouse production provides 30% of all fruit vegetables and 18% of the total vegetable produced if leafy greens, cruciferous, root, allium and strawberries are included. Its share is increasing in the last seven years due to the decline in field-grown production. Total vegetable production in Bulgaria has declined by 29% since 2017 mainly due to the decrease in potato growing and other field vegetables (Fig. 1).

Tomatoes are the major crop in greenhouses with more than half of the areas under cover (51%) and production volumes (52%), followed by cucumbers. Both crops make up around 95% of the total volume, 4% are sweet peppers and the remaining are small quantities of courgettes, aubergines, strawberries, lettuce and greens.

Yields are relatively low and are a result of low-tech growing technology, short harvest period and the large share of unheated facilities.

---

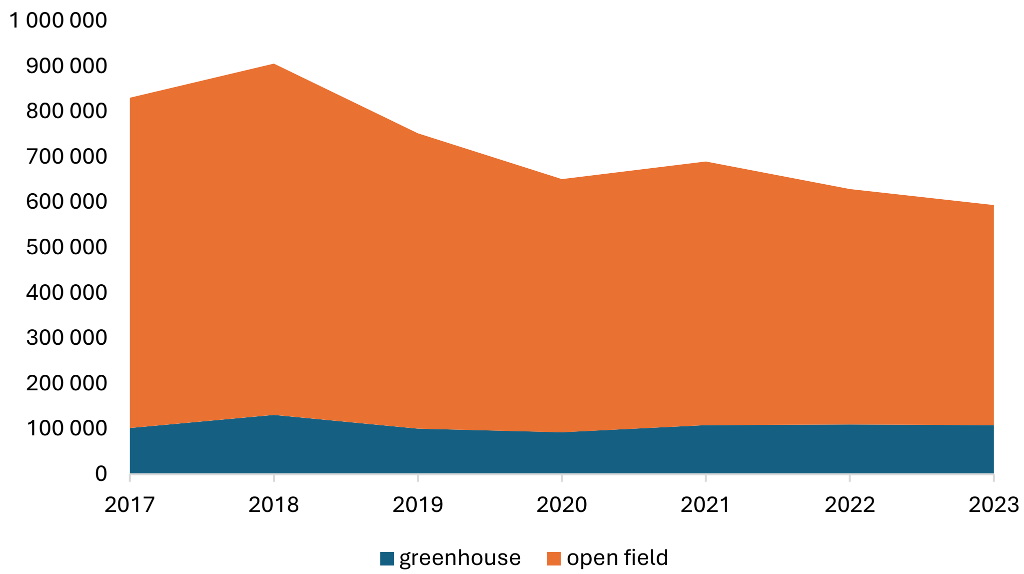
[1] *https://kinsights.capital.bg/business/2024/03/04/4551143_fruit_and_vegetables_top_firms_incomes_rise_yet/*

Table 1 – Average yields of major greenhouse crops (t/ha), 2022-2023

	area (ha)		total production (t)		average yield (t/ha)	
	2022	2023	2022	2023	2022	2023
tomatoes	589	639	57 074	56 113	96,90	87,81
cucumbers	431	389	46 794	44 528	108,57	114,47
peppers	123	147	4461	5741	36,27	39,05
lettuce	39	22	702	215	18,00	9,77
strawberries	26	68	225	1145	8,65	16,84

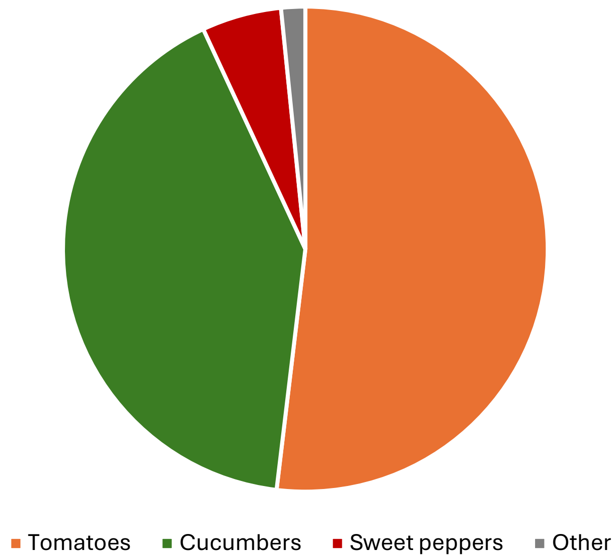
Source: Ministry of Agriculture and Food (MAF), own calculations

Fig. 1 - Production of vegetables in Bulgaria, 2017-2023 (t)



Source: MAF

Fig. 2 - Production of greenhouse vegetables by type of crop, 2023



Source: MAF

Organic production of greenhouse vegetables is estimated to cover about 6.5% of the area. Data derived from the application for income support under the CAP shows that 64,55 ha of protected area has been cultivated in an organic manner or are in transition to organic. Of that area more than half is dedicated to cucumbers, 18% to berries, 13% to peppers, 10% to tomatoes, etc.

2.2 International trade

Vegetable imports increased by 20% in volume and 94% in value during the 2017-2023 period. Bulgaria imported 358 642 t of vegetables in 2023, compared to 297,855 ton in 2017 at the total cost of EUR 300 million. More than half of imports came from Bulgaria's southern neighbours Greece and Türkiye (53%), while the Top 5 list of importers includes northern countries like Germany, Netherlands and Poland.

Bulgaria imports mainly tomatoes (around 100,000 tonnes per year), other vegetables with tariff code 0709 (predominantly sweet and chili peppers and smaller quantities of mushrooms, aubergines etc.) and potatoes (50, 000 tonnes per year) which make for 58% of total imports. The rest of the imports are made of cucumbers, onions, dried leguminous, carrots, etc – see Table 3.

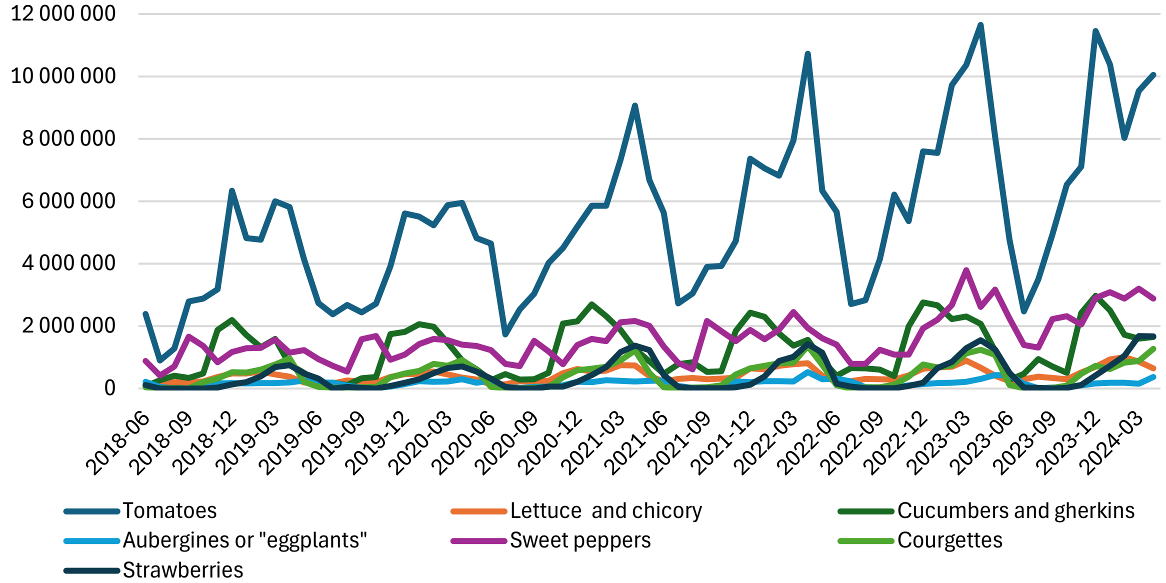
Table 2 – Top 5 vegetable crops imported in Bulgaria by volume

Imported quantity in tons by crop	**2021**	**2022**	**2023**
1. Tomatoes, fresh or chilled ('0702)	99 726	89 880	98 671
2. Other vegetables, fresh or chilled ('0709)	60 375	54 407	57 657
3. Potatoes, fresh or chilled ('0701)	47 982	49 522	52 105
4. Cucumbers and gherkins ('0707)	34 468	29 965	29 907
5. Dried leguminous vegs ('0713)	25 293	27 241	29 486
Total import in tons	**363 982**	**346 105**	**358 642**

Source: ITC

Import is mainly off-season, largest quantities are concentrated during wintertime and springtime (November-April, see Fig.3) when local production is lower, and prices are higher. The highest numbers both in volume and value are observed in the tomato business (incl. cherry tomatoes) due to high off-season consumption. Bell peppers and cucumbers are the next high-value crops with good off-season market prospects. Winter months are the opportunity window for local greenhouse production, meaning that import prices of major off-season crops (like tomatoes and cucumbers) can be used as a benchmark for price competitiveness of the local greenhouse produce – see Table 3.

Fig. – 3 Seasonal Import of fresh vegetables, Jun 2018 – Apr 2024.



Source: Eurostat

Table 3 – Monthly Import prices of major crops (EUR/kg)

	Tomatoes	Cucumbers	Peppers
2022-M11	0.86	0.59	0.77
2022-M12	0.95	0.60	0.88
2023-M01	1.04	0.63	0.95
2023-M02	1.34	0.81	1.08
2023-M03	1.05	0.63	1.33
2023-M04	1.05	0.50	1.13
2023-M05	0.69	0.36	0.85
2023-M06	0.54	0.44	0.56
2023-M07	0.58	0.67	0.65
2023-M08	0.59	0.94	0.89
2023-M09	0.66	0.74	0.78
2023-M10	0.87	0.59	1.03
2023-M11	0.93	0.71	1.00
2023-M12	1.18	0.70	1.17
2024-M01	1.25	0.82	1.14
2024-M02	1.08	0.69	1.18
2024-M03	1.05	0.52	1.29
2024-M04	0.96	0.49	1.04
2024-M05	0.67	0.39	0.82
2024-M06	0.52	0.72	0.66

Source: ITC

Bulgarian vegetable exports are decreasing in volume (by 30%) and increasing in value (by 40%) – these numbers are driven mainly by the truffle business in the country, rather than any traditional crop. The only exception are tomatoes which witness an almost three-fold growth in export to 17 207 t in 2023 from 6 192 t in 2017 mainly thanks to the greenhouse industry. Cucumbers (mostly organic grown) had a good export market in previous years as well, but it started to deteriorate recently.

Key takeaways:

- Bulgaria has traditions in greenhouse production of vegetables, the focus being tomatoes and cucumbers.
- Local off-season production faces strong competition from Greece and Türkiye, where costs are lower due to milder climate.
- The business is endangered by high energy costs, so it has to put substantial effort to decrease the share of heating in total production costs to be competitive both on the domestic market and abroad.

3. Greenhouse map

A complete overview of the greenhouse facilities in Bulgaria by construction type, year of establishment, location, technology used, type of heating, crop grown, etc. has never been conducted in the country. There is no single source that can state the exact number of holdings in greenhouse production as well.

To map the greenhouse facilities in Bulgaria is based on official statistics by the Ministry of Agriculture and Food and State Fund Agriculture have been used as well as on desk research and a questionnaire[2].

3.1 Total greenhouse area, types of cover and geographical distribution of facilities.

Total greenhouse area covers 2006 ha in 2023, according to the Final results for the land use in Bulgaria, compiled by the Agrostatistics office at the Ministry of Agriculture and Food (MAF)[3]. The same source shows a 32% increase in greenhouse area since 2017. This data, based on territorial observation does not consider the cover of the facility, its purpose (e.g. vegetable production, or ornamental flowers), or whether it is being exploited or is empty.

Annual vegetable production data shows the area of production facilities at 1154 ha in 2023, up from 966 ha in 2017, according to MAF. Glass or other hard cover[4] occupy

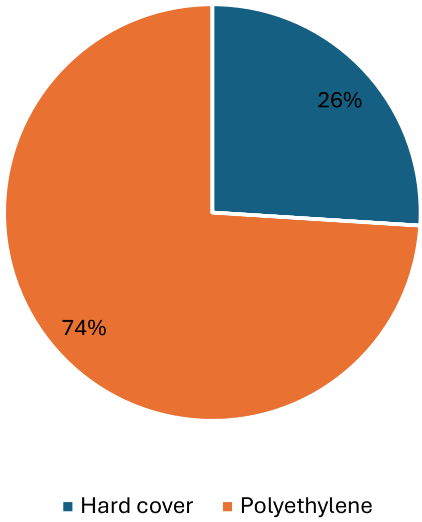
[2] *Disclaimer: The reader must use the information presented in this section with particular care, as it has been collected from different sources using different methodologies. The first main source of information is the Agrostatistics office at the Ministry of Agriculture and Food, which compiles two types of data: for land use and for vegetable production in the country (indoor and outdoor), both of which are conducted annually. The second main source is State Fund Agriculture (SFA) – the agency responsible for the distribution of CAP payments and the Income support for greenhouse producers, which keeps a record of all beneficiaries of support. The list of top 100 greenhouse holdings in the Appendix has been derived from SFA records. The report has been enriched by desk research and by a survey among greenhouse holdings in the country. The results of the latter must be approached with care due to the relatively small number of respondents – 19 (all of size >0,5 ha), which represent 48,3 ha or 4% of the total area under cover in holdings >0,5 ha. The number of respondents is not a result of a small response rate (37%) but rather a result of the share of legal entities versus private farmers. Less than one in five greenhouse holdings are legal entities, while the rest are operating as private farmers and GDPR rules apply limiting the available contact information.*

[3] https://www.mzh.government.bg/media/filer_public/2024/02/02/ra_433_publicationbancik2023.pdf

[4] *Polycarbonate cover has very limited usage, mainly in smaller facilities and in combination with facilities under other types of cover suggests a survey, conducted for the purpose of this report.*

26% of the area, while polyethylene greenhouses comprise the majority of 74%, shows the same source (see Fig. 4). Glass houses are mainly of the old type constructed in the 1970's and many need thorough refurbishment.

Fig. 4 – Area under cover by type of material as of 2023



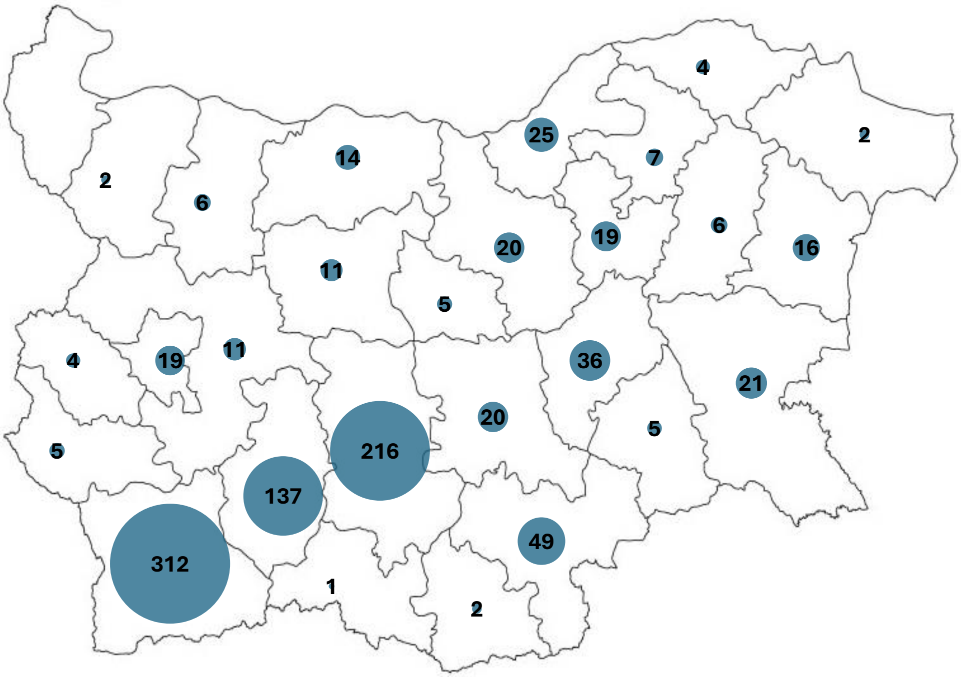
Source: MAF

The survey, conducted by InteliAgro suggests that one in five polyethylene houses above the 0,5 ha threshold also use insect netting or shade netting.

Data from State Fund Agriculture (SFA), the agency responsible for the distribution of CAP payments, suggests that a total of 983 ha are in holdings with greenhouse size larger than 0,5 ha (the threshold for applying for Linked to production income support for greenhouse production). However, under the same intervention[5], it is possible for farmers to combine area under cover with eligible field grown vegetables in order to reach the minimum threshold of 0,5 ha. Farmers can also combine several facilities, meaning that it is not necessary for one to have one 0,5 ha greenhouse, but it should be enough to have 2*0,2 ha covered facilities and 0,1 ha of field grown vegetables. Still, data from SFA is the closest hint to the geographical distribution of facilities over a minimum size. Of the 983 ha 31% are situated in the Southwestern corner of the country (Blagoevgrad district), 32% are in the South-Central region of the country (mostly Plovdiv and Pazardzhik districts), 6% in the Southeast part of the country (Haskovo district) and the rest are scattered all over Bulgaria (see Fig. 5).

[5] https://www.sp2023.bg/index.php/bg/intervencii/i-b-17-obv-rzano-s-proizvodstvoto-podpomagane-na-dohodite-za-oranzerijno-proizvodstvo

Fig. 5 – Total greenhouse area (ha) by province, applied for Income support for greenhouse production in 2023



Source: SFA

You can find a shortlist of the largest facilities in Appendix 1.

3.2 Heated greenhouse facilities

Only 40% or 398 ha of all greenhouse facilities in the country are heated, suggests data from SFA – this is the heated area that has applied for income support. The surging energy prices make it more difficult for producers to keep producing during winter months.

Heated facilities are located predominantly in Blagoevgrad district (40% of all), followed by Pazardzhik district (17%), Plovdiv district (12%), Haskovo (8%), and Sofia (6%) – see Fig. 6. By type of crop heated greenhouses cover mainly tomatoes and cucumbers, with smaller areas of peppers, raspberries and strawberries.

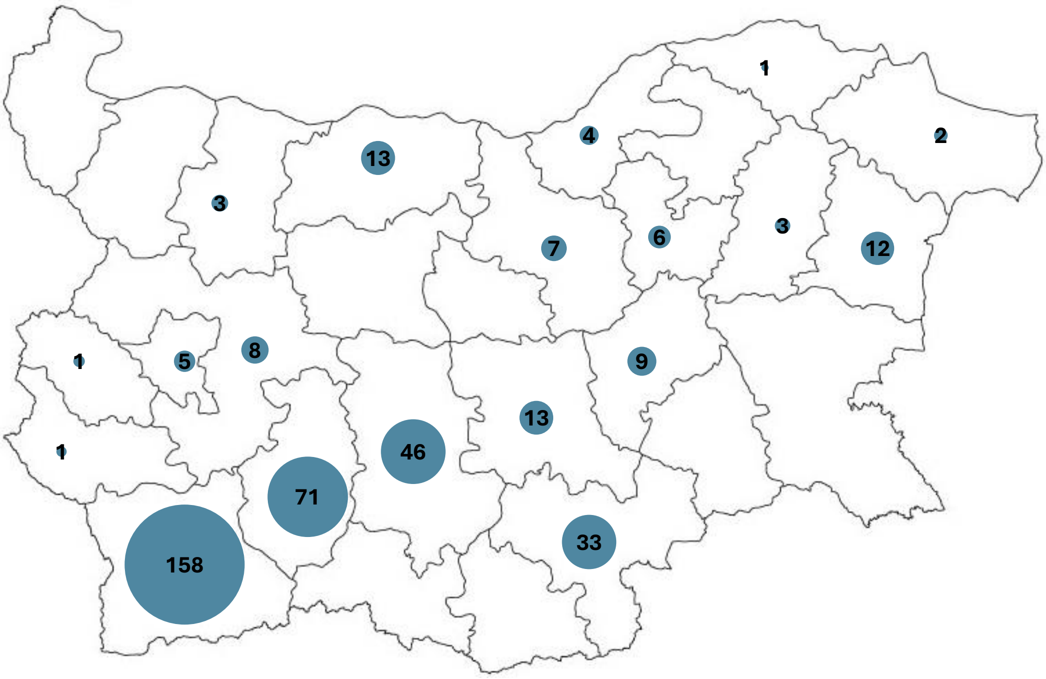
Table 4 – Top 5 provinces with heated greenhouse facilities and by the type of crop grown

ha	tomatoes	peppers	cucumbers	strawberries	raspberries
1. Blagoevgrad	115.39	4.04	37.82	1.05	-
2. Pazardzhik	15.42	3.68	48.8	0.96	-
3. Plovdiv	23.14	1.69	16.07	0.52	4.57
4. Haskovo	15.52	1.5	13.24	2.24	-
5. Sofia*	6.61	8.22	6.06	1.42	1.07

Source: SFA

** Data for Sofia includes Sofia-district and Sofia-capital. Data shown might be higher than actual, as it can include companies that are registered in the district but which facilities are in other parts of the country.*

Fig. 6 – Total greenhouse area (ha) of heated facilities >0,5 ha, 2023



Source: SFA

Some of the largest greenhouse operators in the country – Gimel I&II, are using gas cogeneration system for heating and electricity production, which is sold via the national grid system to offset the cost of heating. The cogeneration system has 41,7% heat efficiency and 43,6% electricity efficiency[6]. Other large companies also use cogeneration system based on natural gas, such as Melgi (7th largest greenhouse), PAP[7] Rymiana Velichkova (15th), Oranjerii Petrov dol (18th). The combined acreage of those farms makes up for 16,2% of total heated greenhouse area in the country.

Key takeaways:

- Total greenhouse area in Bulgaria is growing despite of some discrepancies in statistics.
- Main production areas are Blagoevgrad, Pazardzhik and Plovdiv districts, where also the largest share of heated facilities is.
- The majority of facilities (3/4) are under the relatively more energy intensive polyethylene cover which explains the lower share of heated greenhouses.

4. Technology implementation

In order to determine the level of technology adopted in Bulgarian greenhouse sector and its future intentions, InteliAgro conducted an online survey among greenhouse operators during the period 15-29 September 2024. A total of 19 companies of size > 0,5 ha, and from 10 different districts within the country participated with a combined area of 48,3 ha, representing 4% of protected area in facilities over the threshold size of 0,5 ha. Although the survey cannot be considered a national representative it provides some

[6] https://www.dker.bg/files/DOWNLOAD/res-Or-Gimel-2012.pdf

[7] *PAP stands for Private Agricultural Producer*

valuable insights on the level of technology adopted and the future intentions in the sector.

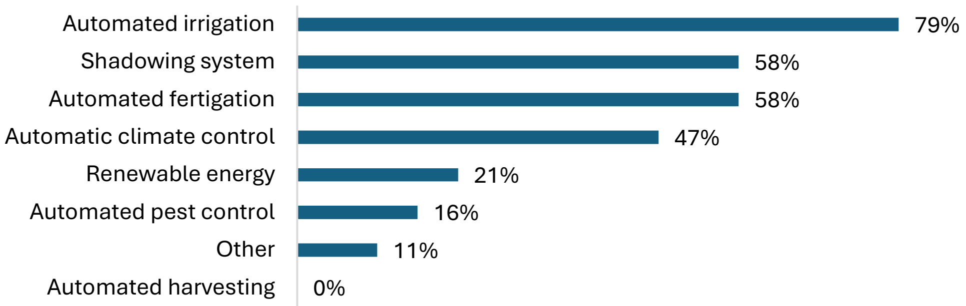
The average age of the respondents was 47 years, of whom 60% have a higher education (master's degree), 10% have a higher education (bachelor's degree), and the rest have lower education. 72% of all respondents are business owners, while 22% are managers.

The results show that a little over 50% of the respondents have built their facilities in the last 10 years. They represent 45% of the total area but most of it is under polyethylene cover. Glass constructions by large are older than 20 years.

Regarding the growing method 56% of the surveyed area is substrate-based, while the rest use hydroponics. These results, however, must be taken with the consideration that half the greenhouse area is more or less a simple tunnel technology which does not use very advanced breeding techniques.

Results show that the surveyed respondents are unevenly distributed between level 2 (semi-advanced) and level 3 (advanced) technology and those who lag are moving forward.

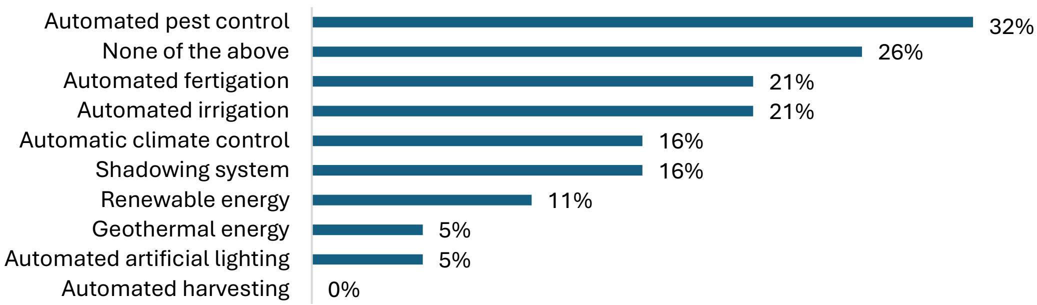
Fig. 7 – Q: Which of the following technologies have you implemented in your greenhouses? (more than one answer is possible)



Base: 19

Source: InteliAgro

Fig. 8 – Q: Which of the following technologies do you plan to implement in your production? (more than one answer is possible)



Base: 19

Source: InteliAgro

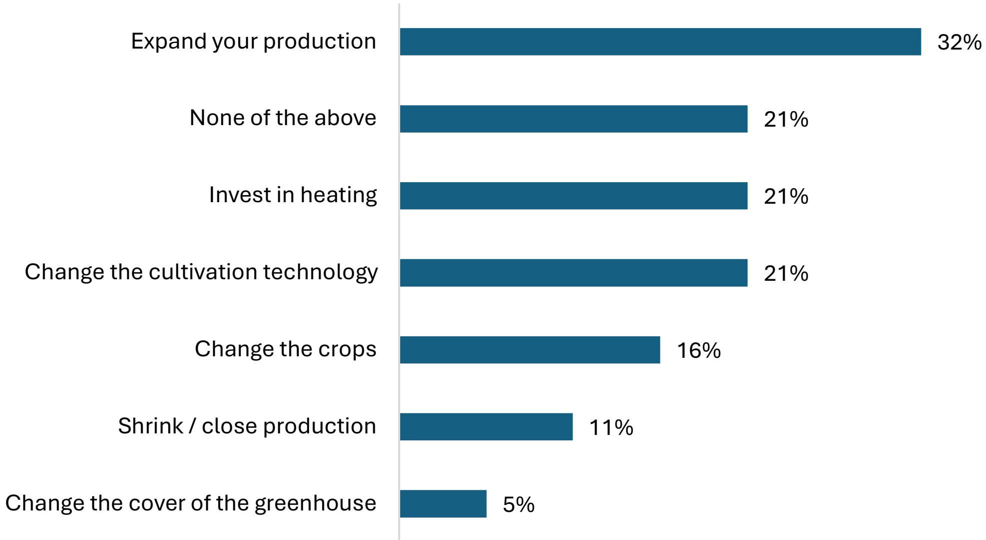
While 31% of the respondents reply that they are planning to expand their production in the next three-year period, one in ten producers say that they will decrease their output or exit the business.

One in five says they will change the growing method from substrate based.

One if five shares intention to invest in heating.

Changing the crops grown is planned by 16% of the respondents.

Fig. 9 – Q: What are your plans for the next three-year period?



Base: 19

Source: InteliAgro

Key takeaways:

- The level of technology adaptation in the sector is somewhat limited taking into account the average yields, share of hard cover and heating, as well as the data from company interviews are considered.
- The large share of polyethylene, incl. in new investments is an indicator for low-intensity production, respectively for low investment incentives.
- One-third of the respondents are willing to expand production. Overall, the number of farmers who are looking for a different technological solution (crop diversification, heating, change of growing method) is double the number of those, who are willing to decrease or quit production.

5. Energy as a production factor

Energy cost is major factor in all-year greenhouse production of vegetables in the temperate climate zone, where Bulgaria (still) belongs. The coldest months are December and January[8], but heating season can start as early as October and can continue through April. Greenhouses use natural gas or biomass (pellets) for heating, while a limited number of facilities use geothermal energy as primary source for heating.

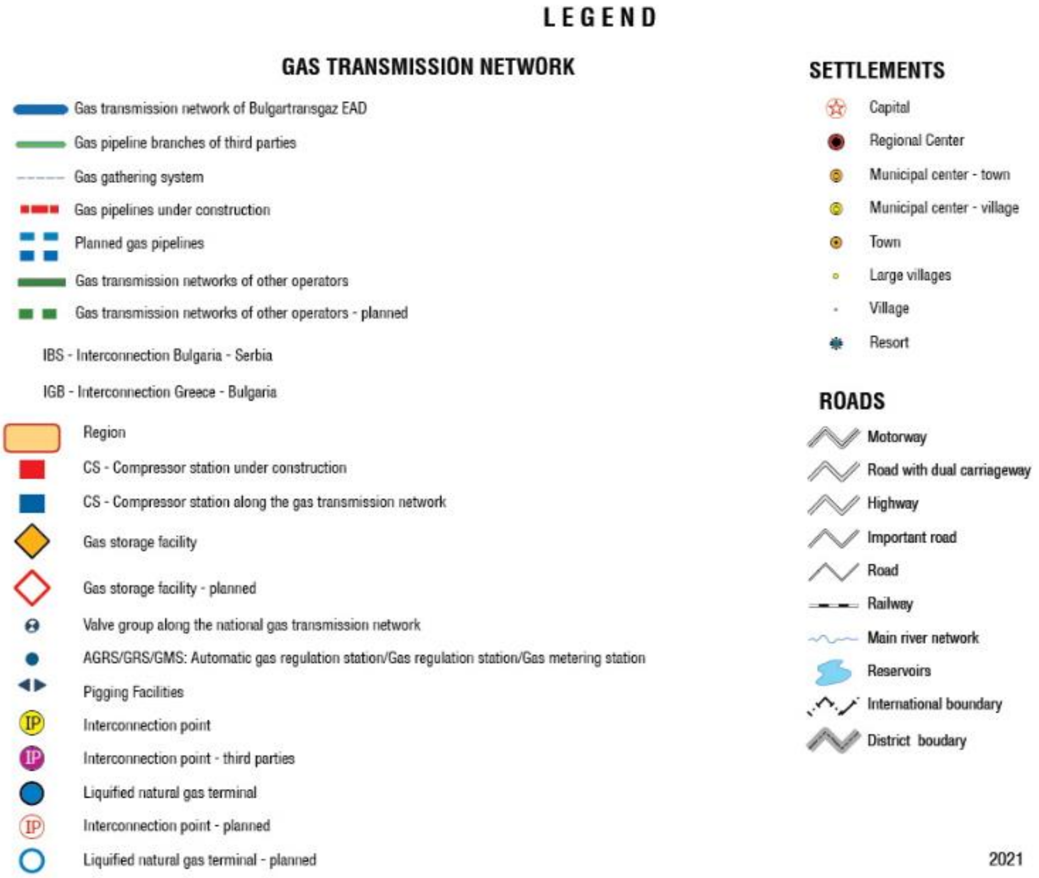
The choice of heating solution depends on the infrastructure (national natural gas grid system), the availability of energy resources, capital costs of alternative solutions, supply cost of different energy sources, access to subsidies or other financial instruments for incentivising low CO2 footprint production, costs and time for issuing permits and other factors.

National natural gas grid system is somewhat developed and covers most of the main production regions in the country – see Fig 10. However, sufficient investments in gas pipeline extensions might be needed in certain areas, where production facilities are kilometres away from the grid, so gasification is not always the easiest solution.

Fig. – 10 Natural Gas Grid

*Source: Bulgartransgaz**
See legend below:

[8] *Source: World Bank Climate Change Knowledge Portal*



If direct access to the natural gas grid is not possible, alternative solution can be the construction of on-site storage solutions (LNG, CNG or switching to LPG), which can require higher investments.

Other alternatives are the biomass (pellets) heating system or geothermal energy. Geothermal energy can be the cheapest solution if it is next to the end user. Most geothermal water deposits in the country are well developed – meaning that they have been researched, drilled and made available to people and business via public infrastructure.

However, if geothermal water deposit is not available nearby and initial investment in drilling, piping, and geothermal heat pumps is needed, gasification remains the cheapest solution when investment costs are considered. Installation of a heating system can vary a lot, depending on several factors, but rough estimations show that initial investment in biomass can surpass gasification by a factor of two, while geothermal heating solution can surpass by a factor of seven and even more[9] – see Table 4.

[9] *ChatGPT was used for the calculations.*

Table 4 - Summary of investment costs of different heating systems for a 2 ha greenhouse

Option	**Estimated Total Cost per installed kWth (EUR)**
Gasification connection to national grid	€80-150
Biomass Heating System	€150 - €300
Geothermal Heating	€600 - €3000

Source: InteliAgro

While initial investment costs may vary by large the exploitation costs and fuel costs are also to be considered. Exploitation costs may be higher in biomass heating system due to ash management. Fuel costs may vary depending on the type of construction of the production facility (polyethylene, glass and polycarbonate, for instance, have different insulation capacity) and the type of energy source which can make a difference when an investor decides what system they will invest in. While polycarbonate has definite advantages in heat preservation its usage remains limited in the country where 74% of the covered acreage is under polyethylene (see previous sections).

Availability of resources and fluctuations of energy prices are also an important factor (e.g. many Bulgaria producers stopped heating due to sky-rocketing prices of natural gas in 2022-2023 season).

Table 5 – Ranking of different types of houses covers by energy consumption

Type of construction	Energy Demand	Pros	Cons
1. Polyethylene (PE) Film	400-700 kWh/m^2/year	Low cost, light weight	Poor insulation, short lifespan, heating costs
2. Single-Glazed Glass	300-500 kWh/m^2/year	Light transmission, durability	Expensive, heavy, relatively high heating cost
3. Double-Glazed Glass	250-350 kWh/m^2/year	Excellent insulation, durability, light transmission	Expensive, heavy
4. Polycarbonate (Multi-Wall)	250-400 kWh/m^2/year	Lightweight, durable, good insulation, and UV-resistant	More expensive than polyethylene, but cheaper than glass
5. Acrylic Panels	250-400 kWh/m^2/year	Durable, good insulation, high light transmission	Higher cost than polyethylene, but more durable and efficient
6. ETFE (Ethylene Tetra-fluoroethylene) Film	200-300 kWh/m^2/year	Lightweight, highly durable (up to 30 years), excellent light transmission, and very energy efficient.	Higher initial cost, though prices are decreasing as the material becomes more widely used.

Sources: IEA, FAO

Table 6 – Price comparison of heating cost for 1 sq. m. of greenhouse production in Bulgaria per year for 2023

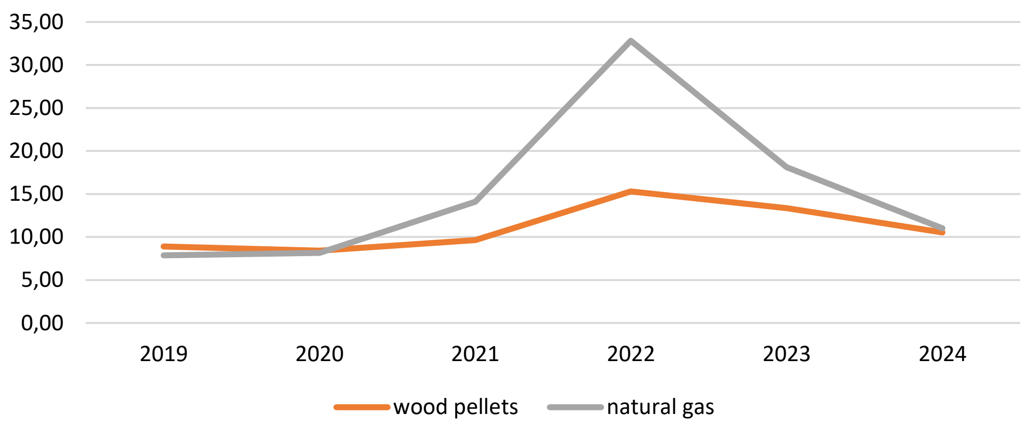
	Energy demand	Natural Gas	Wood Pellets	Geothermal*
Polyethylene	2.16 GJ	€43.2	€28,84	≈€4-10
Glass	1.62 GJ	€32.4	€21,63	≈€3-7
Polycarbonate	1.26 GJ	€25.2	€16,82	≈€2-3

** Based on assessment. Depending on variety of factors the price range is between €2-5/GJ.*

Source: InteliAgro

Although the 2021-2023 period proved very difficult for natural gas consumers, market prices for the biomass alternative are not that competitive in the six-year period starting from 2019. In three out of the six years, heat energy produced by wood pellets cost similar to natural gas.

Fig. – 11 Price comparison between natural gas and wood pellets in EUR/GJ, Bulgaria



Source: National Statistical Institute (NSI), own calculations

Obtaining price data for geothermal energy is not an easy task. In Bulgaria, geothermal energy pricing and the way it is charged depend on several factors, including the type of geothermal resource (low or high temperature), its application (heating, electricity generation, etc.), and regional regulations. Geothermal energy for direct heating (like greenhouse heating) is typically charged based on the amount of water extracted, the heat extracted usually measured in gigajoules (GJ) or megawatt-hours (MWh) and infrastructure maintenance taxes (if applicable). The price can be a subject of local regulation, depending on the operator of the mineral water deposit (whether it be the government or a municipality)[10]. According to own calculations based on public sources 1 GJ can cost as low as EUR 1,5-2[11].

[10] Decisions for water intake - №44/14.07.2015 (Nova Zagora Municipality), №2/10.07.2017 (Blagoevgrad Municipality)

[11] Based on research of decisions for water intake and municipal ordinances.

According to a survey conducted for the purpose of this report the share of energy costs in total production cost might be in the following ranges:

Table 7 – Share of energy cost in production cost by type of energy source

Type of fuel	Number of respondents	Hectares	Share of energy cost in production cost
Natural gas	4	22	65-75%
Biomass (wood pellets, straw)	7	12.5	35%
Geothermal energy	3	4	40-50%*

** Costs are for geothermal facilities based on heating pumps*

Source: interviews with companies

The data, although not representative, suggests that natural gas is used in larger facilities, while biomass and geothermal energy is used in medium and smaller enterprises.

Key takeaways:

- High energy costs can be a setback for production in a region that borders competitors with milder climate.
- While biomass is probably used more often than any other source of green energy, its competitive advantages are somewhat questionable.
- Geothermal energy can provide a low-cost alternative, depending on the size of the initial investment.

6. SWOT

Strengths, Weaknesses, Opportunities and Threats

The Bulgarian greenhouse industry has a solid foundation in terms of climate, tradition, and market access. Industrial off-season production has been developing for 50 years now exploiting the temperate climate and relatively shorter heating season compared to Northeastern Europe, which was its main export market till the early 1990's.

The sector, however, faces many challenges in terms of technological adoption and operational costs. The overall economic downturn in the end of the 20th century led to abeyance in many facilities and to a technological backlog that the industry was not able to catch up despite of the EU pre-accession funds, CAP instalments and private investments. Energy costs can be a drag to production not least because of the limited adoption of more energy efficient solutions. The infrastructure in the country (roads, road connections, border transit capacity, water transfer and irrigation grid) is generally in mediocre condition, which can lead to higher investment, production and logistics costs.

The greenhouse sector in Bulgaria has significant opportunities for growth by leveraging EU funding, improving energy efficiency, and targeting niche markets like organic produce. The country has been focusing on how it can make use of its geothermal potential during the last few years and public funding is expected to be channelled in the development of geothermal usage for electricity and heat energy from the National Recovery and Resilience Plan[12]. Exploiting the organic and sustainable farming niche can also be a successful strategy as the example of Gimel JSC proved in the past decades.

However, to remain competitive, producers need to address threats like increasing competition from countries like Greece, Spain, Turkey, the Netherlands, etc. Bulgaria is bordering the Mediterranean climate zone where its main competitors enjoy more sunny days and less energy demand for heating. In terms of cherry tomato production, the local market is occupied by suppliers like the Netherlands and Spain, who have more advanced growing technology. Energy price volatility, especially in recent years can be a threat to regular supply. Increasing cost of labour can be a limiting factor as well but can also provide opportunity for investment in automation and robotics. Intensive farming and changing climate is another factor for consideration that may lead to increasing pest and disease pressure.

STRENGTHS	**WEAKNESSES**
Favourable climate	Energy costs
Traditions	Limited Adoption of High-Tech Solutions
Proximity to key markets	Infrastructure and logistics
OPPORTUNITIES	**THREATS**
Growing demand for local produce	Increasing international competition
Export opportunities	Volatile energy prices
Technological Advancement and Innovation	Labor shortage
Government and EU Investment in Green Energy	Pest and disease pressure
Organic and sustainable farming	

7. Geothermal-heated showcases

Some examples of geothermal usage for greenhouse heating are Pirin Plod Levunovo, ET Kostadin Baichev – 1977, Greenhouse Group. The common thing between those cases is that they use already available (drilled) mineral water deposits, so they connect to existing infrastructure thus bringing initial investment to a minimum.

7.1 Green House Group

Est.: 2015
Address: Zelendol (Blagoevgrad municipality)
Acreage: 1,29 ha
Crop: cucumbers
Mineral water deposit: “Blagoevgrad – Struma River”, 14XG borehole (managed by Blagoevgrad municipality)
Water t: 63°C

[12] *https://www.mlsp.government.bg/uploads/3/baneri/natsionalen-plan-za-vzstanovyavane-i-ustoychivost-na-republika-blgariya/bg-finalrrp-2022-04-06-08-30-tca.pdf*

Max. debit of drill: 4.8 l/s
Max. debit of the permit: 2 l/s
Max. annual water volume of the permit: 36 633 m3
Period of permit: 15 years

7.2 Pirin Plod Levunovo

Est.: 2016
Address: Levunovo (Sandanski municipality)
Acreage: 1,3 ha
Crop: n.a.
Mineral water deposit: “Levunovo”, MS-3 borehole (managed by Sandanski municipality)
Water t: 83℃
Max. debit of drill: 12.5 l/s
Max. debit of the permit: 3.49 l/s and 7 l/s for the period 01.11-30.04
Max. annual water volume of the permit: 110 073.6 m3
Period of permit: 10 years

7.3 ET “Kostadin Baychev – 1977”

Est.: 2015
Address: Banya (Nova Zagora municipality)
Acreage: 0.66 ha
Crop: n.a.
Mineral water deposit: “Banya (Nova Zagora)”, KEI-1, KEI-2 and XG-1 boreholes (managed by Nova Zagora municipality)
Water t: 56.6℃
Max. debit of drill: 4.24, 7.35 and 0.52 l/s respectively for the boreholes
Max. debit of the permit: 3.66 l/s and 7.29 l/s for the period III-V and IX-XI
Max. annual water volume of the permit: 115 263.6 m3
Period of permit: 20 years

7.4 Greenhouse Dolna Dikanya

Est.: 2015
Address: Dolna Dikanya (Radomir municipality, Pernik District)
Acreage: 1.1 ha
Crop: tomatoes
Energy source: own geothermal boreholes with a total length of 8 km.



Source: company website

8. Geothermal energy capacity in Bulgaria

8.1 General Overview

The term “geothermal” energy comes from the Greek words for heat (therme) and Earth (geo). However, heat in the deep and shallow parts of Earth comes from two distinctly different sources.[13] **The first source is deep heat energy** generated within the Earth itself by the radioactive decay of unstable isotopes and friction. Deep heat causes the temperature of rocks underground to increase with depth, to an estimate of over 5000°C at the Earth’s core. When the buried hot rock is permeable and contains water (termed an ‘aquifer’ or a ‘reservoir’), wells can produce the hot water to carry the heat-energy to the surface for use.

According to Bulgarian Association for Geothermal Energy, “in Bulgaria, the potential of deep geothermal energy for power generation and direct-heat-uses is strongly dependent upon the geology. The country can be divided into two geological provinces, north and south of the Stara Planina Mountains. The northern geological province is an ancient, large sedimentary basin that is prospective for medium to high temperature resources in hot-sedimentary aquifers. In this province, widespread historic drilling for oil and gas has already proven the presence of reservoirs and high temperatures. In the deeper parts of the basin in Northwest Bulgaria, at 4 km to 6 km, the temperature is commonly greater than 150°C and could even exceed 200°C in some places. The southern geological province is a complex patchwork (shown by the topography) of small sedimentary basins (lowlands) separated by hills and mountains made of older rocks (highlands). The small basins formed in places where tectonic movements have fractured, faulted and stretched the Earth’s crust. Shallow aquifers in these basins are prospective for low and possibly medium temperature resources.”

The second source is shallow heat energy from the sun that is stored in the ground. This ambient shallow heat energy means the temperature of the Earth just below ground (from 2m to 250m depth) is a constant 10-15°C. The heat from both deep and shallow geothermal energy sources has many direct uses[14].

Thus, an investor has two main options to use geothermal energy based on the type of geothermal resources available and the greenhouse's design:

1. Direct use of geothermal fluids – either high-temperature geothermal water can be used directly to circulate through pipes in the greenhouse to maintain the desired temperature, or, if the water is not suitable enough for direct circulation, a heat exchanger can transfer the heat to a secondary, cleaner water system that warms the greenhouse.

2. Shallow systems with heat pumps (GHP) – optimal for regions with lower-temperature geothermal sources.

[13] *The information in this paragraph is based directly on: https://www.bage.bg/geothermal-bulgaria*
[14] *See above.*

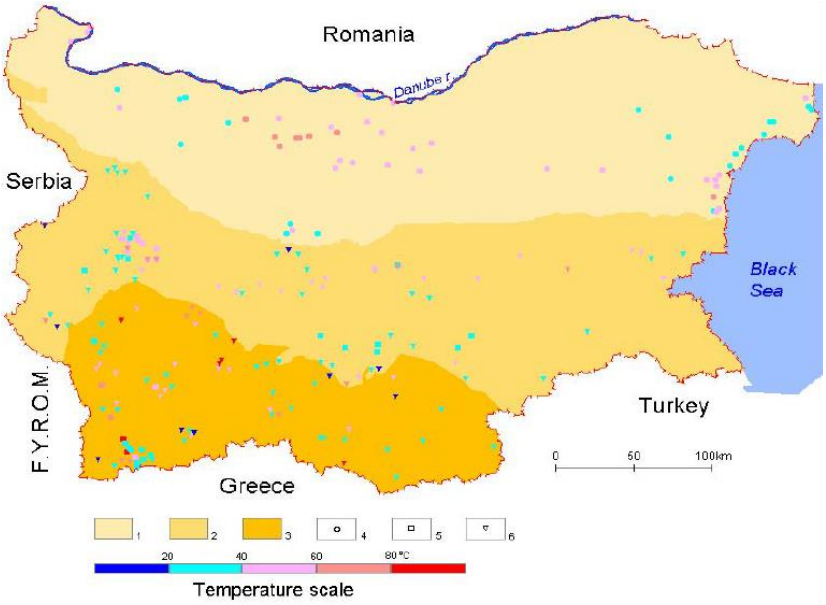
There is a third option as well, which has relatively limited application – integration with balneological facilities where the waste heat is utilized in greenhouse production.

Combined heat and power facilities are solutions only in theory as no plans for such have been announced so far.

In Bulgaria, low and medium temperature sources of deep geothermal energy, at 1km to 4km underground, have a wide-range of viable Direct-Heat-Use applications, so long as the resource is next to the end-user. Sources with temperature up to 75°C can be used to heat greenhouses, fisheries, balneology, and spa hotels[15].

The country's rich mineral water deposits are relatively well researched, mapped and developed and can be used directly for heating purposes. There are a total of 102 deposits that are exclusive state property. They have temperature ranging between 20-90 ℃ (42,5℃ average). The total confirmed exploitation resources of those deposit amount to 6542 l/s with technical debit of the groundwater facilities of 2478 l/s. To this should be added 49 mineral water deposits that are public municipal ownership with confirmed exploitation resources of 493,4 l/s and technical debit of the groundwater facilities of 454 l/s.

Fig. – 12 Map of hydrothermal deposits in Bulgaria

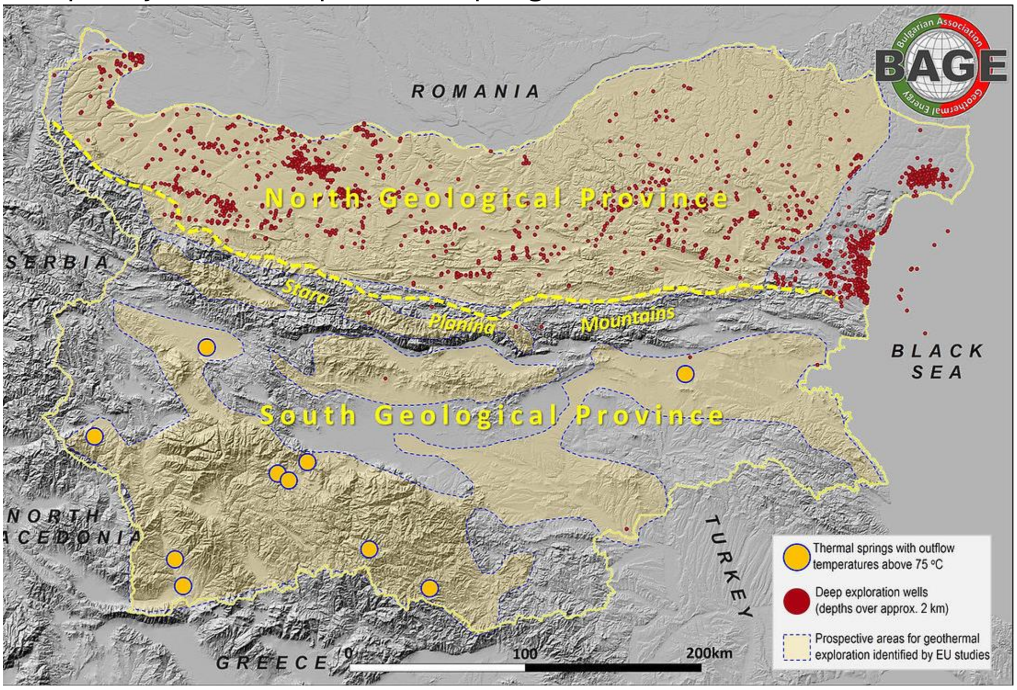


1. Moesian plate (stratified reservoirs)
2. Sredna gora (secondary stratified reservoirs, fractured reservoirs)
3. Rila-Rhodopes mountain region (mainly fractured reservoirs)
4. Major wells and groups of wells discovering stratified reservoirs in a plate region
5. Hydrothermal sources associated with waters from fractured reservoirs located in Southern Bulgaria.
6. Hydrothermal sources associated with waters from secondary stratified reservoirs located in Southern Bulgaria

Source: Bulgaria Geothermal Update Report, Klara Bojadgieva et al., 2010

[15] *See above.*

Fig. – 13 Map of hydrothermal potential, springs and wells



Source: Bulgarian Association Geothermal Energy

8.2 Hydrothermal deposits by debit, energy capacity, temperature:

Northeastern Bulgaria holds the largest capacity of known mineral water deposits in the country amounting to nearly half the debit (48%). The “NE region” underground water deposit from the Malmovalanje aquifer with temperatures between 20-55ºC, has nine sections, covering three districts – Varna, Dobrich and Shumen, and has a total flow rate of 1140 l/s, while the smaller Varna basin with temperatures between 22-30ºC has two sections covering Varna and Dobrich region. Most of the deposits supply mineral water to the Black Sea resorts: Albena, Golden sands, St. Konstantin and Helena, Rusalka, etc.

Table 8: Mineral water deposits in Northeastern Bulgaria (Varna, Dobrich and Shumen districts)

#	Name of deposit - operator	Municipality	District	Temp ℃	Debit l/s	E KJ/s
1	**NE Bulgaria region**			20-55	1140	263132
	Varna – Varna mun.*	Varna	Varna	37.4	1002	1634
	Aksakovo – Aksakovo m.	Aksakovo	Varna	34	50.8	n.a
	Suvorovo – Suvorovo m.	Suvorovo	Varna	23	16	n.a
	Beloslav – Beloslav m.**	Beloslav	Varna	n.a.	n.a.	n.a.
	Avren – Avren mun.	Avren	Varna	32	1944	9.2
	Balchik – Balchik mun.***	Balchik	Dobrich	24-30	194.6	1687
	Kavarna – Kavarna mun.*****	Kavarna	Dobrich	40	135.8	9593
	Shabla – Shabla mun.	Shabla	Dobrich	38.6	35	19020
	Shumen – Shumen mun.	Shumen	Shumen	20.2	8.5	n.a.
2	**Varna basin region**			21-30	54.8	4777

	Varna – Varna mun.*[5]	Varna	Varna	26-30	24.6	2470
	Balchik – Balchik mun.*[6]	Balchik	Dobrich	17-29	30.2	1610

** a total of 23 wells supplying Varna and the resorts Albena and St. Konstantin and Helena*
*** no water taking facilties*
**** a total of 10 wells supplying Balchik, Albena and Kranevo*
***** a total of six wells supplying Kavarna and the resorts: Rusalka and White lagun*
****** a total of seven wells*
******* a total of 12 wells*
Source: Ministry of Environment and Waters (MOEW)

Blagoevgrad district holds nearly 10% of the known mineral water deposits in the country in terms of debit. Some of them, like Ognyanovo (№3), Sandanski (№3), Dobrinishte (№7) are largely exploited for balneological purposes. Bankso, Razlog, Dobrinishte and Sandasnki are popular tourist destinations with many hotels competing for the hydrothermal potential of the respective areas.

Table 9: Mineral water deposits in Blagoevgrad district

#	**Name of deposit - operator**	**Municipality**	**District**	**Temp ℃**	**Debit l/s**	**E KJ/s**
1	**Guliyna banya – Razlog mun.**	Razlog	Blagoevgrad	53	59.73	8822
2	**Rupite-Peteich mun.**	Petrich	Blagoevgrad	73.5	25	3676
3	**Ognyanovo-Garmen mun.**	Garmen	Blagoevgrad	39.58	33.86	3405
4	**Eleshitza – Razlog mun.**	Razlog	Blagoevgrad	56.2	16	2520
5	**Sandanski**	Sandanski	Blagoevgrad	72-82	21.7	1982
6	**Marikostinovo-Petrch mun.**	Petrich	Blagoevgrad	63	11.2	1731
7	**Dobrinishte – Bansko mun.**	Bansko	Blagoevgrad	40.3	15.36	1609
8	**Blagoevgrad – Blagoevgrad municipality**	Blagoevgrad	Blagoevgrad	55	13.5	1207
9	**Hotovo – Sandanski mun.**	Sandanski	Blagoevgrad	38.7	3.94	336
10	**Blagoevgrad-Struma – Blagoevgrad mun.**	Blagoevgrad	Blagoevgrad	57.8	6.3	269
11	**Katuntzi**	Sandasnki	Blagoevgrad	27.4	2.22	90
12	**Simitli**	Simitli	Blagoevgrad	50-60	18.38	60
13	**Levunovo – Sandanski mun.**	Sandanski	Blagoevgrad	83	13.21	n.a.

Source: MOEW

Pazardzhik district holds nearly 8.5% of the mineral water deposits in the country in terms of debit. Most of them are concentrated in the spa resort of Velingrad.

Table 10: Mineral water deposits in Pazardzhik district

#	Name of deposit - operator	Municipality	District	Temp ℃	Debit l/s	E KJ/s
1	**Banya – Panagiyrishte mun.**	Panagiyrishte	Pazardzhik	39	18.83	143.8
2	**Belovo – Belovo mun.**	Belovo	Pazardzhik	22.8	29	185.3
3	**Bratzigovo – Bratzigovo mun.**	Bratzigovo	Pazardzhik	25.5	1.75	n.a.
4	**Varvara – Septemvri mun.***	Septemvri	Pazardzhik	42-87	11.2	3683
5	**Velingrad, Kamentitza****	Velingrad	Pazardzhik	61	29.32	347
6	**Velingrad, Ladzhene****	Velingrad	Pazardzhik	34.5	35.6	5598
7	**Velingrad, Chepino****	Velingrad	Pazardzhik	47.5	55.65	6412
8	**Draginovo, Velingrad mun.**	Velingrad	Pazardzhik	78-97	10	3284
9	**Strelcha – Strelcha mun.**	Strelcha	Pazardzhik	56	18.5	2310

** a total of six wells, some of them supplying hotels and guest houses*
*** Velingrad is the largest spa resort on the Balkan peninsula*
Source: MOEW

Sofia region ranks four in terms of mineral water deposits (8.2% of total debit). While there are many deposits within the city borders, their capacity is somewhat limited and already exploited for balneological, sports and public water uses. The Sofia valley, however, is rich in thermal waters that provide good resource for industrial purposes.

Table 11: Hydrothermal deposits in Sofia district

#	Name of deposit - operator	Municipality	District	Temp ℃	Debit l/s	E KJ/s
1	**Sofia valley***	Sofia	Sofia	20-50	32.8	2591
2	**Sofia-Batalova vodenitza – Sofia mun.**	Sofia	Sofia	43	6.3	739
3	**Sofia Gorna banya****	Sofia	Sofia	19-41	8.54	n.a.
4	**Sofia Zheleznitza – Sofia mun.*****	Sofia	Sofia	30-32	5.18	347
5	**Sofia Kniazhevo******	Sofia	Sofia	21-36	5.7	339
6	**Sofia Lozenetz**	Sofia	Sofia	38,5	2,24	220
7	**Sofia Nadezhda**	Sofia	Sofia	54	4	654
8	**Sofia Ovcha kupel**	Sofia	Sofia	31,5	5	344
9	**Sofia Pancharevo***[5]	Sofia	Sofia	39-48	13,5	1744
10	**Sofia Svoboda***[6]	Sofia	Sofia	48.2	2.23	310
11	**Sofia Tzentar***[7]	Sofia	Sofia	48	20	2765

** a total of 14 wells*
*** a total of four wells*
**** a total of four wells*
***** a total of six wells*
****** a total of two wells*

******* a total of two wells*
******** a total of two wells*
Source: MOEW

Table 12: Hydrothermal deposits in Plovdiv district

#	Name of deposit - operator	Municipality	District	Temp ℃	Debit l/s	E KJ/s
1	**Banya – Karlovo mun.***	Karlovo	Plovdiv	30-50	35.3	4008
2	**Krasnovo – Hisarya mun.****	Hisarya	Plovdiv	53-55	5.74	961
3	**Hisarya – Hisarya mun.*****	Hisarya	Plovdiv	34-52	32	n.a.
4	**Narechenski bani – Asenovgrad mun.**	Asenovgrad	Plovdiv	19-28	2,4	116
5	**Pavel banya******	Pavel banya	Plovdiv	48-60	10,6	1927
6	**Pesnopoy – Kaloyanovo mun.**	Kaloyanovo	Plovdiv	42-43	8,74	1020

** a total of seven wells*
*** a total of two wells*
**** a total of 17 wells, Hisarya is a renown spa resort*
***** a total of four wells*

The installed capacity is relatively modest. Geothermal energy is utilized mainly for direct applications, such as heating and balneotherapy (medical treatment using mineral waters), rather than for electricity or heat generation.

The following figures represent the thermal energy capacity used for direct applications rather than electricity generation, as Bulgaria has not yet developed geothermal power plants for electricity. The potential for expanding geothermal energy, especially for heating and balneotherapy, remains significant across the country, especially in regions with high geothermal gradient and available natural hot springs.

Here is a breakdown of the used geothermal energy capacity in Bulgaria by region:

Southwest Bulgaria (including Sofia region)
Installed Capacity: Approximately 15-20 MW (thermal)
Main Uses: Primarily used for heating in Sofia and surrounding areas, as well as in spa resorts like Sapareva Banya.
Key Locations: Sapareva Banya, Blagoevgrad, Sofia, and surrounding areas.

South Central Bulgaria
Installed Capacity: Around 10-15 MW (thermal)
Main Uses: Heating and balneotherapy, particularly in regions like Hisarya and Velingrad.
Key Locations: Hisarya, Velingrad, and Pazardzhik.

Southeast Bulgaria
Installed Capacity: Approximately 5-10 MW (thermal)

Main Uses: Primarily for heating and spa facilities.
Key Locations: Burgas, Sliven, and Yambol regions.

Northeast Bulgaria
Installed Capacity: Around 5 MW (thermal)
Main Uses: Balneotherapy and heating.
Key Locations: Varna, Shumen, and Dobrich.
North Central Bulgaria
Installed Capacity: Less than 5 MW (thermal)
Main Uses: Limited use, mainly for balneotherapy.
Key Locations: Veliko Tarnovo, Pleven, and Lovech regions.

Northwest Bulgaria
Installed Capacity: Minimal, less than 2 MW (thermal)
Main Uses: Mostly underdeveloped potential, minor heating uses.
Key Locations: Vidin, Montana, and Vratsa regions.

Total Geothermal Energy Capacity in Bulgaria:
Estimated Total Installed Capacity: Around 40-50 MW (thermal)

8.3. SUSTAINABLE USAGE

Using geothermal energy in a sustainable way has broader aspects than the released / saved CO_2 emissions from its production, but also the continuous availability of energy at the source. The technology used can lead to the so called "thermal breakthrough" – a point of time when the produced water temperature starts to decline (Gringarten, 1978; Gringarten and Sauty, 1975) due to the cooling down of the initial reservoir caused by re-injection of the used water back into the ground.

In Bulgaria this issue is indirectly addressed through a combination of legal frameworks designed to regulate the sustainable use of geothermal resources. The primary legislative tools include the Renewable Energy Act (REA), the Spatial Planning Law (SPL), and the Waters Act (WA). These laws govern permits for resource extraction and usage, categorize geothermal systems based on depth (e.g., deep versus shallow sources), and provide guidelines for operational practices to ensure resource longevity and prevent overexploitation. These include rules for annual self-monitoring of end-users of hydrothermal waters and for regular monitoring of the reservoirs by the respective administrative bodies who oversee the water basins.

Efforts to prevent thermal breakthrough involve regulating the flow rates and extraction volumes under state-issued permits. Currently, about 80% of the utilized geothermal water is managed through such permits, which are aimed at ensuring sustainable extraction while maintaining thermal equilibrium in reservoirs. The government also emphasizes modernizing and managing heating networks and geothermal facilities, reducing inefficiencies that could exacerbate issues like thermal breakthrough

However, re-injection of water is permissible in cases of water use for the extraction of hydro-geothermal resources (both deep and shallow) and the parameters of the outflow are regulated within the initial permit (art. 118a (11) and (12) of the Waters Act) – see Waters Act below.

Key takeaways:

- Bulgaria is rich in hydrothermal deposits which in many cases can provide an extremely cheap source of energy.
- Some of the richest regions in terms of hydrothermal deposits are those with highest concentration of greenhouse facilities. Some of those are already utilizing mineral water deposits for heating purposes. Sometimes existing hotel infrastructure could have already reserved the capacity of existing mineral water wells. In the latter cases integration with balneological facilities can be made to use the waste heat in greenhouse production.
- Shallow heat energy can also be used for the purpose of greenhouse heating, however high investment costs can be a setback, unless grant funding is available.

9. Regulatory environment, public policy and funding

Bulgaria has been working actively to enhance the usage of geothermal energy, aligning it with its broader renewable energy and decarbonization goals. Recent amendments to the Renewable Energy Act (REA), Spatial Planning Law (SPL), and Waters Act (WA) have simplified administrative processes for geothermal projects. For example, shallow geothermal systems no longer require detailed investment project approvals and permits for deep-source geothermal systems have been streamlined. Geothermal resources are now classified by depth (shallow vs. deep), with regulatory frameworks tailored to the specific requirements of each type.

The use of geothermal energy for greenhouse production in Bulgaria involves navigating several legal frameworks. Here are the specific legal limitations and regulations that apply:

9.1 Review of current legislation.

9.1.1. Renewable Energy Sources Act - RESA (2011)[16]

The Act defines the terms “geothermal energy”, “low-temperature geothermal energy” (up to 30 degrees Celsius), “mid-temperature geothermal energy” (up to 90 degrees Celsius) and “high-temperature geothermal energy” (>90 degrees Celsius), “geothermal resources”, “deep” and “shallow geothermal resources” (up or below 200 m. depth), as well as “hydro geothermal resources”. It also treats the installation of GHP’s and the long-term contracts for buying out of energy, produced via geothermal resources.

9.1.2. Waters Act (2000)[17]

[16] *https://lex.bg/laws/ldoc/2135728864*
[17] *https://lex.bg/laws/ldoc/2134673412*

- **Permitting:** Individuals and legal entities have the right to free use of surface and underground water bodies in the cases of exploitation of shallow geothermal resources and construction of related geothermal systems up to certain capacity (in accordance with art. 7 of Reg. 2022/2577) in accordance with the terms of the Law on Energy from Renewable Sources.

  The use of mineral waters as a source of geothermal energy is regulated by the Water Law, unless otherwise specified by the Underground Resources Act (see below). To utilize geothermal resources from mineral water deposits, you must obtain a permit from the Ministry of Environment and Water (MOEW). The permit will specify the amount of water that can be used, as well as the method of outflow, circulation, reinjection or injection of water into the water body. In case the geothermal resource is managed by a local municipality by decision of MOEW, which is very often the case, the respective municipality is responsible for issuing the permit.

- **Environmental Impact:** For larger projects, an Environmental Impact Assessment (EIA) may be required. The assessment would evaluate the potential environmental effects of the geothermal project, including impacts on water resources. If EIA is not applicable for your project, a Decision for absence of the need to carry out an EIA will be needed.

- **Fees:** The use of geothermal energy might involve paying fees or royalties to the state or to the municipality which is managing the deposit. The price of water depends on the purpose of the permit (greenhouse heating usually is classified as „other economic activity"), volume and temperature of the water and is regulated by a Municipal ordnance.

- **Term:** A permit for water intake from already developed mineral water deposit might be given for up to 20 years.

9.1.3. Underground Resources Act (1999)[18]

The act treats deep geothermal resources as natural underground resources and regulates the requirements for their exploration and exploitation via concessions. The term of the concession may not last for more than 35 years.

9.1.4. Energy Law (2003)[19]

- **Energy Production:** If the geothermal energy is used to generate electricity or heat that is sold to third parties, the project will be subject to the Energy Law. This law requires licensing from the Energy and Water Regulatory Commission (EWRC).

---

[18] *https://lex.bg/laws/ldoc/2134650880*
[19] *https://lex.bg/laws/ldoc/2135475623*

- **Grid Connection:** If you plan to connect a geothermal energy-based heating system to the national grid, you must comply with technical standards and regulations set by the EWRC.

9.1.5. Agricultural Land Use

- **Land Zoning:** The construction of greenhouses using geothermal energy may require zoning permits or land-use changes, particularly if the land is classified as agricultural. You must comply with local municipal regulations regarding land use.
- **Building Permits:** Constructing greenhouses will require building permits under the Spatial Planning Act. The design must comply with specific standards, including those for energy efficiency.

9.1.6. Environmental Protection Act

- **Protected Areas:** If the geothermal project is near a protected area, such as a national park or Natura 2000 site, additional restrictions apply. You may need to conduct an Appropriate Assessment (AA) to ensure the project does not negatively impact the conservation objectives of the area.
- **Waste Management:** The project must include plans for managing any waste products, such as drilling waste or emissions, under the Environmental Protection Act.

9.1.7. Health and Safety Regulations

- **Operational Safety:** Geothermal installations must comply with health and safety standards, including those related to drilling operations, water handling, and greenhouse operation.

9.1.8. Local Regulations

- **Municipal Approvals:** Local municipalities may have additional requirements, such as public consultations or specific conditions for the use of geothermal energy.

Key Considerations:

- **Compliance with EU Directives:** As a member of the European Union, Bulgaria must also comply with EU regulations related to renewable energy and environmental protection, which may impose additional requirements or limitations on geothermal projects.
- **Monitoring and Reporting:** Permits and concessions usually require ongoing monitoring and reporting of geothermal resource usage, temperature of the water, environmental impacts, and compliance with permit conditions.

It is crucial to consult with legal and environmental experts to navigate these regulations fully and ensure compliance when using geothermal energy in greenhouse production in Bulgaria.

9.2 Public policies in the sector

Bulgaria's public policies regarding geothermal usage are part of a broader strategy to increase renewable energy use and improve energy efficiency. The country has made several commitments in its national strategies, National Recovery and Resilience Plan, and international collaborations to enhance the utilization of geothermal energy.

There are several incentives and financial support mechanisms to encourage in the field. The Bulgarian government, through various EU funds and national programs, provides subsidies and grants for geothermal energy projects. This financial support is often structured to attract private investors by reducing their initial capital expenditure.

EU Cohesion Funds can also be a viable tool. Bulgaria utilizes EU Cohesion Funds to co-finance geothermal energy projects, which often involve PPPs. These funds are used to de-risk investments by covering a portion of the development costs.

The government offers tax relief and incentives for private companies involved in geothermal projects, including reduced VAT rates and exemptions from certain taxes for energy producers using renewable sources.

Below is an overview of the key public policies and initiatives related to geothermal energy in Bulgaria:

9.2.1. National Energy and Climate Plan (NECP)[20]

- **Goals**: The NECP outlines Bulgaria's commitment to the EU’s 2030 climate and energy framework. The plan includes increasing the share of renewable energy sources (RES) in the country's energy mix. Geothermal energy is part of this strategy, particularly in the context of heating and cooling systems.
- **Implementation**: The plan supports the exploration and development of geothermal resources, including the use of geothermal heat for district heating and industrial processes.

9.2.2. National Strategy for Energy Development[21]

- **Focus**: This strategy sets long-term goals for Bulgaria's energy sector, with an emphasis on diversifying energy sources and enhancing energy security. Geothermal energy is identified as a key area for development, especially in regions with high geothermal potential.

---

20 *https://me.government.bg/uploads/manager/source/VOP/obshtestveno%20obsajdane/INPEK_22.12.23_1.pdf*

21 [See here]

- **Measures**: The strategy includes measures to encourage investment in geothermal projects, streamline the regulatory framework, and support research and development in geothermal technologies.

9.2.3. National Recovery and Resilience Plan (NRRP)[22]

- **Green Transition**: Bulgaria's NRRP, developed as part of the EU's Recovery and Resilience Facility, includes specific measures to support the green transition. The plan allocates funding for renewable energy projects, including geothermal energy.
- **Geothermal Projects**: The NRRP supports pilot projects for geothermal energy, especially in the context of decarbonizing district heating systems and integrating geothermal energy into public infrastructure.

9.2.4. World Bank Involvement[23]

- **Technical Assistance**: The World Bank has provided technical assistance to Bulgaria in various sectors, including renewable energy. This includes support for the development of policies and frameworks that encourage the use of geothermal energy.
- **Financial Instruments**: The World Bank has also been involved in facilitating access to financial instruments for renewable energy projects, including geothermal energy, through programs that aim to reduce investment risks and attract private sector participation.

9.2.5. EU Funds and Initiatives

Common Agricultural Policy[24] In Bulgaria, several tools under the EU's Common Agricultural Policy (CAP) can support the use of geothermal energy for greenhouse production of vegetables. These tools include both financial instruments and programs aimed at modernizing agriculture and promoting sustainable energy use. Here are the key CAP tools that could apply:

- **Rural Development Program (RDP)**

  The RDP is the main instrument under the CAP that supports rural areas, including greenhouses and sustainable energy use:

  Measure 4: Investments in physical assets – This measure supports investment in modernizing agricultural holdings, including implementing renewable energy sources like geothermal energy.

---

[22] *https://www.mlsp.government.bg/uploads/3/baneri/natsionalen-plan-za-vzstanovyavane-i-ustoychivost-na-republika-blgariya/bg-finalrrp-2022-04-06-08-30-tca.pdf*

[23] *The World Bank to help Bulgaria benefit from its geothermal resources*

[24] *https://www.sp2023.bg/index.php/bg/sprzsr-bg/za-sprzsr*

Measure 6: Farm and business development – This measure offers financial support for farm diversification, including the installation of energy-efficient systems like geothermal energy for greenhouses.

Measure 16: Cooperation – Supports innovation and cooperation between farmers, research institutions, and companies for implementing innovative solutions, including geothermal systems.

Measure 7: Basic services and village renewal – Some funding is directed at infrastructure and renewable energy projects that could also be used to support geothermal heating solutions in rural areas.

- **European Agricultural Fund for Rural Development (EAFRD)**

  Part of the CAP's second pillar, the EAFRD focuses on sustainability and climate action, making funds available for projects that involve renewable energy. Greenhouse producers can apply for funding to develop geothermal heating systems.

- **European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI)**

  Through the EIP-AGRI initiative, agricultural businesses, including greenhouse operations, can gain support for implementing innovative practices like geothermal energy. The platform helps to foster innovation, linking research to practical farming solutions, which includes energy-efficient heating technologies for greenhouses

Operational Program "Environment"[25]: Funded by the EU, this program supports investments in energy efficiency and the use of renewable energy, including geothermal energy. Projects under this program aim to reduce greenhouse gas emissions and promote sustainable development.

The Operational Program "Environment" (OPE) in Bulgaria provides opportunities for funding projects that support environmental sustainability, and while it doesn't directly target greenhouse vegetable production, certain aspects of greenhouse operations, particularly related to energy efficiency, renewable energy, and sustainable resource management, may qualify for funding under this program.

Here are some key areas of potential support for greenhouse production through the OPE:

- **Energy Efficiency and Renewable Energy:**

  If a greenhouse project incorporates renewable energy solutions (such as geothermal heating, solar panels, or biomass) or energy efficiency measures (like insulation, climate control, or efficient heating systems), it may qualify for funding under the

---

[25] https://www.eufunds.bg/sites/default/files/uploads/opos/editor/POS%202021-2027_BG%2010102022.pdf

program's focus on energy and climate measures. This can help reduce operational costs and environmental impact.

- **Water Resource Management:**

The OPE promotes sustainable management of water resources, including efficient irrigation systems, water recycling, and rainwater harvesting. Greenhouses that invest in modern water-saving technologies or infrastructure can potentially apply for funding in this area.

- **Waste Management and Circular Economy:**

If a greenhouse project includes organic waste management (e.g., composting plant residues or using plant waste as biomass for energy production), there may be funding opportunities through initiatives aimed at supporting the circular economy.

- **Pollution Reduction and Sustainable Practices:**

Projects that aim to reduce pollution through the reduction of pesticides or adopt sustainable agricultural practices can also align with the program's goals of environmental protection. Implementing environmentally friendly growing techniques can make a greenhouse operation more eligible for support.

- **Biodiversity and Ecosystem Conservation:**

If greenhouse operations involve environmental protection measures, such as integrated pest management (IPM) to reduce chemical use or protect natural habitats near production sites, they may be supported by funding streams aimed at biodiversity preservation.

Horizon 2020 and Horizon Europe: Bulgaria has participated in EU research and innovation programs, such as Horizon 2020 and Horizon Europe, which support geothermal energy research and the development of new technologies.

9.3. Local Initiatives and Regional Development

Municipal Programs: Several municipalities in Bulgaria have initiated local projects to utilize geothermal resources, particularly in areas with known geothermal potential. These projects often focus on heating public buildings, greenhouses, and spas.

Examples:

Petrich Municipality[26]:

[26] https://petrich.bg/wps/portal/petrich/about-us/municipal-strategies/gal21012

Located in southwestern Bulgaria, Petrich is known for its geothermal springs. The municipality has initiated projects to utilize geothermal energy for heating public buildings and greenhouses. There are plans to expand this utilization further.

Sapareva Banya Municipality[27]:

Famous for having the hottest geyser in Europe, Sapareva Banya has initiated projects to harness geothermal energy for spa tourism and heating purposes. The municipality has developed infrastructure to use geothermal water for balneotherapy and wellness centres

Pavel Banya Municipality[28]:

Located in the Stara Zagora Province, Pavel Banya is another area with significant geothermal potential. The municipality has developed spa and wellness facilities using geothermal waters, which are also being explored for potential use in heating and agricultural applications.

Velingrad Municipality[29]:

Velingrad, located in the Rhodope Mountains, is one of the most famous spa towns in Bulgaria, with numerous geothermal springs. The municipality utilizes geothermal resources for balneotherapy, heating public buildings, and in the tourism sector.

Hisarya Municipality[30]:

Hisarya is renowned for its mineral springs, which have been used since ancient times. The municipality has projects focused on utilizing geothermal energy for spa tourism and public heating.

Kyustendil Municipality[31]:

---

[27] http://saparevabanya.bg/bg/pages/pid/57/%D0%9E%D0%B1%D1%89%D0%B8%D0%BD%D0%B0%D1%82%D0%B0/%D0%95%D0%BD%D0%B5%D1%80%D0%B3%D0%B8%D0%B9%D0%BD%D0%B0-%D0%B5%D1%84%D0%B5%D0%BA%D1%82%D0%B8%D0%B2%D0%BD%D0%BE%D1%81%D1%82/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D0%B8.html

[28] https://pavelbanya.bg/wp-content/uploads/2023/02/%D0%BA%D1%80%D0%B0%D1%82%D0%BA%D0%BE%D1%81%D1%80%D0%BE%D1%87%D0%BD%D0%B0-%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0-%D0%97%D0%95%D0%92%D0%98-2023-%D0%9F.%D0%B1%D0%B0%D0%BD%D1%8F.pdf

[29] https://m.velingrad.bg/wp-content/uploads/2021/08/%D0%BA%D1%8A%D0%BC-%D1%80%D0%B5%D1%88%D0%B5%D0%BD%D0%B8%D0%B5-217-21_compressed.pdf

[30] https://hisarya.bg/pages/plan-za-integrirano-razvitie-na-obshtina-hisarya-2021-2027-g

[31] https://kyustendil.bg/index.php?option=com_jdownloads&task=download.send&id=2265&catid=6&m=0&lang=bg

Known for its thermal springs, Kyustendil has developed geothermal energy projects primarily focused on the spa and wellness industry. The municipality is also exploring further applications in heating and agriculture.

Blagoevgrad Municipality[32]:

Blagoevgrad has geothermal resources that are being used for balneotherapy and heating public facilities. The municipality is exploring ways to expand the use of geothermal energy for other purposes, such as in agriculture.

These municipalities are at various stages of development, with some already reaping the benefits of geothermal energy while others are in the process of expanding or initiating new projects. The focus is largely on the tourism sector, given Bulgaria's strong tradition in balneotherapy, but there is also growing interest in using geothermal energy for heating and agriculture.

9.4. Public-Private Partnerships (PPP)

The government encourages PPPs in the geothermal sector to leverage private investment and expertise in developing geothermal energy projects.

Bulgaria has been increasingly interested in promoting Public-Private Partnerships (PPPs) in the geothermal sector to leverage private investment and expertise for developing geothermal energy projects. While the country is still developing its geothermal potential, the government has taken several steps to encourage PPPs in this area:

- **National Energy Strategy:** Bulgaria’s National Energy Strategy emphasizes the need for diversification of energy sources, including the development of renewable energy like geothermal. The strategy outlines the potential for PPPs in the renewable energy sector, including geothermal, and creates a conducive policy environment.
- **Renewable Energy Act:** The Renewable Energy Act in Bulgaria provides a legal basis for the development of renewable energy sources. It includes provisions for facilitating PPPs by offering incentives such as feed-in tariffs and long-term power purchase agreements (PPAs) for geothermal projects.
- **Amendments in Concession Laws:** Bulgaria has amended its concession laws to simplify the process for granting concessions for the exploration and exploitation of geothermal resources. These amendments aim to make it easier for private investors to partner with the government in geothermal projects.

9.5. Capacity Building and Technical Assistance

- **Technical Assistance Programs:** Bulgaria, often in collaboration with international organizations like the World Bank and the European Investment

[32] https://blagoevgrad.bg/files/Ekologiya/2020/Blagoevgrad_2020-2029.pdf

Bank (EIB), offers technical assistance programs to support PPPs in the geothermal sector. These programs help both the public and private sectors develop the necessary expertise and skills for successful geothermal projects.

- **Public-Private Dialogue Platforms:** The government has established platforms for dialogue between public authorities and private sector stakeholders. These platforms facilitate the exchange of ideas, experiences, and best practices, helping to build trust and cooperation in PPPs.
- **Regional Development Initiatives:** The government has focused on regional development initiatives that include geothermal energy as a key component. These initiatives often involve PPPs to develop local geothermal resources, contributing to regional economic growth.

9.6. Institutional Support and Coordination

- **National Renewable Energy Agency:** The creation of specialized agencies, such as a National Renewable Energy Agency, helps streamline the process for developing renewable energy projects, including geothermal. These agencies act as intermediaries between the government and private investors, facilitating the establishment of PPPs.
- **Interministerial Committees:** Bulgaria has established interministerial committees to coordinate geothermal energy projects across different government departments. These committees help in aligning policies and regulations, making it easier for private companies to engage in PPPs.

Key takeaways:

- Bulgaria is actively working on enhancing the use of geothermal energy as part of its broader renewable energy strategy.
- The country is leveraging national policies, EU funds, and international cooperation to develop this sector, although there are still challenges to be addressed in terms of infrastructure, investment, and regulatory support.

10. SWOT analysis – opportunities for Dutch stakeholders

Based upon the overview already provided in this report regarding the level of technological adoption and the investment needs in the sector (incl. in cheaper energy) we can conclude that there is a relatively good potential for Dutch suppliers of greenhouse equipment for the Bulgarian market in the long term, the Netherlands being a leading supplier in technology, know-how and turn-key solutions, including in geothermal integration. However, addressing cost barriers, building local partnerships, and navigating regulatory complexities will be crucial for long-term success.

While geothermal energy still has a limited penetration in greenhouse production of vegetables in the country, Bulgaria's potential in this field is promising. Many greenhouse facilities are in areas with already explored and developed thermal water deposits. While this can be a fast, easy and low-cost energy source, in many places where the spa industry has already seen strong development, thermal springs might have limited capacity for new industrial-use connections. Even these sites, however, might be appropriate for smaller integrated projects that use waste heat from spa.

Dutch companies are global leaders in greenhouse technologies, including climate control, automation, and geothermal integration. Their reputation as a quality supplier for agribusiness and horticulture solutions can foster trust in their counterparts in the region, bringing advanced technology that can increase productivity and efficiency in Bulgarian greenhouses. EU incentives and Dutch government support for exporting sustainable technologies to EU member states can provide financial and logistical advantages.

However, Dutch technologies can be expensive, which may deter Bulgarian greenhouse operators who can be very cost oriented. Bulgarian operators may lack technical knowledge about more advanced systems, requiring additional training and ongoing support. Navigating Bulgaria's legal framework for geothermal energy usage in greenhouse projects may also pose a challenge for Dutch entrepreneurs who are unfamiliar with local regulations.

STRENGTHS	**WEAKNESSES**
Know-how	High initial costs
Reputation	Knowledge gap
Government support	Regulatory complexity
OPPORTUNITIES	**THREATS**
Growing greenhouse sector	Local competition
EU funding programs	Economic uncertainty
Abundant geothermal potential	Political and regulatory risk
Rising demand for sustainability	
Finding a unique selling point	

Bulgaria's greenhouse industry is expanding due to increasing demand for locally grown vegetables, creating opportunities for innovative technology integration. EU subsidies for renewable energy and sustainable agriculture can support projects that integrate geothermal solutions in Bulgarian greenhouses. The abundance of geothermal resources in Bulgaria, particularly in the Struma and Thracian Valleys and along the Black Sea coast provide opportunities for Dutch companies to offer geothermal-integrated greenhouse solutions. Finding a unique selling point, be it a turn-key solutions, or quick delivery, integrations and post-sale support will be vital for success.

Local competition can be a limiting factor for growth. Many companies entered the market in recent years and local providers offering lower-cost solutions may compete aggressively, especially for smaller-scale projects. Inflation, economic challenges and lack of labour in Bulgaria may limit the ability of local businesses to invest in advanced technologies. There is also a certain regulatory risk because of the high political instability in the past three years.

11. Useful Links:

Bulgarian Association of Greenhouse Producers – the main business organization in the sector.

Bulgarian Association Hydrogeology, Drilling and Geothermal – the association's activity is focused on the study and protection of underground water in Bulgaria, assistance of the state authorities for the improvement of the legislative base regulating underground water in Bulgaria,

Bulgarian Geothermal Water Association – connects professionals in the domain of geothermal water management.

Bulgarian Association Geothermal Energy – a national association bringing together science, business and experts working in all the fields of geothermal energy use.

List of mineral water deposits by the Ministry of Environment and Water

Legislation database

12. Contacts:

Contractor:

InteliAgro

Nikolay Valkanov

InteliAgro

Sofia, Bulgaria

www.inteliagro.bg

nikolay@inteliagro.bg

Assignor:

LVVN Attaché Netwerk

Kingdom of the Netherlands

Embassy of the Kingdom of the Netherlands in Bulgaria

Netherlands Agricultural Network – Sofia

1504 Sofia, 15 Oborishte St

The Netherlands and Bulgaria (netherlandsandyou.nl)

sof-lvvn@minbuza.nl

Appendix 1 - Top 100 greenhouse holdings (based on income support*)

	Company	District	Municipality	Ha	Heating	Bedding	Cover	Crop
1	Gimel	Pazardzhik	Pazardzhik	32.71	cogen (gas)	Organic matter	Glass	Cucumbers, tomatoes
2	Greens	Plovdiv	Parvomay	18.70	gas	Hydroponics	Glass	Tomatoes, cucumbers, peppers
3	Guard invest	Plovdiv	Rakovski	15.41	gas	n.d.	Glass	Cucumbers, tomatoes
4	Tzar Samuil	Blagoevgrad	Petrich	14.30	n.d.			
5	Gimel II	Pleven	Levski	12.12	cogen (gas)	Organic matter	Glass	Cucumbers, tomatoes
6	Ganka Taneva	Blagoevgrad	Petrich	9.11	n.d.	n.d.	n.d.	n.d.
7	Melgi	Sofia	Capital	8.09	cogen (gas)	n.d.	Glass	n.d.
8	Alt ko	Sofia	Capital	7.54	gas	Hydroponics	Glass	Cucumbers, tomatoes
9	Greenhouse Sandasnki	Blagoevgrad	Sandanski	6.89	biomass	Soil	Glass	Cucumbers, tomatoes
10	Agro in 2001	Blagoevgrad	Sandanski	6.15	biomass	n.d.	n.d.	n.d.
11	Georgi Stankov	Blagoevgrad	Petrich	6.12	n.d.	n.d.	n.d.	n.d.
12	VGD Oil	Sofia	Capital	6.10	n.d.	n.d.	n.d.	n.d.
13	Gaz Trading 2002	Blagoevgrad	Petrich	6.09	gas and biomass	Hydroponics	Glass	Tomatoes, cucumbers
14	Iordan Velichkov-Vladi	Sofia	Capital	6.05	biomass	Hydroponics	Glass	Cucumbers
15	Rumiana Velichkova	Sofia	Capital	5.98	cogen (gas)	n.d.	n.d.	Cucumbers, tomatoes
16	Krum Tiliovski 89	Blagoevgrad	Sandanski	5.82	no heating	substrate	n.d.	Tomatoes
17	ZAGORA Bio EOOD	Stara Zagora	Stara Zagora	5.59	n.d.	substrate	n.d.	n.d.
18	Oranjerii - Petrov Dol OOD	Varna	Provadia	5.39	cogen (gas)	substrate	Glass	Organic, cucumbers
19	Rosela AD	Blagoevgrad	Simitli	4.89	Geothermal	hydroponics	Glass	Cucumbers
20	ET Koicho Derventski	Plovdiv	Plovdiv	4.87	Biomass	n.d.	n.d.	Lettuce
21	VIP 2012 EOOD	Pazardzhik	Septemvri	4.16	n.d.	n.d.	Glass	n.d.
22	ET Ivan Popov	Blagoevgrad	Petrich	3.97	n.d.	n.d.	n.d.	n.d.
23	Vasislava Stefanova	Plovdiv	Stamboliyski	3.65	n.d.	n.d.	n.d.	n.d.

24	Dimitar Petrov	Stara Zagora	Stara Zagora	3.62	n.d.	n.d., hydroponics	Mixed, Polycarbonate	Cucumbers, tomatoes
25	Eko Plod OOD	Varna	Varna	3.37	n.d.	n.d.	n.d.	n.d.
26	Krasimir Kirov	Sliven	Sliven	3.20	n.d.	n.d.	n.d.	n.d.
27	Navona OOD	Plovdiv	Plovdiv	3.18	Gas	n.d.	Glass	n.d.
28	B.V.K. Vinifera OOD	Sofia	Capital	3.10	n.d.	n.d.	n.d.	n.d.
29	Eko Nuts 2014	Haskovo	Harmanli	3.07	n.d.	Hydroponics	Polyethylene	Cucumbers, tomatoes
30	Agro Omega EOOD	Haskovo	Harmanli	3.04	n.d.	Hydroponics	Polyethylene	Cucumbers, tomatoes
31	Elena Sofianska	Sofia	Capital	3.03	n.d.	n.d.	n.d.	n.d.
32	Nikolay Valchev	Plovdiv	Parvomay	3.03	Gas	n.d.	Polycarbonate	Cucumbers, tomatoes
33	Partners Komers Grup EOOD	Plovdiv	Plovdiv	2.95	n.d.	n.d.	n.d.	n.d.
34	ET Agroprofit - Vladimir Velichkov	Sofia	Capital	2.95	Biomass	Perlite	Glass	Tomatoes
35	Makenna 08 OOD	Ruse	Slivo pole	2.93	Heated	Soil	Glass	Cucumbers, tomatoes
36	Melo 98 K EOOD	Blagoevgrad	Sandanski	2.85	Biomass	Soil	n.d.	Cucumbers, tomatoes
37	Elitagro OOD	Pazardzhik	Pazardzhik	2.78	Biomass	n.d.	n.d.	Cucumbers, tomatoes
38	Toplina-Chid EOOD	Pazardzhik	Pazardzhik	2.62	n.d.	n.d.	n.d.	n.d.
39	ET Oziris - Tsvetan Yordanov	Vratza	Mezdra	2.59	n.d.	n.d.	n.d.	Tomatoes
40	Eli-D EOOD	Pazardzhik	Pazardzhik	2.53	n.d.	n.d.	n.d.	n.d.
41	Agroinvest-97 OOD	Blagoevgrad	Petrich	2.49	n.d.	n.d.	n.d.	n.d.
42	Duloba - EOOD	Blagoevgrad	Petrich	2.48	n.d.	n.d.	n.d.	n.d.
43	ET Nelifrukt - Ivan Lambov	Burgas	Nessebar	2.40	n.d.	n.d.	n.d.	n.d.
44	KPTU Ksanes	Haskovo	Haskovo	2.34	Biomass	n.d.	n.d.	n.d.
45	Svetoslav Gardev	Veliko Tarnovo	G. Oriahovitza	1.97	n.d.	n.d.	n.d.	n.d.
46	Kemer OOD	Plovdiv	Plovdiv	1.96	n.d.	n.d.	n.d.	n.d.
47	Agro BOSS	Blagoevgrad	Sandanski	1.89	No	Soil	Glass	Leafy greens
48	Milevoplod OOD	Plovdiv	Sadovo	1.79	No	Soil	n.d.	n.d.
49	Terra e Vita EOOD	Plovdiv	Plovdiv	1.72	n.d.	n.d.	n.d.	Berries

50	Hadzhiev 87 EOOD	Blagoevgrad	Strumiani	1.72	n.d.	n.d.	n.d.	n.d.
51	999-Eko Frut EOOD	Plovdiv	Sadovo	1.70	n.d.	n.d.	n.d.	n.d.
52	Demetra Agro EOOD	Pazardzhik	Septemvri	1.67	n.d.	n.d.	n.d.	n.d.
53	Ekofrut K i K EOOD	Pazardzhik	Pazardzhik	1.67	n.d.	n.d.	n.d.	n.d.
54	Selcho Invest OOD	Sofia	Capital	1.66	n.d.	n.d.	n.d.	n.d.
55	Terra Vitis EOOD	Plovdiv	Plovdiv	1.64	n.d.	n.d.	n.d.	n.d.
56	ET Ivan Trifonov-2001	Plovdiv	Karlovo	1.62	n.d.	n.d.	n.d.	n.d.
57	Bio Dinamik - Nikola Tonchev	Sofia	Capital	1.61	Geothermal	n.d.	n.d.	n.d.
58	Siitech 77 EOOD	Varna	Varna	1.61	Biomass	Hydroponics	n.d.	n.d.
59	Eli 2004 OOD	Haskovo	Dimitrovgrad	1.52	n.d.	n.d.	n.d.	n.d.
60	Topik 2012 OOD	Blagoevgrad	Sandanski	1.49	Biomass	Soil	n.d.	Cucumbers, tomatoes
61	Mond Development EOOD	Sofia	Capital	1.48	n.d.	n.d.	n.d.	Tomatoes
62	Krastev i Sinove Grup	Sliven	Sliven	1.47	n.d.	Soil	Polyethylene	Peppers, radishes
63	Nikola Tsarnelov	Blagoevgrad	Sandanski	1.47	n.d.	n.d.	n.d.	n.d.
64	Boris Petrov	Blagoevgrad	Sandanski	1.46	n.d.	n.d.	n.d.	n.d.
65	Ivan Pahlew	Blagoevgrad	Sandanski	1.46	n.d.	n.d.	n.d.	n.d.
66	Kaloyan Karadakov	Blagoevgrad	Petrich	1.45	n.d.	n.d.	n.d.	n.d.
67	Ivan Hristoskov	Pazardzhik	Pazardzhik	1.45	n.d.	n.d.	n.d.	n.d.
68	Agrini EOOD	Blagoevgrad	Sandanski	1.42	Biomass	Hydroponics	n.d.	Tomatoes, cucumbers
69	Kiril Tilyovski	Blagoevgrad	Petrich	1.39	n.d.	n.d.	n.d.	n.d.
70	Mandzha Grup	Blagoevgrad	Kresna	1.37	n.d.	n.d.	n.d.	n.d.
71	Avesta EOOD	Plovdiv	Sadovo	1.35	n.d.	n.d.	n.d.	n.d.
72	Hristo Kumchev	Plovdiv	Plovdiv	1.35	No	Soil	Polyethylene	Leafy greens
73	Nikolay Gegov	Blagoevgrad	Sandanski	1.34	n.d.	n.d.	n.d.	n.d.
74	Maya Popova	Blagoevgrad	Petrich	1.32	n.d.	n.d.	n.d.	n.d.
75	Krasimir Uchitelski	Blagoevgrad	Petrich	1.32	n.d.	n.d.	n.d.	n.d.

76	Stiliyan Markov	Blagoevgrad	Petrich	1.32	n.d.	n.d.	n.d.	n.d.
77	Boris Dragnev	Blagoevgrad	Petrich	1.30	n.d.	n.d.	n.d.	n.d.
78	Brod 2013 EOOD	Haskovo	Dimitrovgrad	1.30	n.d.	n.d.	n.d.	n.d.
79	Green House Grup EOOD	Blagoevgrad	Blagoevgrad	1.29	Geothermal	Hydroponics	n.d.	Cucumbers
80	ET FET - Sergey Yulianov	Sofia	Capital	1.28	n.d.	n.d.	Glass	Cucumbers, tomatoes
81	Pirinplod - Levunovo OOD	Blagoevgrad	Blagoevgrad	1.28	Geothermal	n.d.	n.d.	n.d.
82	Dimitar Petkov	Pazardzhik	Pazardzhik	1.24	n.d.	n.d.	n.d.	n.d.
83	Vladimir Ignatov	Pazardzhik	Pazardzhik	1.22	n.d.	n.d.	n.d.	n.d.
84	Vasil Nikolov	Pazardzhik	Pazardzhik	1.21	n.d.	n.d.	n.d.	n.d.
85	Petko Petkov	Plovdiv	Stamboliyski	1.21	n.d.	n.d.	n.d.	n.d.
86	Petar Hadzhiev	Haskovo	Stamboliyski	1.16	n.d.	n.d.	n.d.	n.d.
87	Encho Baramov	Stara Zagora	Stara Zagora	1.15	n.d.	n.d.	n.d.	n.d.
88	Nikola Dlekchev	Plovdiv	Stamboliyski	1.14	n.d.	n.d.	n.d.	n.d.
89	Velichka Dimitrova	Pazardzhik	Pazardzhik	1.14	n.d.	n.d.	n.d.	n.d.
90	Slavcho Iliev	Blagoevgrad	Petrich	1.13	n.d.	n.d.	n.d.	n.d.
91	Petar Kumchev	Plovdiv	Plovdiv	1.13	n.d.	n.d.	n.d.	n.d.
92	Spas Grozdanov	Pazardzhik	Septemvri	1.13	n.d.	n.d.	n.d.	n.d.
93	Tanya Ilieva	Blagoevgrad	Petrich	1.11	n.d.	n.d.	n.d.	n.d.
94	Maya Slavova	Sofia	Capital	1.11	n.d.	n.d.	n.d.	n.d.
95	Desislava Ilieva	Blagoevgrad	Petrich	1.10	n.d.	n.d.	n.d.	n.d.
96	Katya Radeva	Plovdiv	Parvomay	1.09	n.d.	n.d.	n.d.	n.d.
97	Desislava Genova	Plovdiv	Maritza	1.07	n.d.	n.d.	n.d.	n.d.
98	Biser Georgiev	Veliko Tarnovo	Polski Trambesh	1.06	n.d.	n.d.	n.d.	n.d.
99	Irena Kuzmanova	Blagoevgrad	Petrich	1.04	n.d.	n.d.	n.d.	n.d.
100	Lyubomir Gunchev	Plovdiv	Stamboliyski	1.03	n.d.	n.d.	n.d.	n.d.

* In some cases actual acreage may be higher than shown.