BULGARIAN GREENHOUSE PRODUCTION. POTENTIAL FOR IMPLEMENTATION OF GEOTHERMAL ENERGY

“Geothermal energy: utilization and ongoing initiatives”

Sofia Event Centre, 2025

InteliAgro

Content:

1. Overview of the greenhouse sector in Bulgaria

Key takeaways:

- Bulgaria has traditions in greenhouse production of vegetables, the focus being tomatoes and cucumbers.

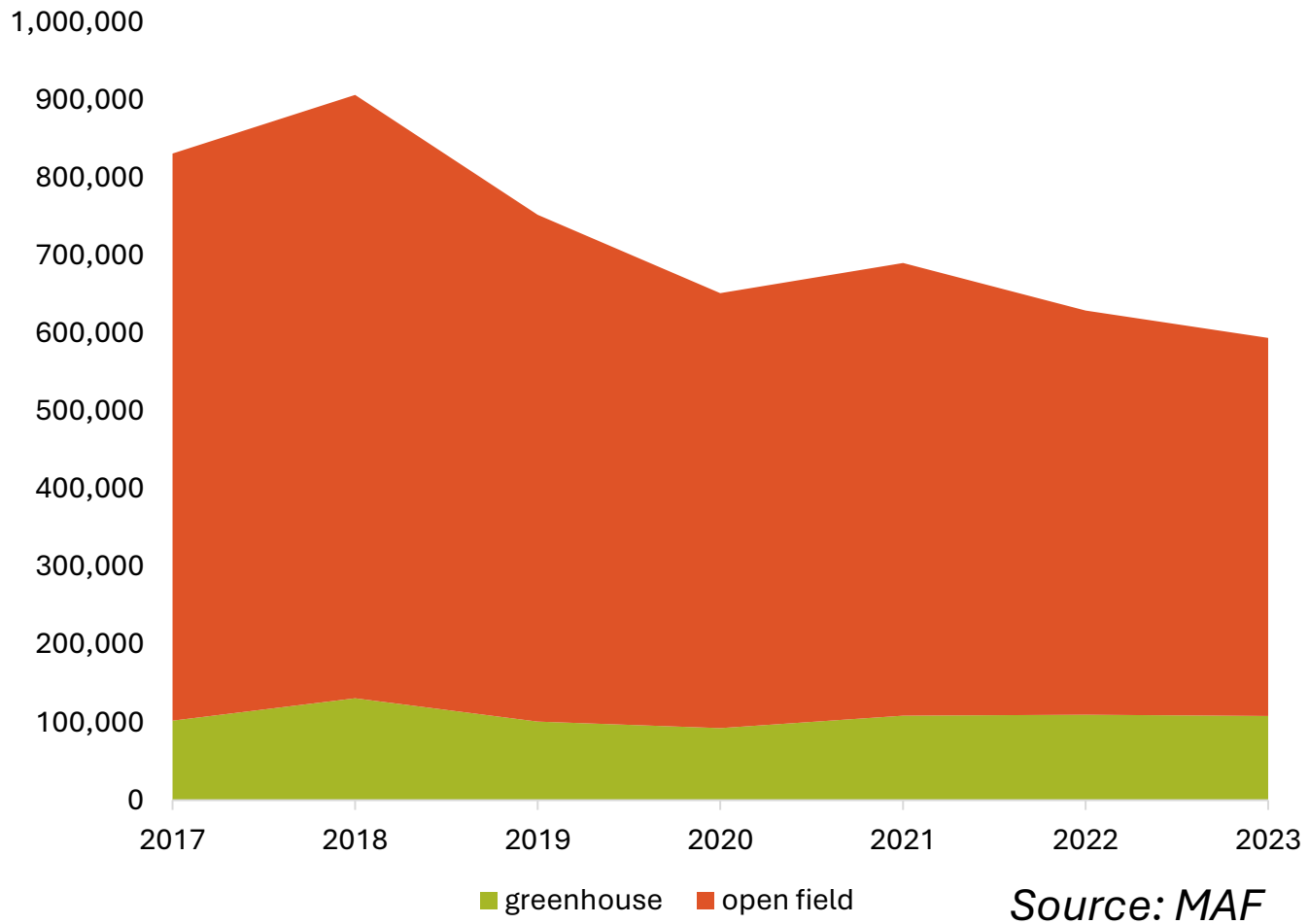
- Local off-season production faces strong competition from Greece and Türkiye, where costs are lower due to milder climate.

- The business is endangered by high energy costs. A substantial effort is needed to decrease the share of heating in total production costs to increase competitiveness.

(1) Greenhouse production provides 30% of all fruit vegetables and 18% of the total vegetable produced

- Large-scale greenhouse production was introduced in Bulgaria during the 1970s.
- French and Dutch technology was used for some of the facilities.
- During the general economic decline of the 1990's, many greenhouses were abandoned.
- Total vegetable production has declined by 29% since 2017 mainly due to the decrease in potato growing and other field vegetables (Fig. 1).
- Bulgarian greenhouse production has averaged around 107,000 tonnes per year for the 2017-2023 period (with a deviation of about 10%).

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



Source: MAF

(1) Main greenhouse crops are tomatoes and cucumbers

Production of greenhouse vegetables by type of crop, 2023

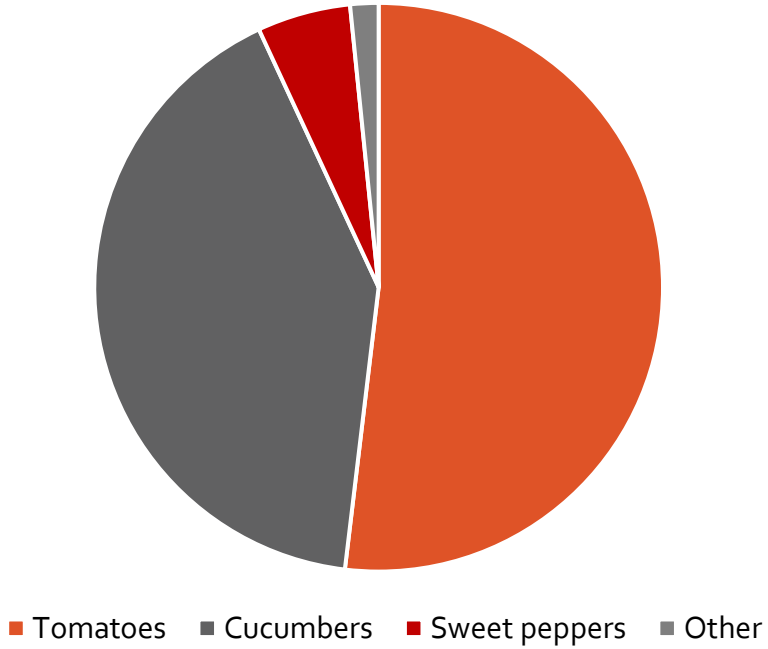


Table 1 – Average yields of major greenhouse crops (t/ha), 2022-2023

	area (ha)		total production (t)		average yield (t/ha)	
	2022	2023	2022	2023	2022	2023
tomatoes	589	639	57 074	56 113	96,9	87,8
cucumbers	431	389	46 794	44 528	108,6	114,5
peppers	123	147	4461	5741	36,3	39,1
lettuce	39	22	702	215	18,0	9,8
strawberries	26	68	225	1145	8,7	16,8

Source: MAF

(1) Bulgaria imports mainly tomatoes and other vegetables (HS:0709)

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

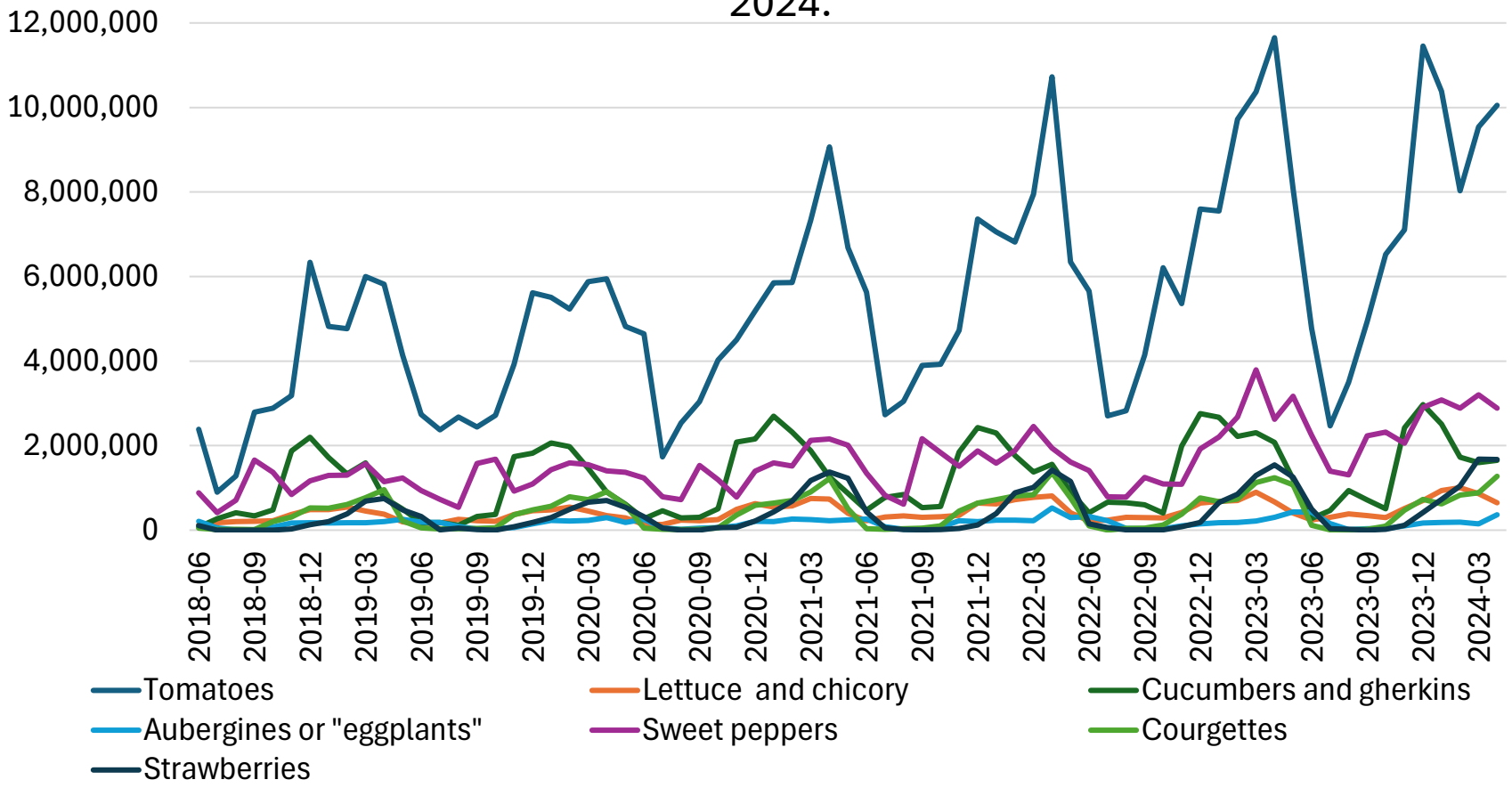
Table 3 – Monthly Import prices of major crops (EUR/kg)

	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

(1) Import is mainly off-season (November-April)

- **Rapidly growing market – EUR 57M in 2018 to EUR103 M in 2024.**
- Highest numbers both in volume and value are in tomatoes (incl. cherry tomatoes).
- Bell peppers and cucumbers are the next high-value crops with good off-season market prospects.

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



Source: Eurostat

2. Energy as a production factor

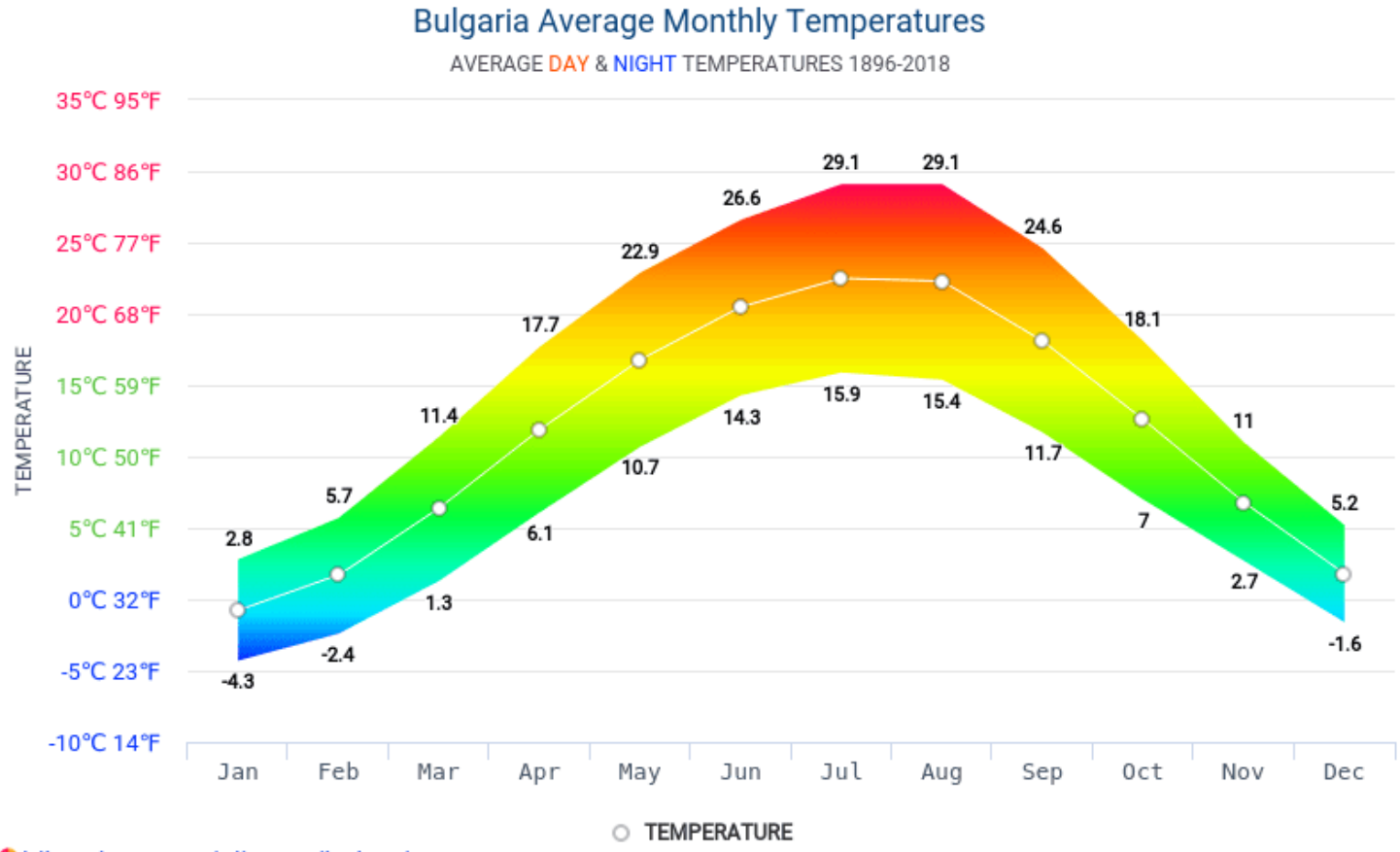
Key takeaways:

- 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.

(2) Heating necessities and solutions



- Energy cost is major factor in all-year greenhouse production of vegetables in the temperate climate zone.
- The coldest months are December and January , but heating season can start as early as October and can continue through April.
- Greenhouses use natural gas or biomass (pellets, rarely straw) for heating, while a few facilities use geothermal energy as primary source for heating.
- The choice of heating solution depends on proximity to the 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.

(2) Different types of house 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.

Source: IEA, FAO

(2) Investment costs and price comparison by type of energy source

Table 5 - 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

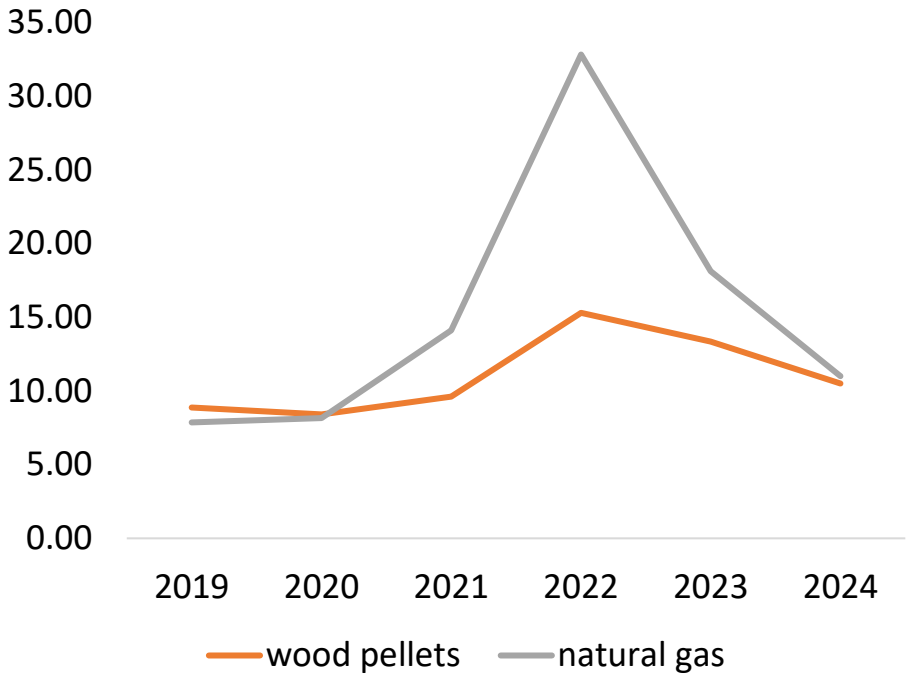
Table 6 - Price comparison of heating cost for 1 sq. m. of greenhouse production in Bulgaria per year for 2023

	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

Price comparison between natural gas and wood pellets in EUR/GJ, Bulgaria



Source: NSI

3. Map of hydrothermal potential, springs and wells

Top 5 regions by hydrothermal deposits (proven):

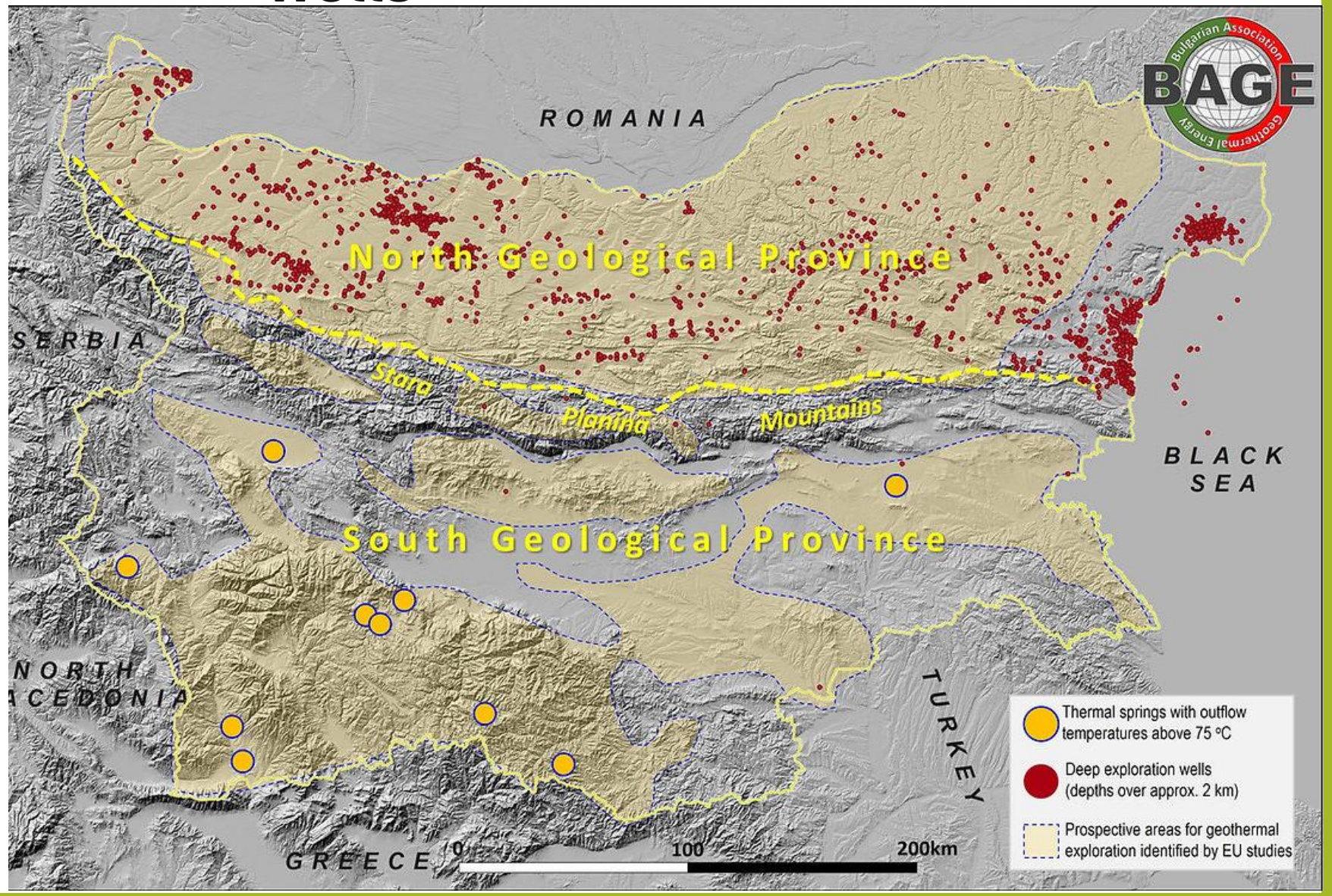
1. Northeastern Bulgaria (Varna, Dobrich and Shumen districts) – 48% of debit, 20-55ºC, has a total flow rate of 1140 l/s.

2. Blagoevgrad district – 10% of debit, 40-80ºC.

3. Pazardzhik district – 8.5% of debit, 23-97ºC.

4. Sofia district – 8.2% of debit, 20-50ºC.

5. Plovdiv district - 20-60ºC.



Source: BAGE

(3) Showcases mainly connected to existing mineral water deposits

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℃
   - 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

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

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

4. Greenhouse Dolna Dikanya
   - Est.: 2015
   - Address: Dolna Dikanya (Radomir municipality, Pernik District)
   - Acreage: 1,1 ha
   - Crop: tomatoes
   - Mineral water deposit: own geothermal boreholes with a total length of 8 km.



4. Greenhouse map

Key takeaways:

- Total greenhouse area in Bulgaria is growing despite of some discrepancies in statistics.

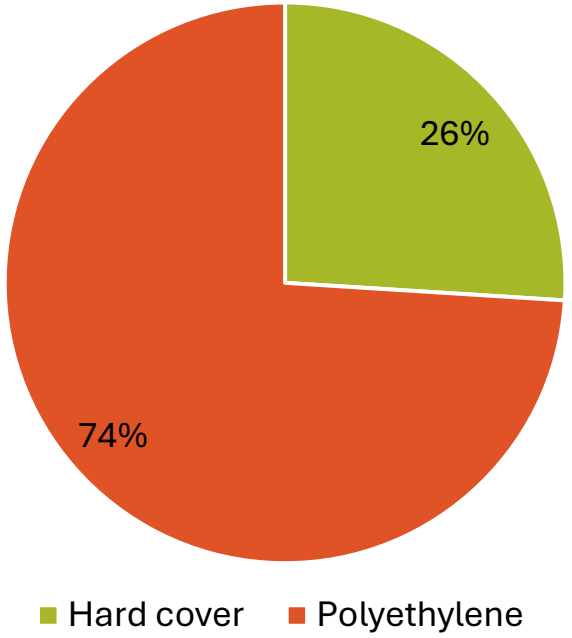
- Main production areas are Blagoevgrad, Pazardzhik and Plovdiv districts, where also the largest share of heated facilities is.

- Most facilities (3/4) are under the relatively more energy intensive polyethylene cover which explains the lower share of heated greenhouses.

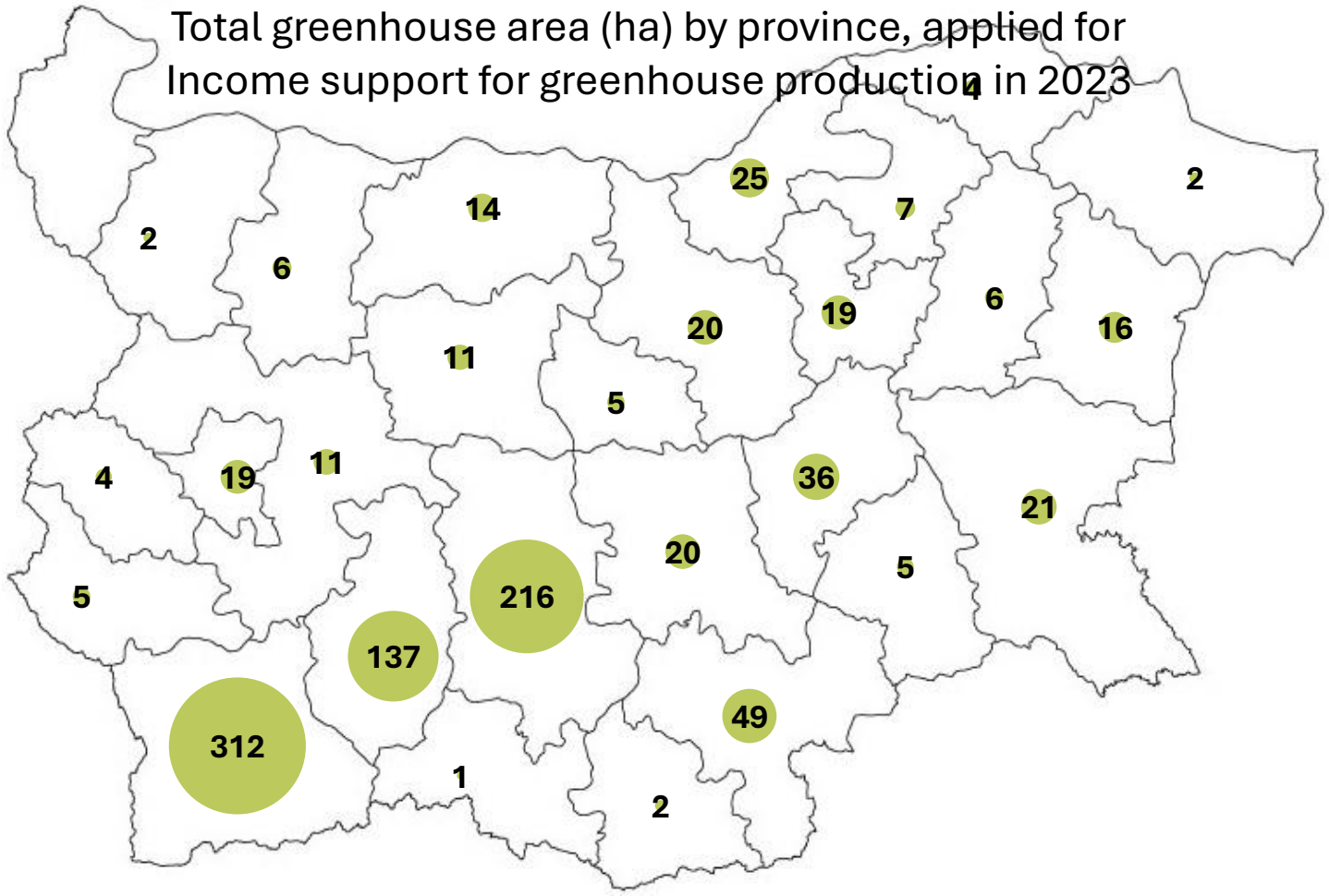
- 398 ha of all greenhouse facilities in the country are heated, suggests data from SFA. 40% of them are in Blagoevgrad district.

(4) 63% of all greenhouses are in Southwestern Bulgaria – Blagoevgrad, Pazardzhik and Plovdiv districts

Area under cover by type of material as of 2023



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



Source: MAF

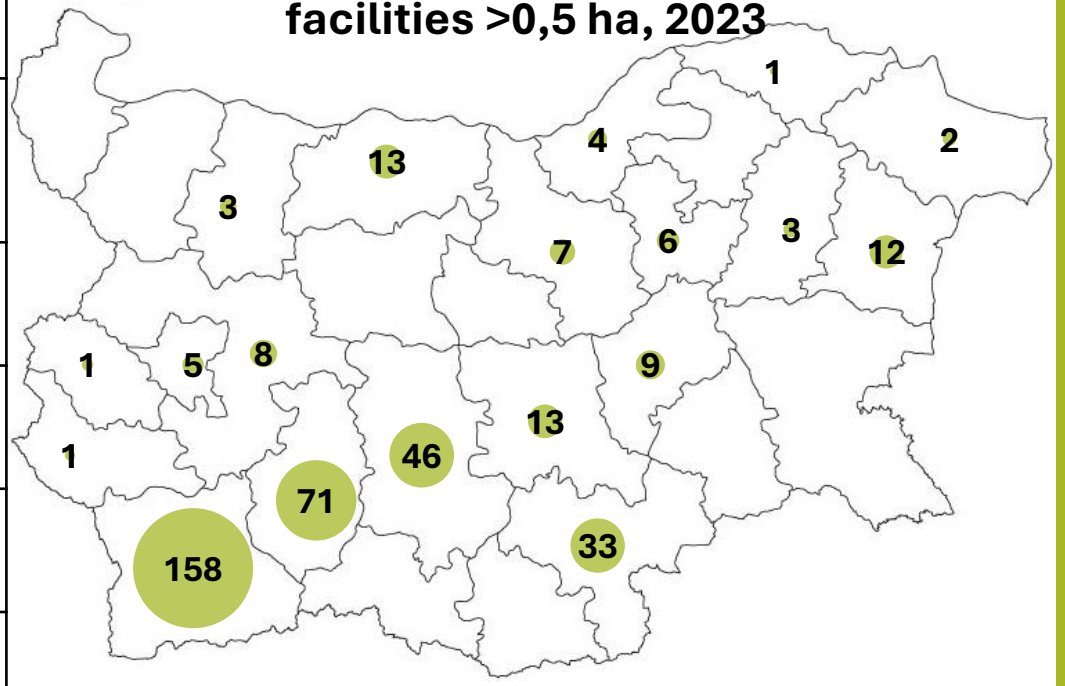
Source: SFA

(4) 40% of the heated facilities are in Blagoevgrad district, tomatoes being the leading crop

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

ha	Blagoevgrad	Pazardzhik	Plovdiv	Haskovo	Sofia*
tomatoes	115.4	15.42	23.14	15.52	6.61
peppers	4.04	3.68	1.69	1.5	8.22
cucumbers	37.82	48.8	16.07	13.24	6.06
strawberries	1.05	0.96	0.52	2.24	1.42
raspberries	-	-	4.57	-	1.07

Total greenhouse area (ha) of heated facilities >0,5 ha, 2023



Source: SFA

5. SWOT

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	

6. Considerations & conclusions

- Bulgaria has huge geothermal energy potential – some of it in areas with well-developed greenhouse production of vegetables.

- Using hydrothermal energy from already developed reservoirs is the cheapest way to heat a greenhouse.

- Geothermal energy offers a sustainable, low-carbon energy source, which aligns well with the growing consumer preference for environmentally friendly products.

- 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.

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