

## Annex 2

# Estimation of the high-efficiency cogeneration and efficient district heating/cooling potential

Budapest, December 2015



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## 1. Introduction and antecedents

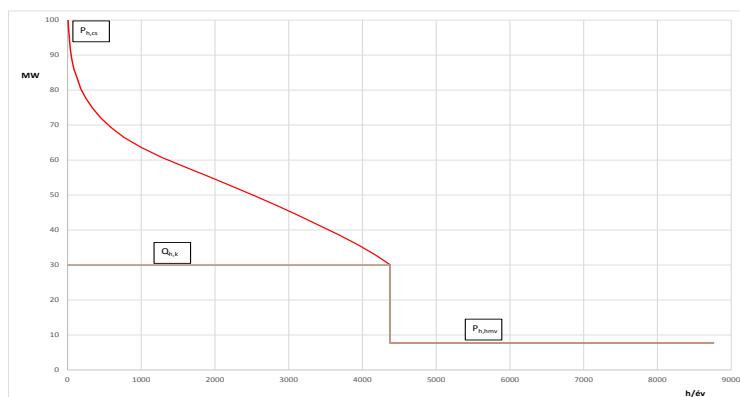
Article 14(1) of the Energy Efficiency Directive (EED) requires the following:

'Promotion of efficiency in heating and cooling

(1) By 31 December 2015, Member States shall carry out [...] a comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling, ...'

The potential for high-efficiency cogeneration is, firstly, the amount of heat that can be produced by high-efficiency cogeneration and, secondly, the quantity of electricity that is cogenerated with this amount of heat. It is possible to determine these only by hydraulically independent district heating system (district heating area) on the basis of the heat demand of currently operational district heating systems converted to average meteorological conditions. The value of the theoretical feasibility potential of efficient district heating can be obtained from duration charts.

As an example, the nature ( $P_{h,cs}=100$  MW,  $P_{h,hmv}=7.7$  MW,  $Q_{h,k}=30$  MW) of the baseline (converted to heating season with an average climate) duration chart of a district heating system is illustrated by the following figure:



where  $P_{h,cs}$  is the peak thermal output fed to the network by heat generator(s) (heat input required by the system) at  $-13^{\circ}\text{C}$ ,  $P_{h,hmv}$  is the heat output required by the system to be fed to an average network outside the heating season, and  $Q_{h,k}$ . is a preferred (e.g. cogenerating or renewable) capacity, which is to be primarily utilised. For the determination of the heat output duration chart of district heating systems relating to an average heating period, the distribution function of daily average outside temperatures in the heating season as well as the linear regression relationship between the actual daily heat demand of the system and the daily outside temperature must be known. The latter must be calculated for an entire heating season. The duration chart of outside temperatures shows the number of hours on 183 days (184 days in a leap year), a specific or lower outside temperature occurs during an average heating season. Duration charts depend on geographical location. In Hungary, the table available for the capital can be used with good approximation. (The duration chart is available in tabular form. In the period before the proliferation of personal computers, scientific papers dealt with the determination of approximate closed formulas, but the development of information technology has made them obsolete.) Heat demand outside the heating season was taken into account in this study, with a single average value calculated on the basis of the actual use data made available for the last two years.

The existing cogeneration and renewable capacities may be fit into these duration charts made for the individual systems, thereby giving rise to the energy potential that is theoretically usable at present.

As can be seen from the table below, 50 % coverage (e.g. implemented from renewable energy) in the above system requires, taking into account an actual availability of 23 %, the installation of nearly 30 % of renewable capacity.

$Q_{h,k}/P_{h,cs}$ (%)	Proportion of max. cogenerated/renewable heat generation (%)
23	50
30	61
35	69.2
40	76.2
45	82.4
50	87.6

It can be determined from the actual installed capacity data for each district heating system that in the event of the maximum and actual utilisation of existing cogeneration/renewable/waste heat-based generation capacities, to what extent the set of conditions of 'efficient district heating' is met. Furthermore, the required utilisation rate of existing capacities and/or the magnitude and required utilisation rate of new cogeneration/renewable/waste heat-based capacities to be established can be determined, where the criterion of efficient district heating can be met upon the fulfilment of the above conditions. With the appropriate summing up of the data determined for the individual district heating systems, the territorial/regional and national potential is obtained.

Consequently, in the 2014–2020 programming period, it will be necessary to change and green the heat generation portfolio (the system integration of mainly biomass, geothermal, waste and waste heat) and to increase the efficiency of the distribution system, which requires the implementation of a significant number of large-scale projects. This requires the assessment and impact analysis of expected projects and the drawdown of KEHOP funds (capital cost estimates, expected indicators and schedule).

On the basis of the specifications, the duration charts associated with the energetically optimal development of the district heating systems of the country that may be characterised with a heat demand over 8 TJ/year were surveyed and presented with the theoretical load distributions between heat source types. The results obtained serve as a basis for the fulfilment of the reporting obligation specified in Article 14 of the EED in the case of Annex VIII to the Directive, point 1(d), (e), (f), (h), (i) and (j).

## 2. Summary results

The following summarises the results of our calculations from the available, individually reviewed basic energy data for 194 district heating systems of 93 municipalities in total. For lack of available data, the study did not include district heating systems that may operate in the individual municipalities and meet industrial demand only or in at least 90 % (basically with steam heat carrier).

### 2.1 Initial data

The total peak heat input required by the existing district heating systems taken into account, determined by calculation<sup>1</sup> (at a daily average design outdoor air temperature of -13 °C), is 3 365 MW, its total heat demand fed to the network, converted to average meteorological conditions, is 31.9 PJ/year, while the amount of heat sold is 28.0 PJ/year (see Figure 1). More than three-quarters (76.4 %) of district heat is used for residential purposes.

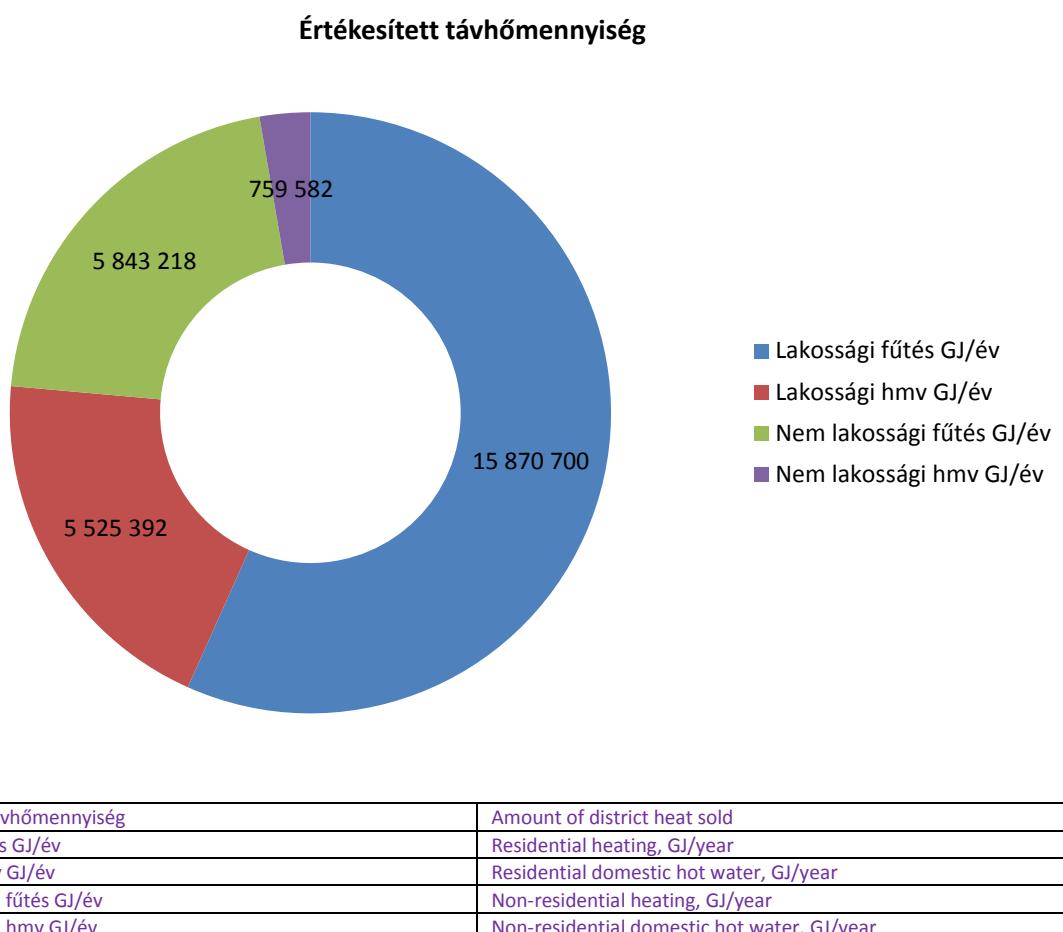
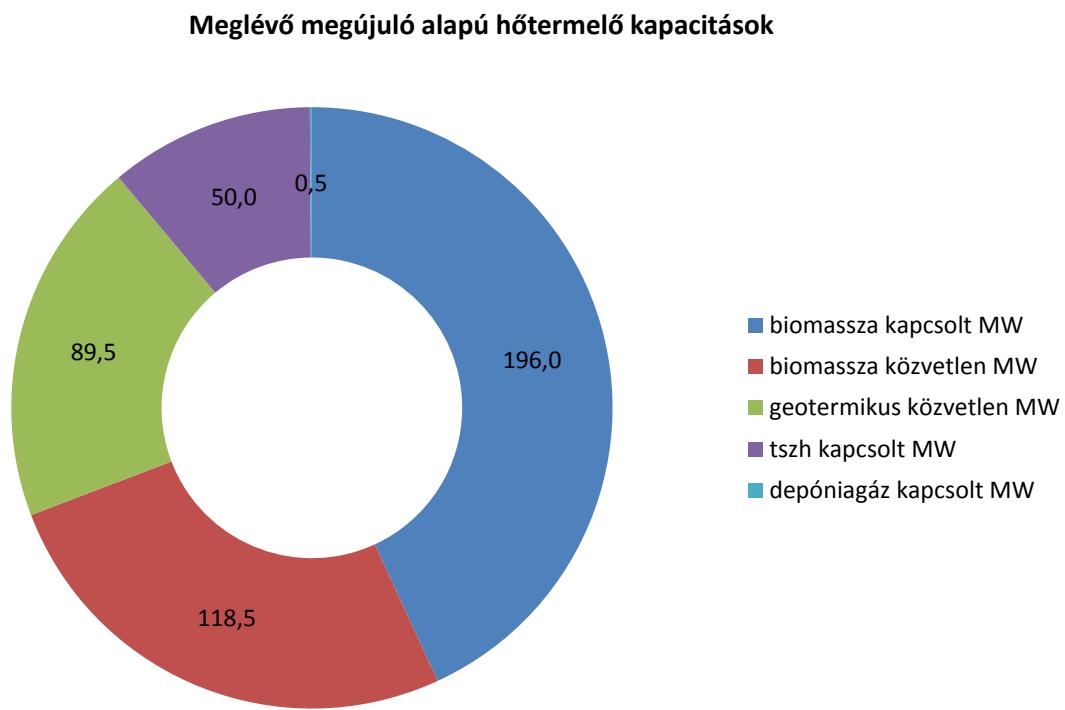


Figure 1 – Amount of district heat sold nationally

<sup>1</sup> In our country, the heating design outdoor temperature depends on the geographic location and varies between -11 °C and -15 °C. As national average, the value of the capital, -13 °C, can be used as a good approximation. (See, e.g. Baumann, Mihály: Building Energy Engineering, Figure 3.1.1.1, source: Hungarian Standard MSZ-04-140/3)

The existing renewable-based installed heat generation capacities that may be taken into account for the purposes of ‘efficient district heating’ rating are illustrated in Figure 2. Based on the figure, it can be established that at present, a total renewable-based heat generation capacity of 454.5 MW<sup>2</sup> is installed in the district heating systems in question, 246.5 MW of which is cogeneration and 208 MW is direct heat generation capacity. About 111.5 MW of renewable-based installed cogeneration<sup>3</sup> electrical capacity is associated with them.



Meglévő megújuló alapú hőtermelő kapacitások	Existing renewable-based heat generation capacities
biomassza kapcsolt MW	biomass cogeneration, MW
biomassza közvetlen MW	biomass direct, MW
geotermikus közvetlen MW	geothermal direct, MW
tszh kapcsolt MW	municipal solid waste cogeneration, MW
depóniagáz kapcsolt MW	landfill gas cogeneration, MW

**Figure 2 – Existing renewable-based heat generation capacities**

The existing natural gas-based installed cogeneration thermal capacity, which may be taken into account for the ‘efficient district heating’ rating, is almost 1 300 MW in total (combined cycle power plants, gas turbine power plant, steam power plant and gas engines), and the existing nuclear-based installed cogeneration thermal capacity is 20 MW. In total, about 1 150 MW of non-renewable-based installed cogeneration electrical capacity is associated with them.

## 2.2 Reviewed scenarios and results

In our calculations, the thermal and primary energy mixes and the amount of cogenerated electricity of four energy scenarios were determined for each district heating system. In the case of the latter

<sup>2</sup> Considering the biomass capacity in Tatabánya existing and the geothermal capacity in Győr non-existing.

<sup>3</sup> Therefore, no condensing capacity is included in this.

amount, only the electricity fully cogenerated with the useful amount of heat was taken into account.

In further calculations, a constant district heating demand in the future was taken as a basis in this paper, i.e. with a somewhat optimistic approach, it was assumed that the sector would be able to offset the heat demand-reducing effect of the upgrading of primary and secondary systems through market expansion; greening the generated heat mix provides a hope to this.

The four scenarios reviewed are as follows:

- (1) The heat generation mix attainable with existing equipment with the actual/real utilisation of cogeneration and renewable-based equipment (labelled ‘Existing actual/r.’ in the figures)

For systems where actual data were available for the typical average value of the heat generation mix and natural gas-based electricity cogeneration in the current legal and economic environment, these values were included. In other systems, the peak utilisation rate of the natural gas-based cogeneration capacity quantified by the Hungarian Cogeneration Association at 2 000 h/year in the current condition was reckoned with, and 80 % of the demand that may be met at maximum with existing renewable capacities was taken into account.

- (2) The best heat generation mix attainable with existing equipment from the point of view of the efficient district heating criterion (labelled ‘Existing max.’ in the figures)

In load distribution, renewable capacities are taken into account for base load, and natural gas-based cogeneration capacities are loaded after renewable capacities have been loaded to maximum.

- (3) The heat generation mix attainable in the event that new renewable-based generation capacities enter<sup>4</sup> (labelled as ‘Theoretical 1’ in the figures)

The existing cogeneration capacity carries the base load at maximum utilisation rate in the Theoretical 1 mix, if any. Conceivable new types: bio-biomass, geo-geothermal and municipal solid waste (the ‘MSW’). Of the new renewable-based district heat generators, cogeneration was reckoned with only in Debrecen and in the case of the new Waste-to-energy Plant in Budapest. However, only the value calculated for exclusive heat generation<sup>5</sup> was taken into account. For district heat supply systems where the proposed development is already known (e.g. Budapest North Buda), only the planned capacity was reckoned with, even if the heat generation mix required for the ‘efficient district heating’ rating also would expect/allow a higher capacity. Otherwise, the capacity of the new technology was selected in such a way that the old cogeneration and the new renewable heat generation units jointly ensure the ‘efficient district heating’ rating under any circumstances. In the case of systems that already meet the ‘efficient district heating’

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<sup>4</sup> No establishment of any new natural gas-based cogeneration capacity in the foreseeable future was reckoned with.

<sup>5</sup> According to estimates, the total capital cost of the whole Waste-to-heat Plant 2 (HUHA2) would be HUF 50 to 65 billion depending on the location of installation and the technical solution.

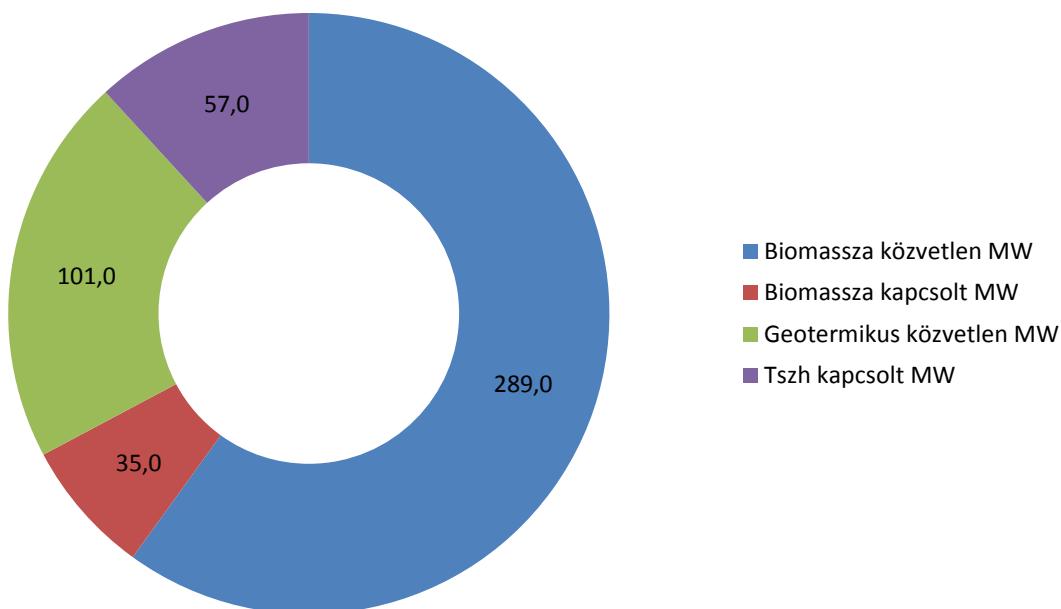
rating even now, no new development was envisaged, and the calculation is based on existing capacities (thus, e.g. no further development was reckoned with for Komló, because on the basis of the current mix, the ‘efficient district heating’ criterion is met). No development projects were reckoned with for 44 small systems, which do not reach an annual heat demand of 8 TJ, i.e. a peak thermal power demand of 0.7 to 0.8 MW (less than 200 homes), the total heat demand from a network does not even reach 155 TJ/year, which is half per cent of the total heat demand.

- (4) Heat generation mix attainable in the event of the entry of new renewable-based generation capacities (labelled as ‘Theoretical 2’ in the figures)

The scenario reckons with the capacities taken into account for the Theoretical 1 mix, but in this case, renewable capacities carry the base load. For currently efficient systems (in which no new heat generation equipment was reckoned with), it is identical with Scenario 2.

In Scenarios ‘Theoretical 1’ (3) and ‘Theoretical 2’ (4), the renewable-based thermal and electrical capacities foreseen to be installed are shown in Figure 3 and Figure 4 . According to the figures, the installation of 482 MW of renewable-based thermal capacity and 41.4 MW related cogeneration electrical capacity were foreseen in the reviewed district heating systems. We note that the possible future appearance of any new aid scheme similar to the previous mandatory power purchase scheme was not taken into account for the estimation of the foreseen cogeneration electrical capacities.

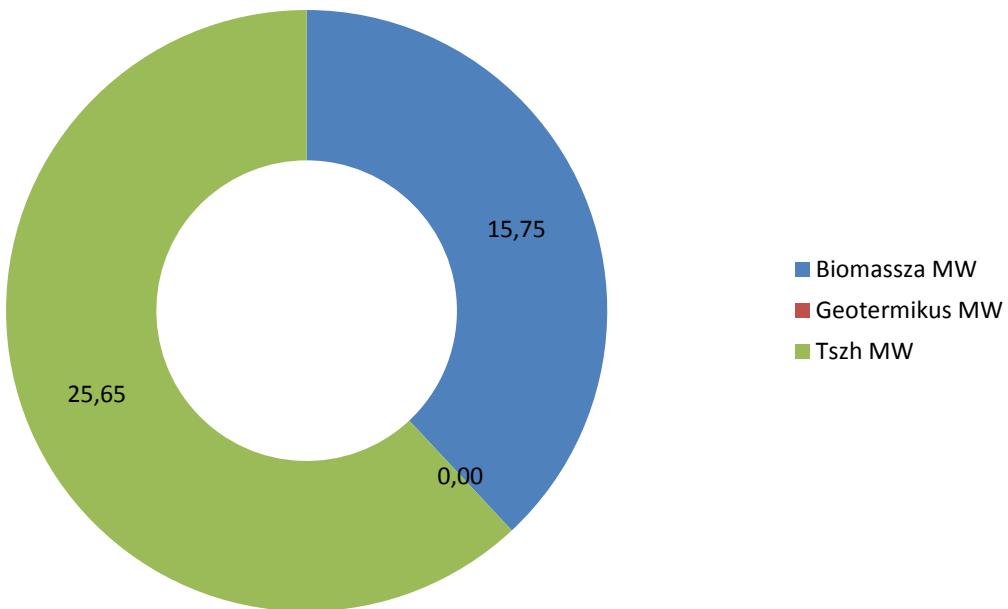
#### Új megújuló alapú hőtermelő kapacitások



Meglévő megújuló alapú hőtermelő kapacitások	Existing renewable-based heat generation capacities
Biomassza közvetlen MW	Biomass direct, MW
Biomassza kapcsolt MW	Biomass cogeneration, MW
Geotermikus közvetlen MW	Geothermal direct, MW
Tszh kapcsolt MW	MSW cogeneration, MW

Figure 3 – New renewable-based heat generation capacities

### Új megújuló alapú villamos kapacitások

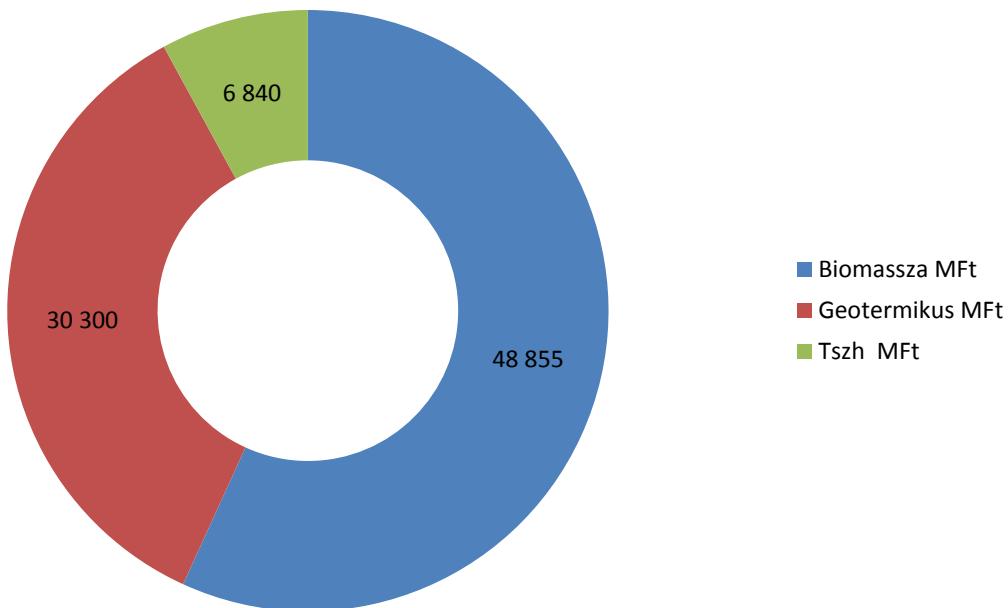


Új megújuló alapú villamos kapacitások	New renewable-based electrical capacities
Biomassza MW	Biomass, MW
Geotermikus MW	Geothermal, MW
Tszh MW	MSW, MW

Figure 4 – New renewable-based cogeneration electrical capacities

The estimated total capital cost requirement for establishing these would be exactly HUF 86 billion<sup>5</sup> (see Figure 5).

### Új megújuló alapú hőtermelő kapacitások becsült beruházási költsége



Új megújuló alapú hőtermelő kapacitások becsült beruházási költsége	Estimated capital cost of new renewable-based heat generation capacities
Biomassza M Ft	Biomass, HUF million
Geotermikus M Ft	Geothermal, HUF million
Tszh M Ft	MSW, HUF million

**Figure 5 – Estimated capital cost of new renewable-based heat generation capacities**

The district heat mix generated in the individual scenarios and their percentage distribution are illustrated in Figure 6 and Figure 7, respectively.

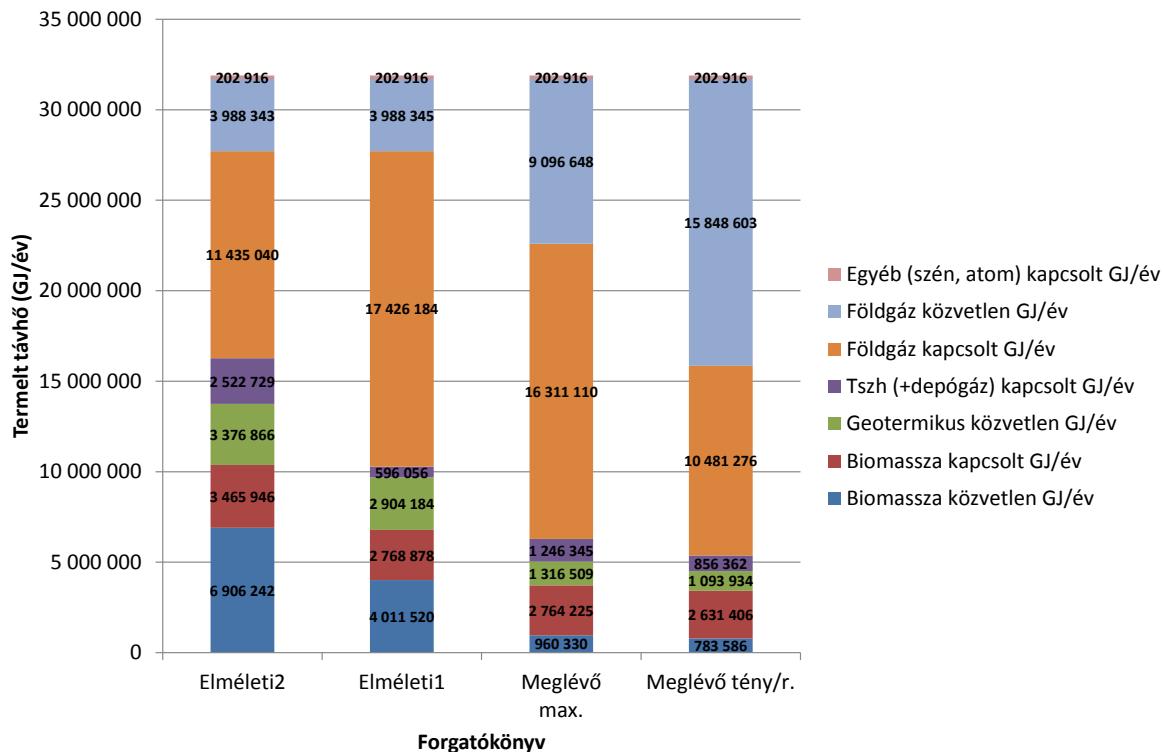
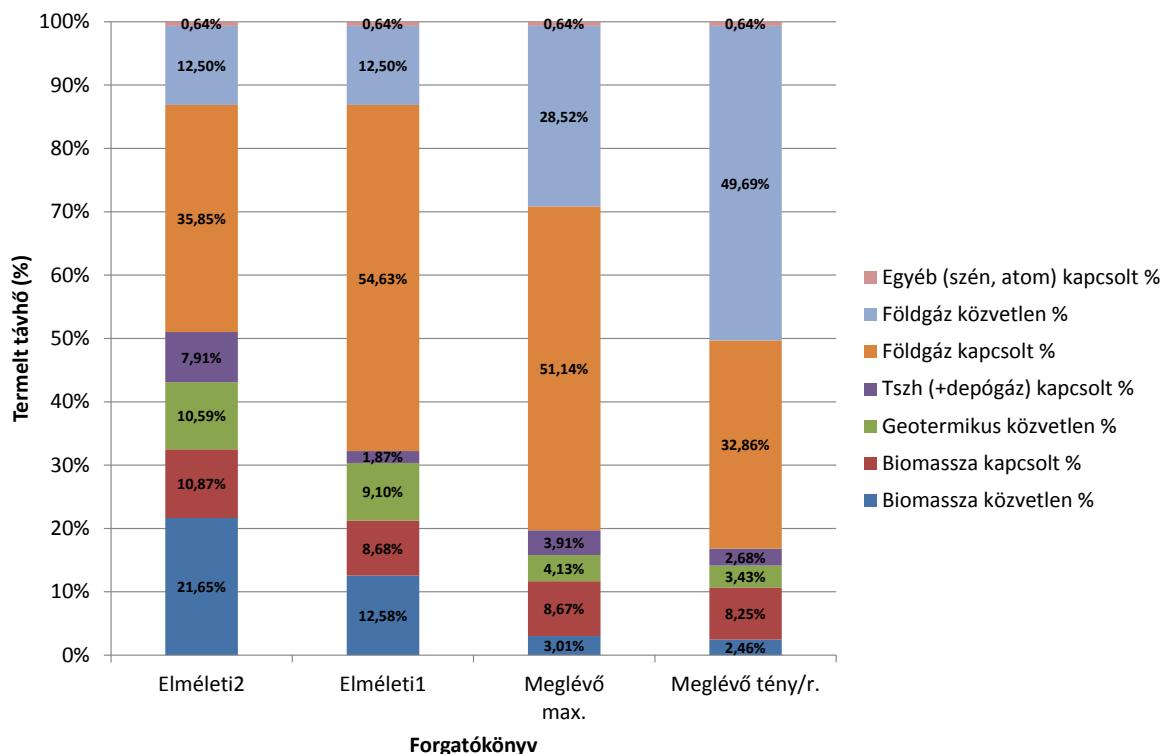


Figure 6 – District heat mix emerging in the individual scenarios



Termelt távhő (%)	District heat generated (%)
Egyéb (szén, atom) kapcsolt %	Other (coal, nuclear) cogeneration, %
Földgáz közvetlen %	Natural gas, direct, %
Földgáz kapcsolt %	Natural gas, cogeneration, %
Tszh (+depógáz) kapcsolt %	MSW (+ landfills gas) cogenerated, %
Geometrikus közvetlen %	Geothermal, direct, %

Biomassza kapcsolt %	Biomass, cogeneration, %
Biomassza közvetlen %	Biomass, direct, %

**Figure 7 – District heat mix emerging in the individual scenarios (in percentage)**

The specific values are summarised in Table 1 and Table 2.

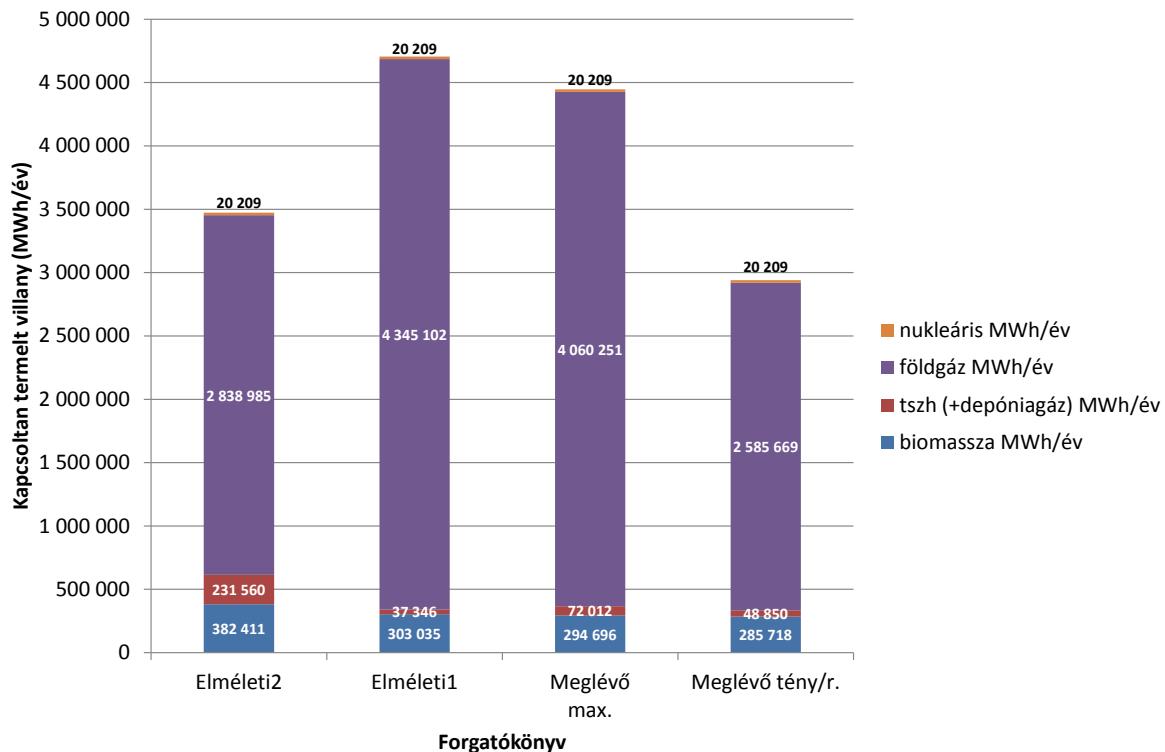
Heat mix generated		Theoretical 2	Theoretical 1	Existing max.	Existing actual/r.
Biomass, direct	GJ/year	6 906 242	4 011 520	960 330	783 586
Biomass, cogeneration	GJ/year	3 465 946	2 768 878	2 764 225	2 631 406
Geothermal, direct	GJ/year	3 376 866	2 904 184	1 316 509	1 093 934
MSW (+ landfill gas), cogeneration	GJ/year	2 522 729	596 056	1 246 345	856 362
Natural gas, cogeneration	GJ/year	11 435 040	17 426 184	16 311 110	10 481 276
Natural gas, direct	GJ/year	3 988 343	3 988 345	9 096 648	15 848 603
Other (coal, nuclear), cogeneration	GJ/year	202 916	202 916	202 916	202 916
Total	GJ/year	31 898 082	31 898 084	31 898 083	31 898 083

**Table 1 – Heat mix generated in the individual scenarios (GJ/year)**

Heat mix generated		Theoretical 2	Theoretical 1	Existing max.	Existing actual/r.
Biomass, direct	%	21.65 %	12.58 %	3.01 %	2.46 %
Biomass, cogeneration	%	10.87 %	8.68 %	8.67 %	8.25 %
Geothermal, direct	%	10.59 %	9.10 %	4.13 %	3.43 %
MSW (+ landfill gas), cogeneration	%	7.91 %	1.87 %	3.91 %	2.68 %
Natural gas, cogeneration	%	35.85 %	54.63 %	51.14 %	32.86 %
Natural gas, direct	%	12.50 %	12.50 %	28.52 %	49.69 %
Other (coal, nuclear), cogeneration	%	0.64 %	0.64 %	0.64 %	0.64 %
Total	%	100.00 %	100.00 %	100.00 %	100.00 %

**Table 2 – Heat mix generated in the individual scenarios (%)**

The amount of cogenerated electricity associated with the outlined development projects is illustrated in Figure 8 and Table 3.



Kapcsolt termelt villany (MWh/év)	Cogenerated electricity (MWh/year)
nukleáris MWh/év	nuclear, MWh/year
földgáz MWh/év	natural gas, MWh/year
tszh (+depóniagáz) MWh/év	MSW (+ landfill gas), MWh/year
biomassza MWh/év	biomass, MWh/year

Figure 8 – Cogenerated electricity in the individual scenarios

Cogenerated electricity		Theoretical 2	Theoretical 1	Existing max.	Existing actual/r.
biomass	MWh/year	382 411	303 035	294 696	285 718
MSW (+ landfill gas)	MWh/year	231 560	37 346	72 012	48 850
natural gas	MWh/year	2 838 985	4 345 102	4 060 251	2 585 669
nuclear	MWh/year	20 209	20 209	20 209	20 209
Total	MWh/year	3 473 165	4 705 692	4 447 167	2 940 446

Table 3 – Cogenerated electricity in the individual scenarios

The previously stated boundary condition is repeated with respect to the amount of cogenerated electricity, whereby it only contains the amount that is 100 % cogenerated with useful heat and does not contain any, even partial, condensation production.

In the four outlined scenarios, the distribution of primary energy use for district heat generation and its percentages are shown in Figure 9 and Figure 10, respectively.

In the case of cogeneration, the primary energy used for district heat generation was derived in such a way that the primary energy used for cogenerated electricity, calculated with reference efficiency, was deducted from the total primary energy used. Accordingly, the primary energy demand of

district heat is lower in the scenarios that assume more cogeneration (this is exactly the energy benefit of cogeneration).

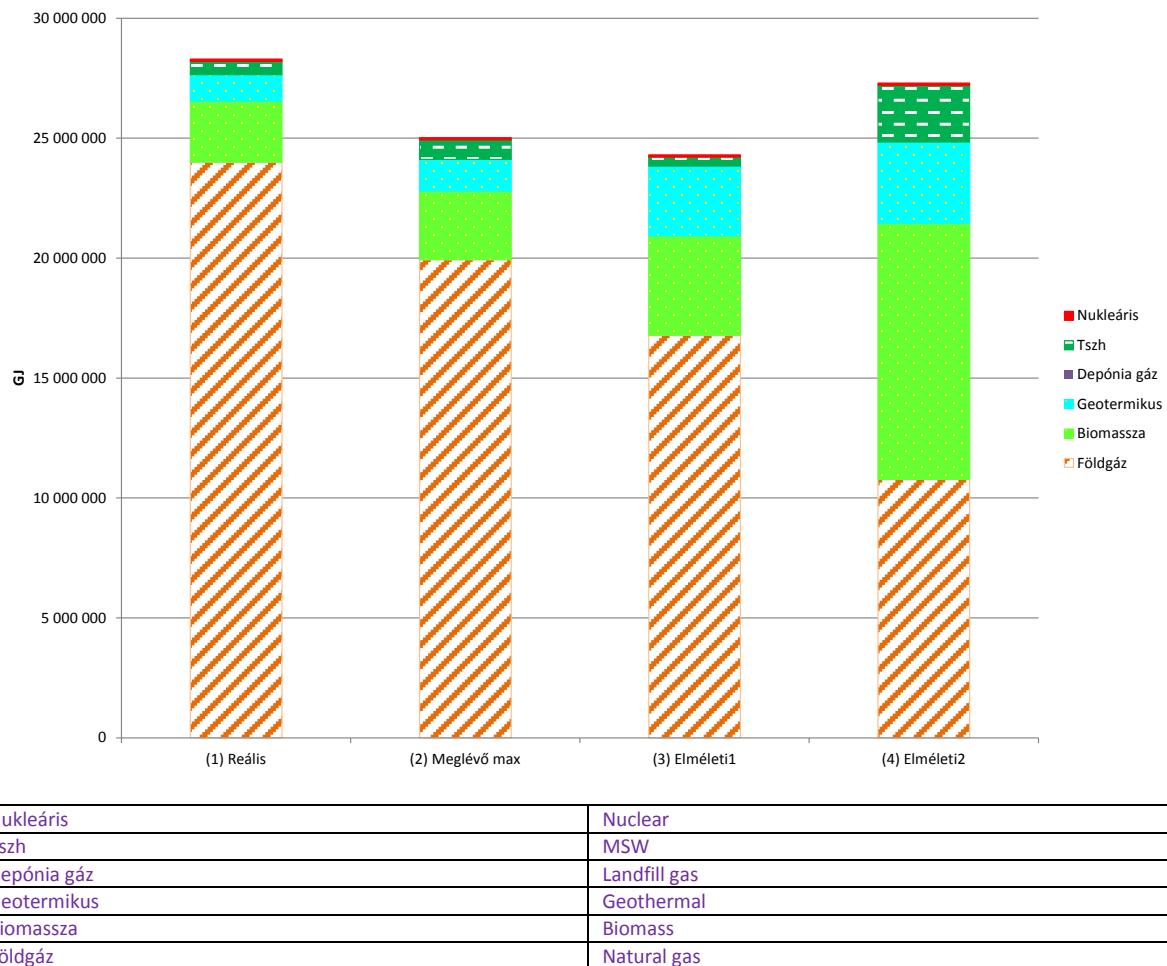


Figure 9 – Primary energy used for district heat generation in the individual scenarios (GJ/a)

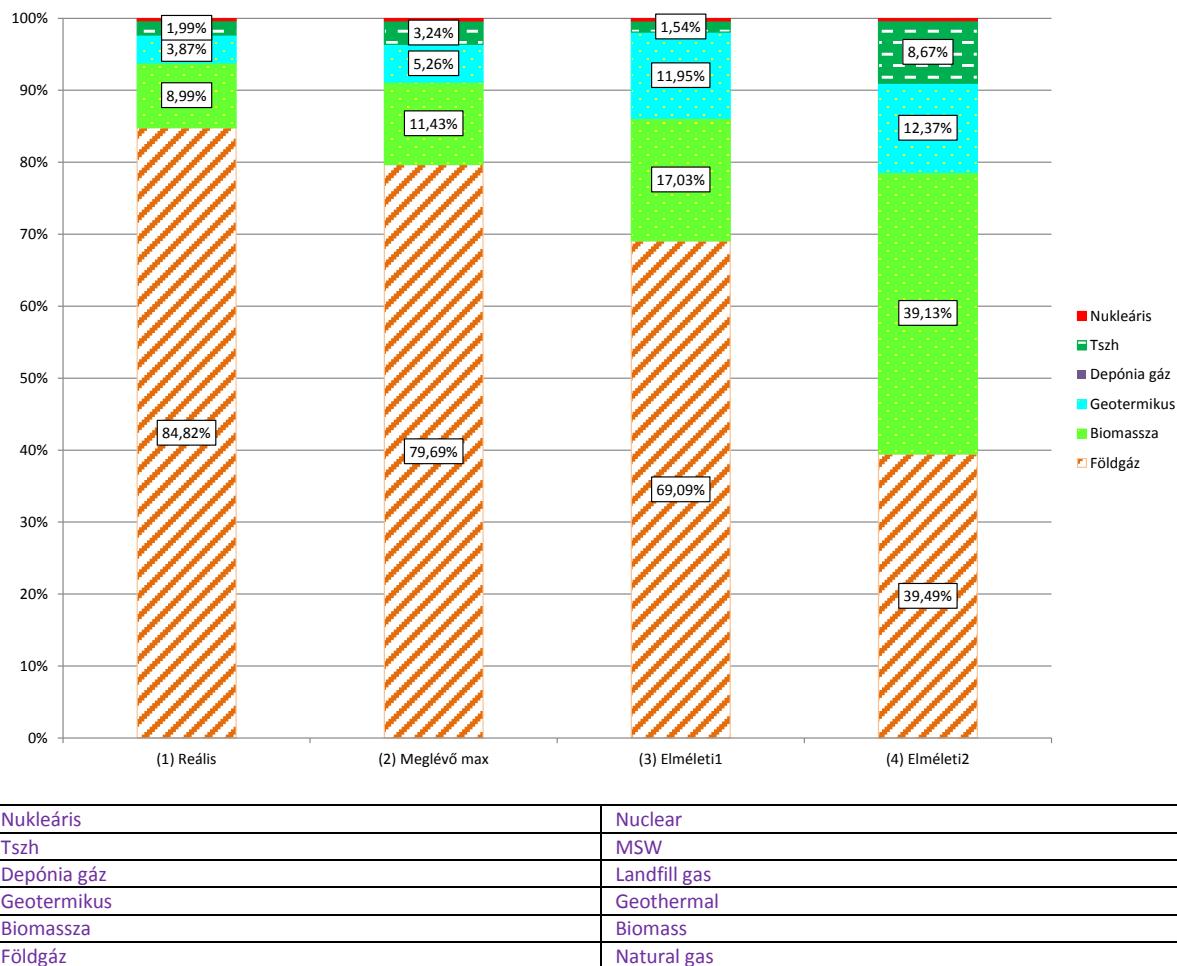


Figure 10 – Primary energy used for district heat generation in the individual scenarios (%)

In the four outlined scenarios, the number of district heating systems meeting the ‘efficient district heating’ criterion and the amount of district heat sold in district heating systems meeting the ‘efficient district heating’ criterion are shown Table 4

Meeting the ‘efficient district heating’ criterion		Theoretical 2	Theoretical 1	Existing max.	Existing actual/r.
Efficient district heating system	qty	134	134	44	28
Amount of district heat generated in efficient district heating systems	GJ/year	30 917 660	30 917 660	20 563 467	9 166 177
Proportion of district heat generated in efficient district heating systems	%	96.93%	96.93%	64.47%	28.74%

Table 4 – Meeting the ‘efficient district heating’ criterion in the individual scenarios

According to Scenarios ‘Theoretical 1’ and ‘Theoretical 2’, 134 systems attain the ‘efficient district heating’ rating, which amounts to 97 % of the amount fed to the network. As already been mentioned, no development was assumed in 44 ‘small systems’ representing a heat demand of only 155 TJ/year in total fed to the network. One of them, the Nagyatád system, forms part of the

134 'efficient district heating' systems due to its existing geothermal heat generation, thus the number of small systems 'not to be improved' is actually 43. The heat demand of the remaining 15 'inefficient' systems is 834 TJ/year, which is 2.6 % of the total demand. In their case, due to the high (but not 'sufficiently' high) proportion of either the existing cogeneration (gas engine) or renewable capacity, the establishment of only smaller or '0' new capacities was assumed.

### 2.3 Additional potential

In the scenarios outlined above, the new capacities were included in the systems by bearing in mind only the condition that they should possibly meet (with modest reserves) the criterion of 'efficient district heating'.

With regard to practical examples of certain existing district heating systems and values determined by estimation, used in technical and energy engineering practice, if the establishment of new capacities at a rate allowing them to approach 50 % of the peak thermal power demand in the given system were envisaged, it would be conceivable to establish an additional about 110 MW of new renewable heat generation capacity. The amount of heat that can be generated by them is about 1.6 PJ/year. Assuming that mostly biomass and to a smaller extent geothermal-based capacities are involved, the investment required for this can be estimated at HUF 15 or 16 billion.

### 2.4 Estimation of cooling potential

A few words will be said below also about the potential of district cooling in this paper (which means only heat-driven cooling (trigeneration)).

The economic potential of district cooling is currently zero, because only the energy costs of heat-driven cooling clearly exceed the energy cost of cooling energy generated with traditional electric-driven compressor liquid coolers, not to mention capital load differences due to significantly higher capital costs.

The theoretical potential for the district cooling of residences can be estimated on the basis of the amount of heat used for heating (15.87 PJ/year), which is sold to the general public. According to the experience from the few completed district cooling projects, compared to heating demand, both the peak cooling power demand and the cooling energy demand can be approximated at 50 %, thus the theoretical cooling energy potential can be estimated at 25 % of the heating demand, i.e. exactly 4 PJ/year, in the case of the general public. In the case of non-residential users, setting the peak capacity demand at 80 % and the cooling energy demand at 65 % of the heating demand (5 843 PJ/year), the theoretical cooling energy potential can be estimated at 52 % of the heating demand, i.e. exactly 3 PJ/year.

The technical potential of district cooling is lower than this, because for economic and security of supply reasons, it is not warranted to establish heat-driven liquid coolers to meet peak load demand. The heat-driven liquid cooler capacity installed at half of the peak cooling capacity demand may provide for meeting 80 % of the cooling energy demand. Therefore, the technical potential can be put at 80 % of the theoretical potential.

There is currently no example for the local trigeneration (a cogenerating and heat-driven liquid cooler at the same 'site') in domestic district heating systems. Heat-driven ('sorption') liquid coolers

are installed at one consumer of each of the Tiszaújváros, Szentendre and Csepel (Budapest) district heating systems and a few users of the Debrecen district heating systems, but these pieces of equipment do not operate or hardly operate due to a driving energy price that has multiplied compared to the period of installation. Instead, cooling energy is generated with electric-driven machines.

## Annexes – Duration charts for district heating systems that can be characterised by over 8 TJ/year of heat fed to the network according to Scenario ‘Theoretical 2’

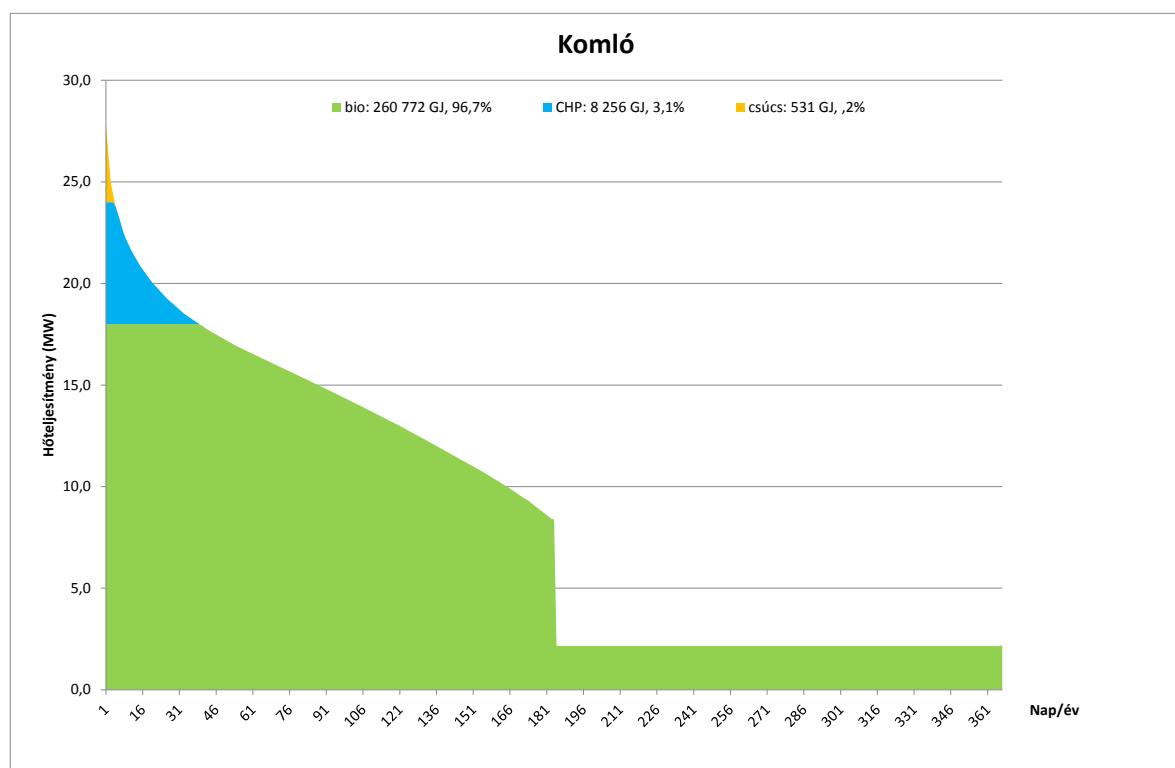
The diagrams also show a particular theoretical load distribution between heat generators in accordance with the load allocations in Scenario ‘Theoretical 2’, taking into account an existing or planned/proposed **renewable** (biomass, geothermal energy or municipal solid waste) energy source for base load (shown in green). In the diagrams, the next element in the order of loading is the **existing natural gas-based cogeneration** capacity (shown in blue), and finally thermal capacities of **natural gas fired peak load boilers** are shown in yellow ‘on top’. The new renewable capacities were determined in such a way that together with the existing (high-efficiency) cogeneration equipment, the primary energy mixes required for the ‘efficient district heating’ rating can be met with a modest reserve for the given district heating system.

The figures show, under the name of the system as title, the quantities of heat (GJ/year) generated by the above three heat generation groups (renewable, connected, peak) in a year with an average climate and their share in the heat generation mix.

The quantities from renewable (biomass, geothermal) heat generation and cogeneration, taken into account in district heat supply, are theoretical maximum values, which may be affected in reality by scheduled and unexpected failures of the specific equipment generating them. If, in municipalities that have several district heating systems in island operation, the strategic connection of the systems is carried out, both the load allocations and the duration charts of thermal power demand themselves may also change.

In the capital, nine large district heating systems supply heat to nine district heating areas. Of these, the strategic connection of the North Pest and Újpalota systems has been implemented. The experience of joint operation is continuously evolving; therefore, the two systems were presented in separate heat demand duration charts in this paper. The Kispest-Kőbánya, Csepel-Pesterzsébet and South-Buda Heating Districts are supplied with heat in island operation; therefore, the duration charts are also shown separately. The connection of three systems in the South Budapest area is a task planned for the coming years.

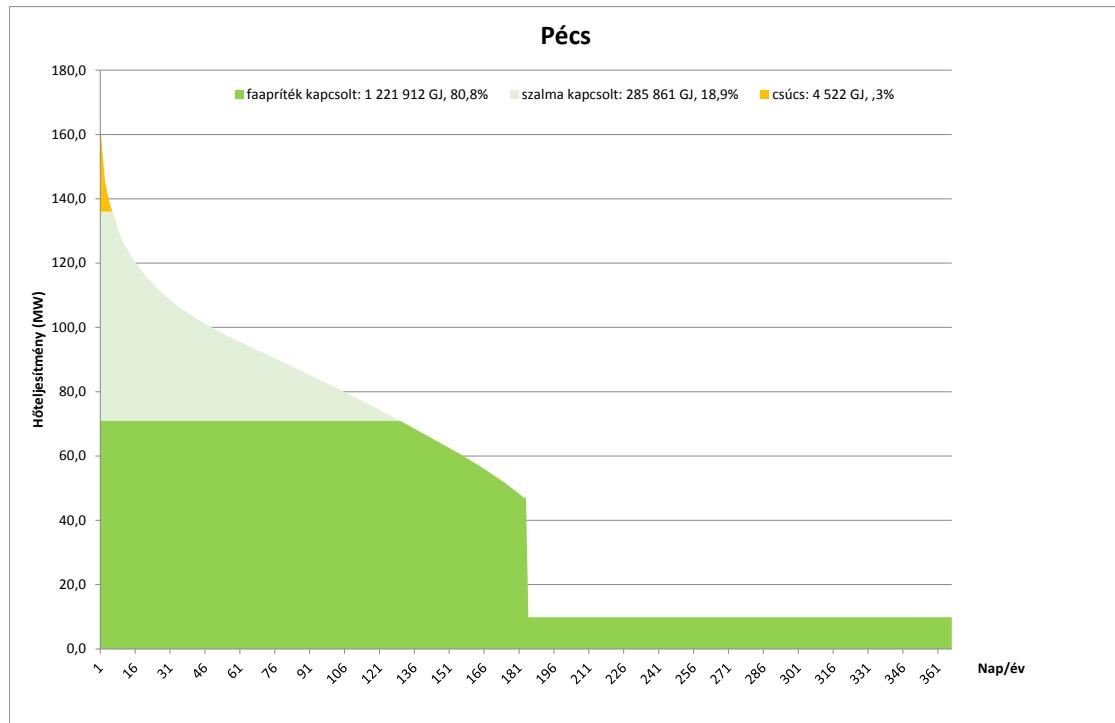
The one- or two-line brief remarks to the figures belong to the figure ‘above’ the text.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 11 – District heating system, Komló**

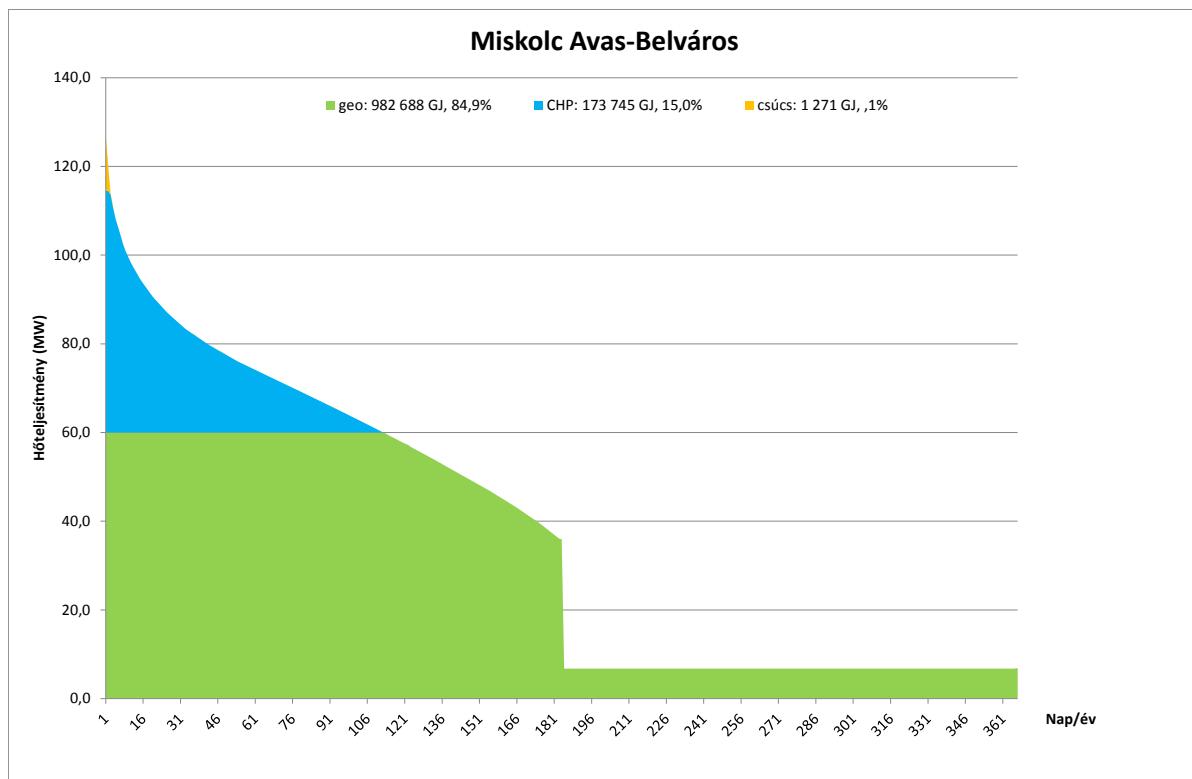
With existing wood chips-fired boiler.



faapríték kapcsolt	wood chips, cogeneration
szalma kapcsolt	straw, cogeneration
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 12 – District heating system, Pécs**

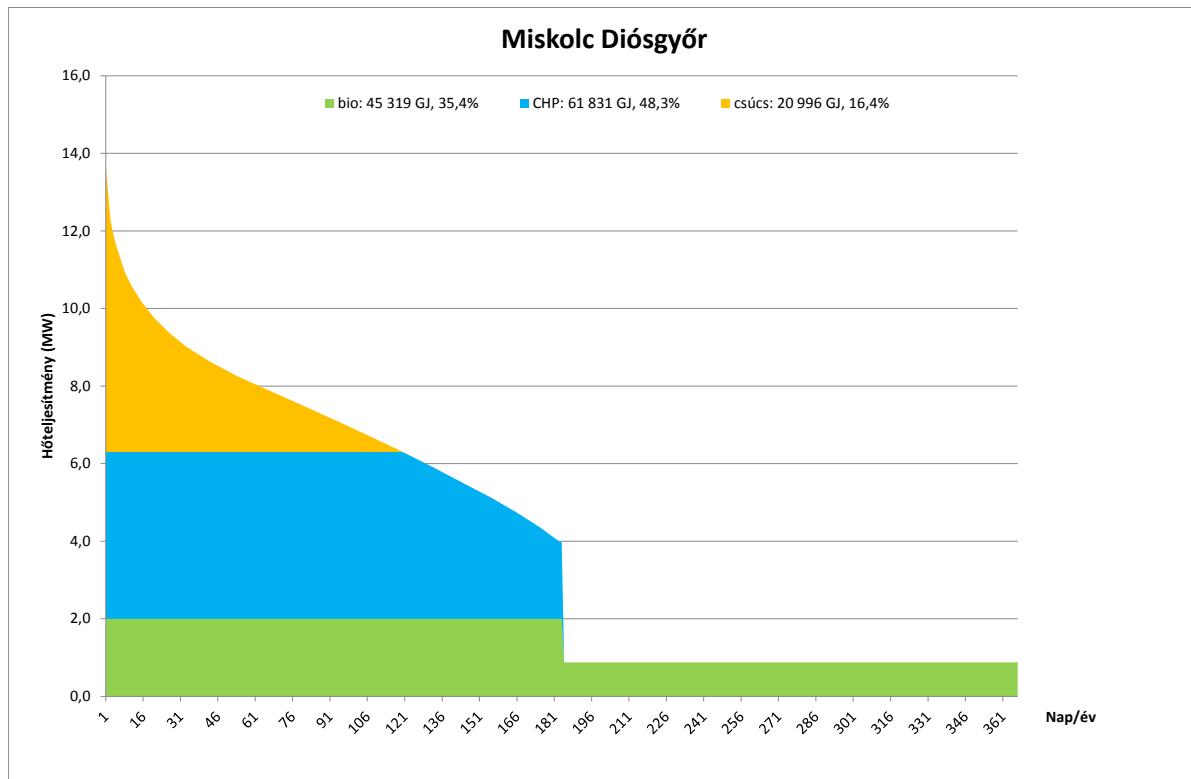
Cogeneration based on wood chips and cereal straw.



Miskolc Avas-Belváros	Miskolc Avas-City Centre
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 13 – Avas-City Centre System, Miskolc

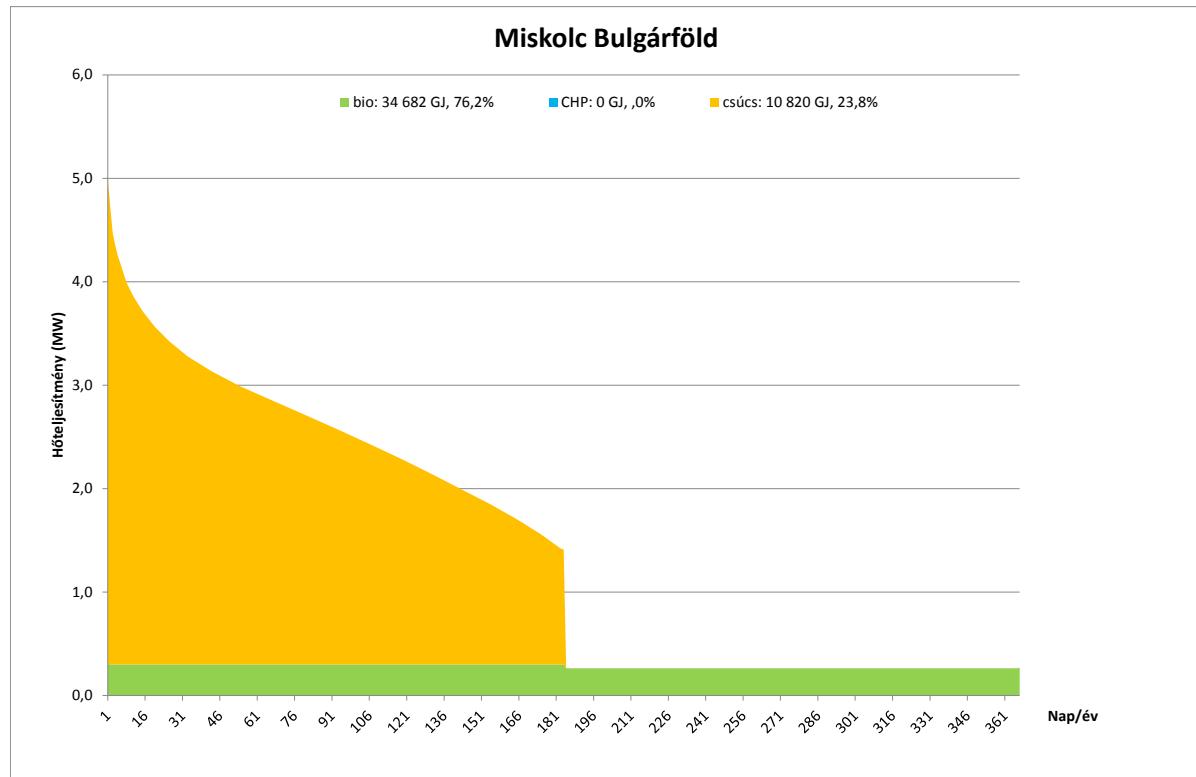
Loading up to a theoretical geothermal capacity of 60 MW.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

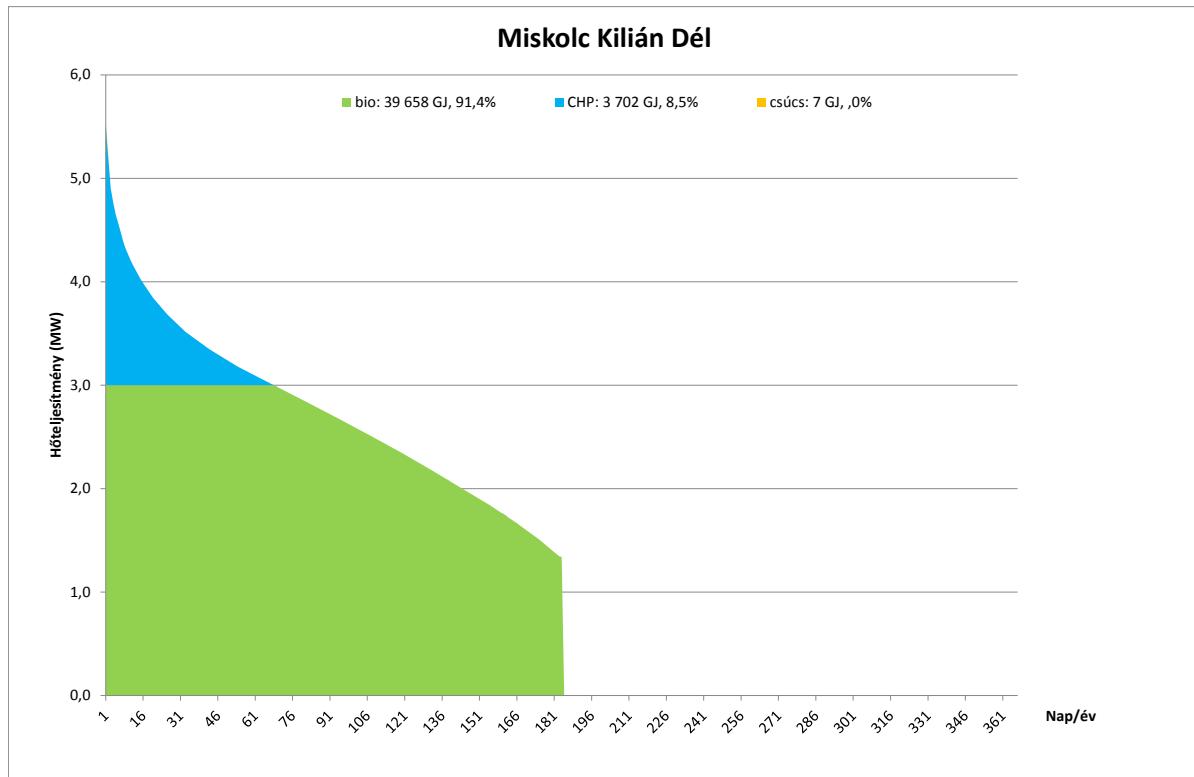
Figure 14 – Diósgyőr System, Miskolc

With the establishment of a 2 MW biomass boiler.



Miskolc Bulgárföld	Miskolc Bulgárföld
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

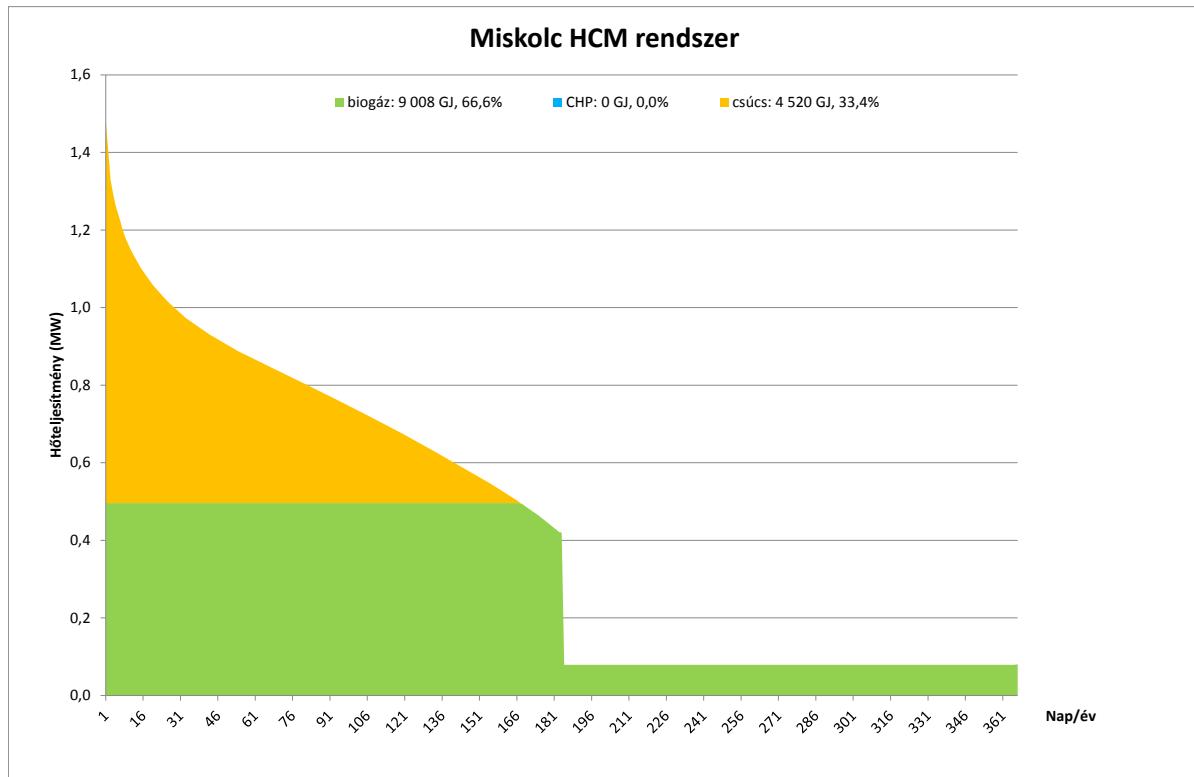
Figure 15 – Bulgárföld, Miskolc



Miskolc Kilián Dél	Miskolc Kilián South
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 16 – Kilián South, Miskolc**

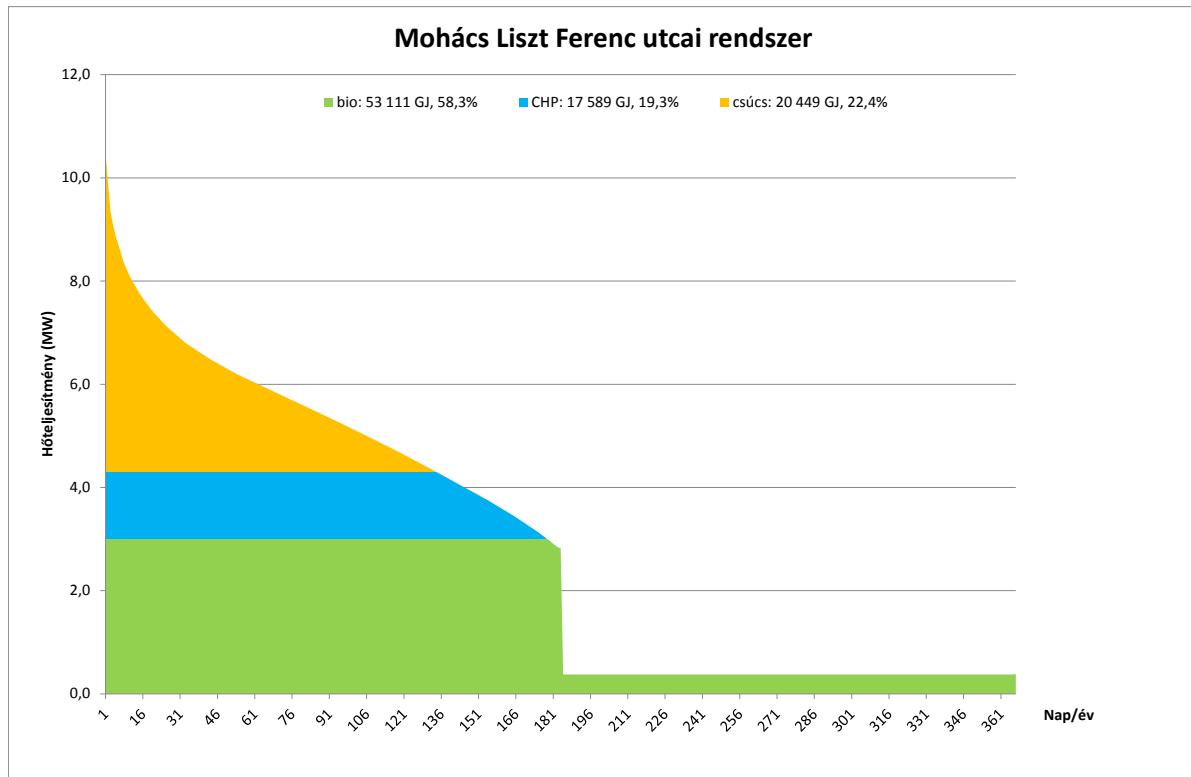
Existing wood chips-fired boiler.



Miskolc HCM rendszer	Miskolc HCM system
biogáz	biogas
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 17 – HCM System, Miskolc

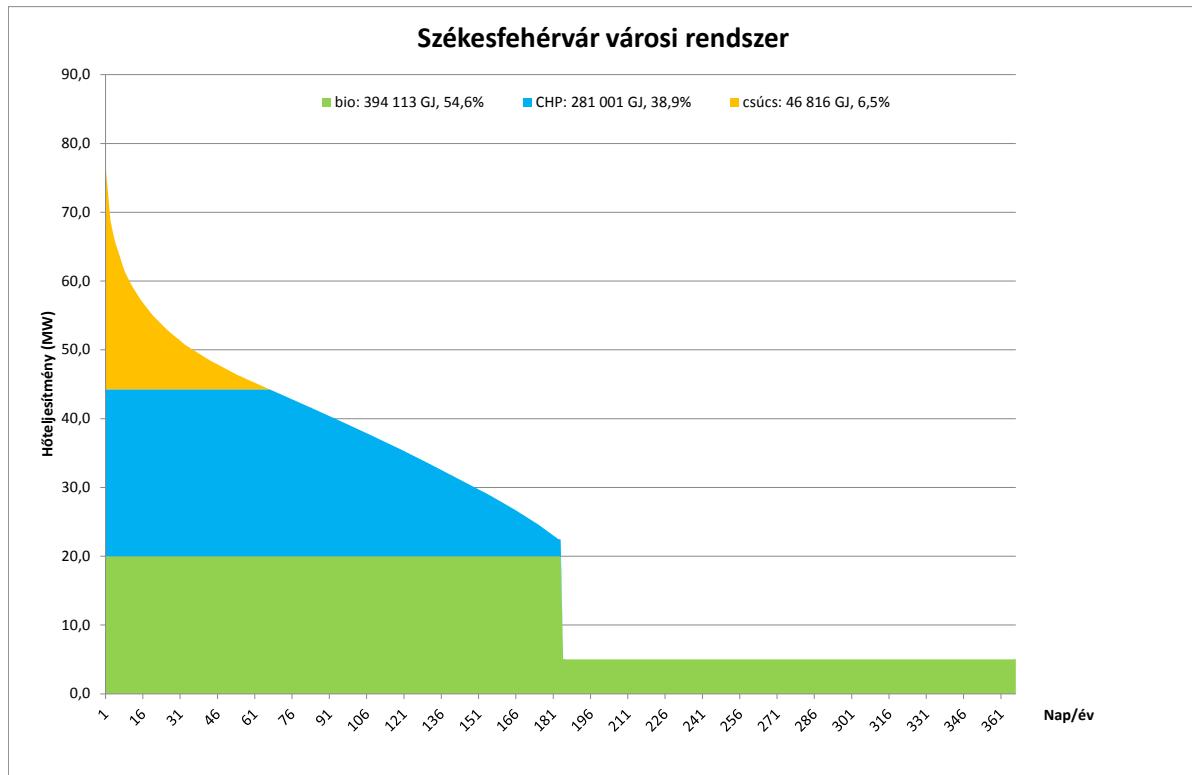
With existing landfill gas engine.



Mohács Liszt Ferenc utcai rendszer	Liszt Ferenc utca System, Mohács
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 18 – Liszt Ferenc utca System, Mohács**

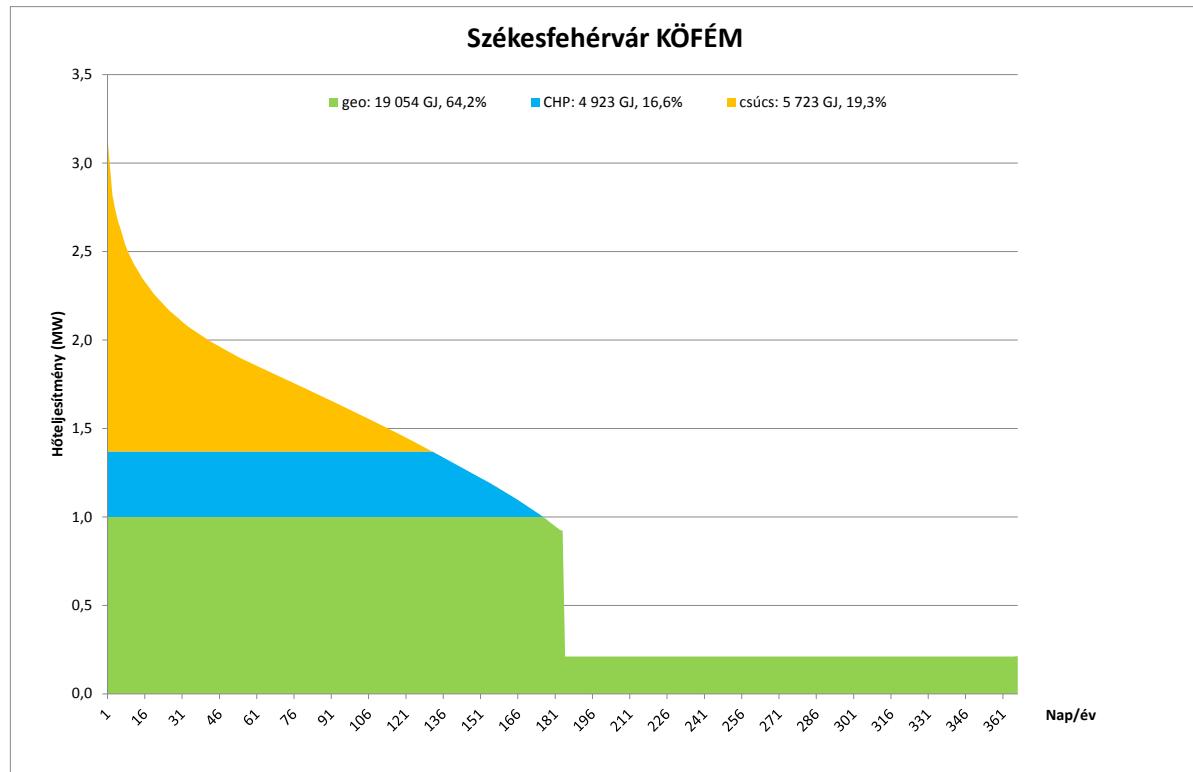
With the installation of a new biomass boiler.



Székesfehérvár városi rendszer	Municipal System, Székesfehérvár
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 19 – Municipal System, Székesfehérvár**

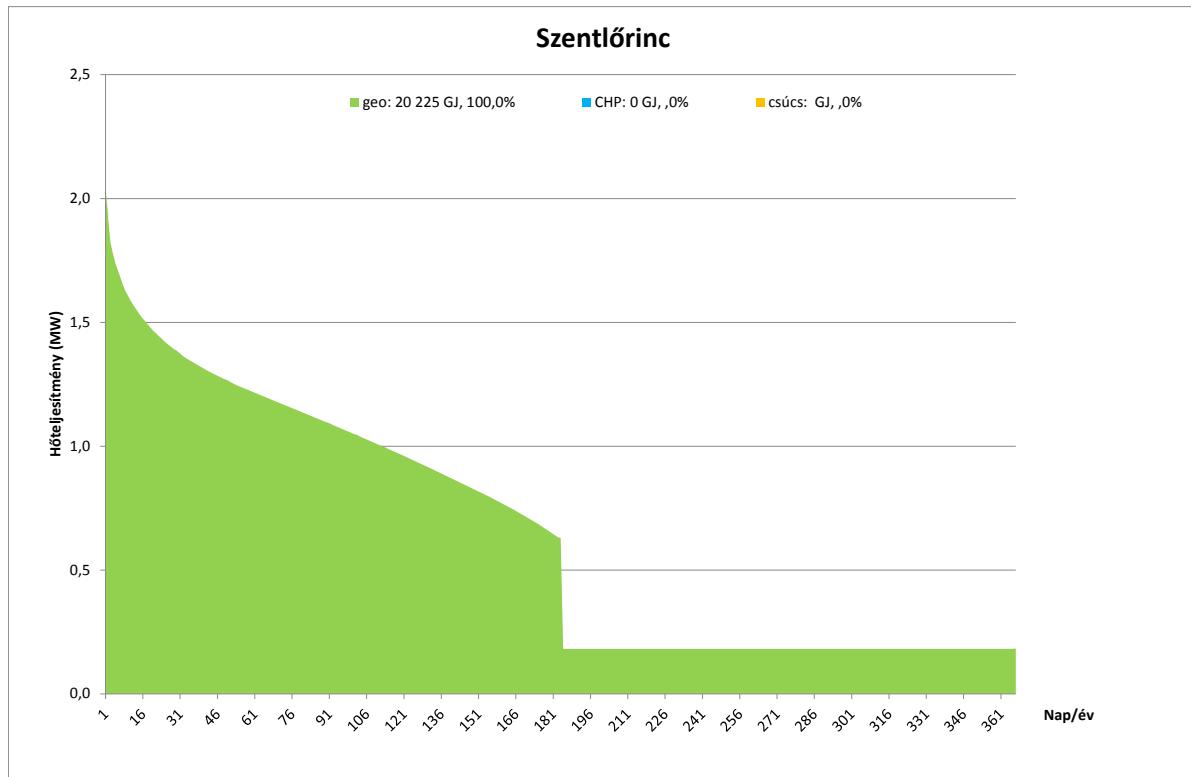
New 20 MW biomass boiler, existing gas engine capacity of 25 MW<sub>th</sub>.



Székesfehérvár KÖFÉM	KÖFÉM, Székesfehérvár
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 20 – KÖFÉM System, Székesfehérvár

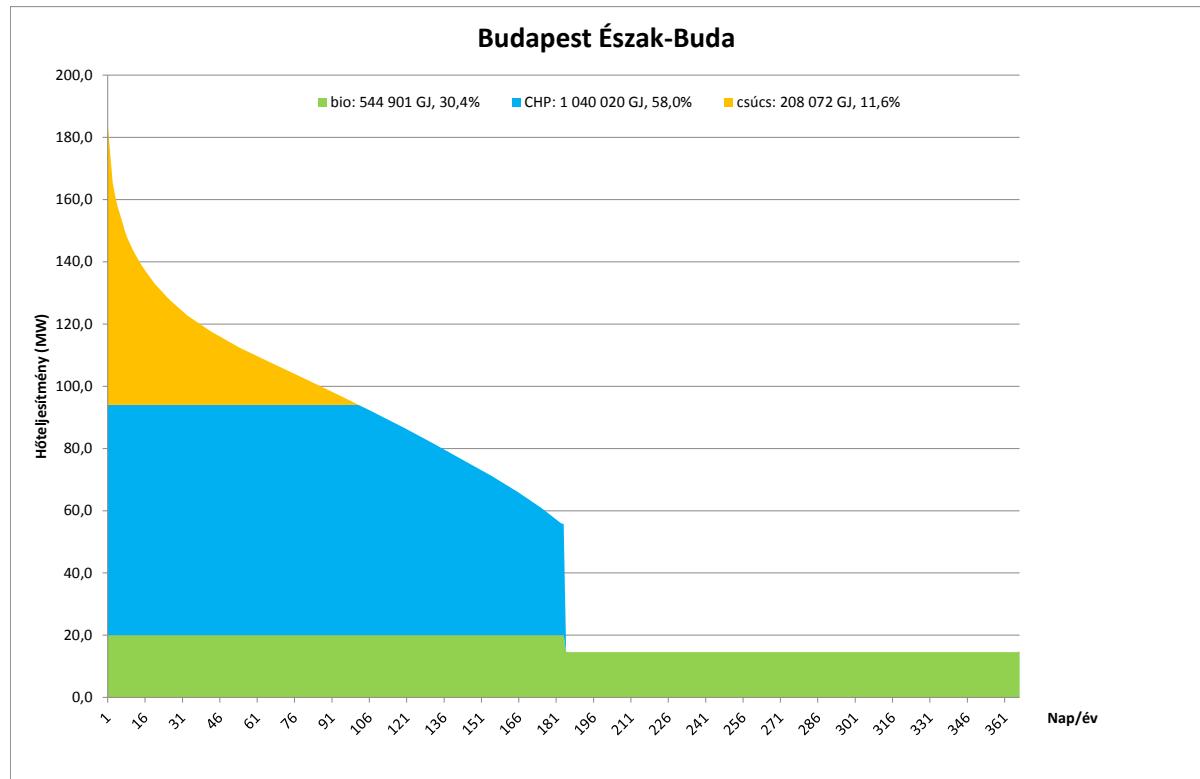
With a 1 MW new biomass boiler.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 21 – District heating system, Szentlőrinc**

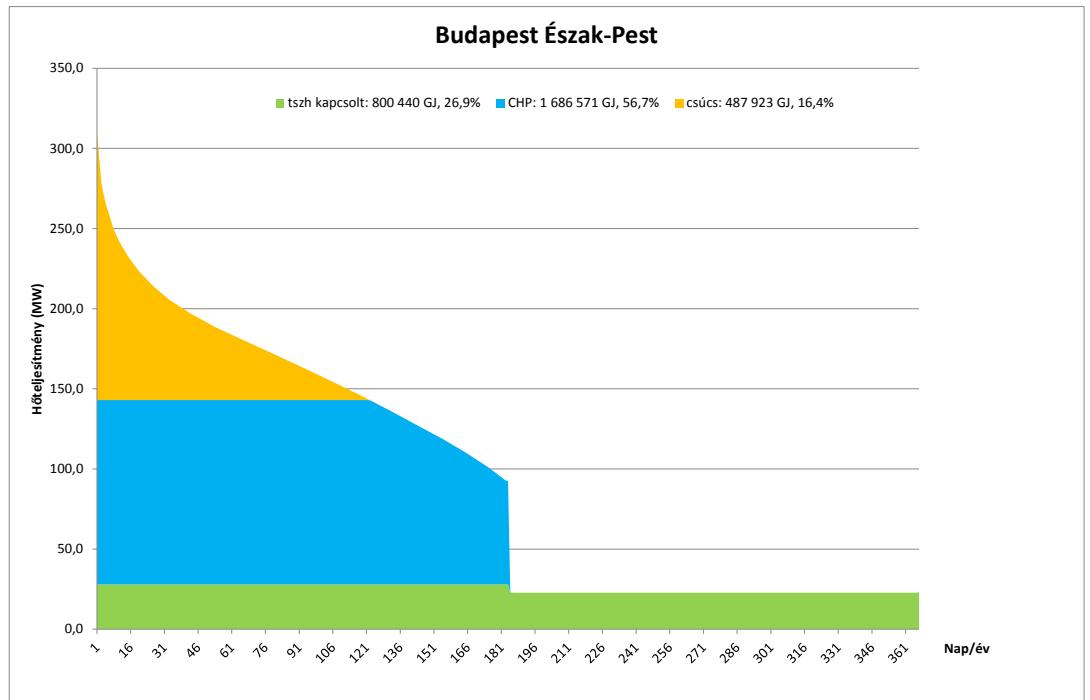
With existing geothermal heat source.



Budapest Észak-Buda	North Buda, Budapest
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 22 – North Buda District Heating System, Budapest**

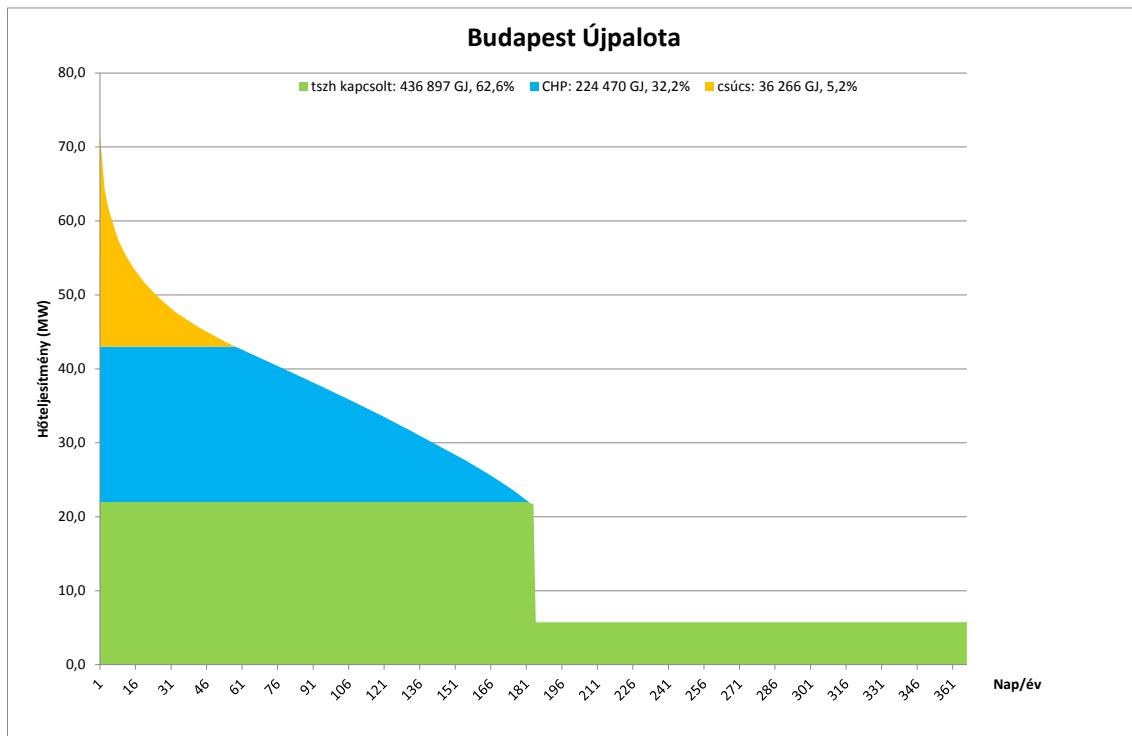
A new 20 MW wood chips-fired boiler and an existing gas turbine heat cogeneration capacity of 74 MW<sub>th</sub>.



Budapest Észak-Pest	North Pest, Budapest
tszh kapcsolt	MSW, cogeneration
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 23 – the North Pest District Heating System, Budapest**

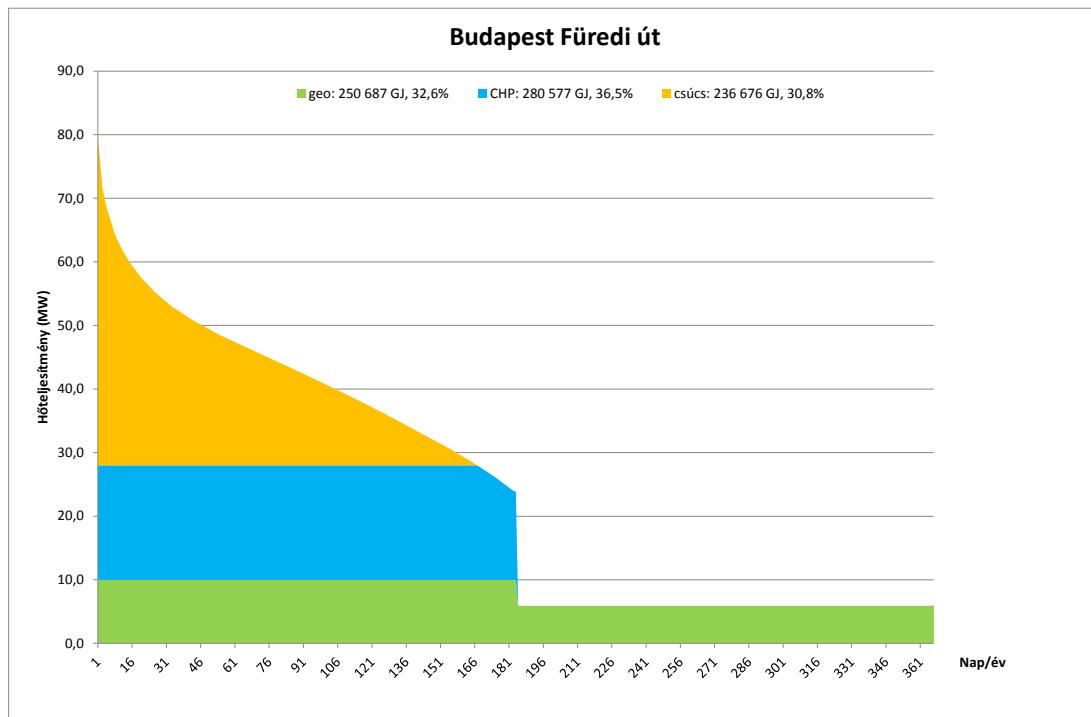
28 MW<sub>th</sub> municipal solid waste-based capacity (Waste-to-heat Plant) and 115 MW<sub>th</sub> combined cycle power plant + gas engines.



Budapest Újpalota	Újpalota, Budapest
tszh kapcsolt	MSW, cogeneration
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 24 – Újpalota District Heating System, Budapest**

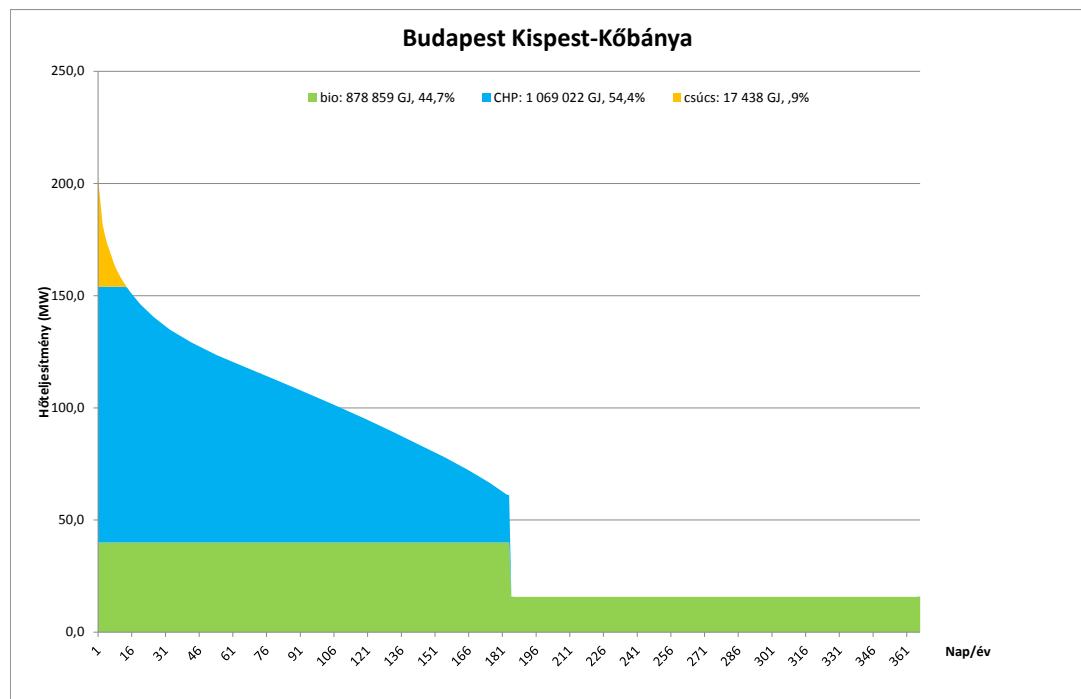
Heat generation capacities taken into account: existing 22 MW<sub>th</sub> cogenerated municipal solid waste and 21 MW<sub>th</sub> of existing gas engine cogeneration thermal capacity.



Budapest Füredi út	Füredi út, Budapest
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 25 – District heating system of the Füredi út Central Heating Plant, Budapest**

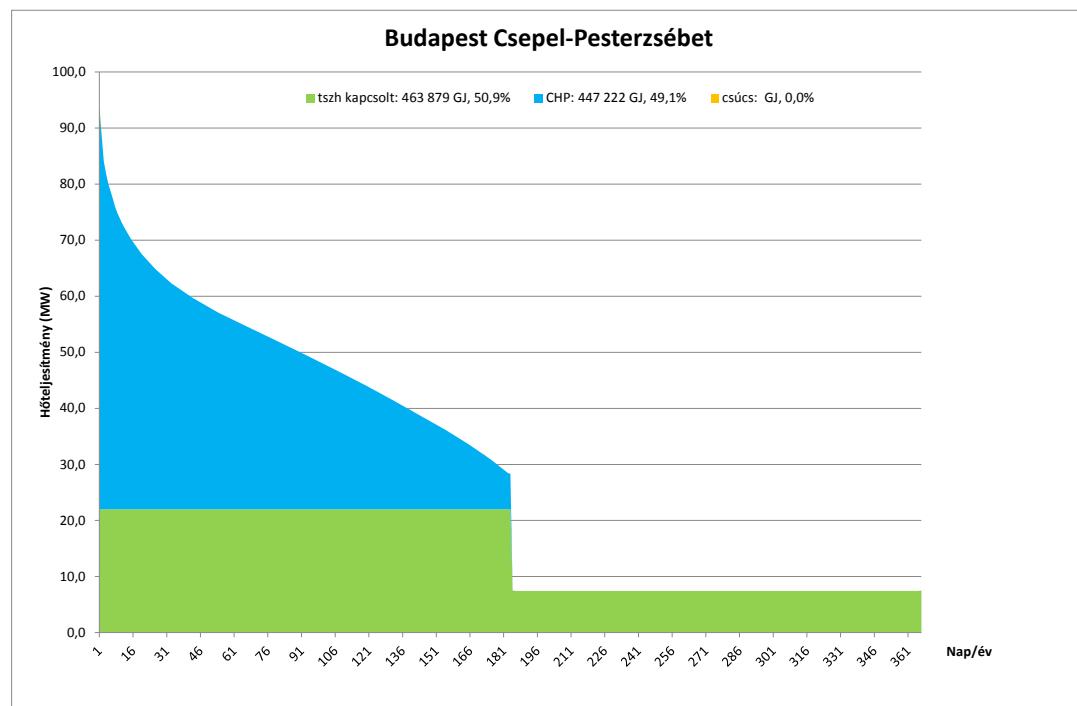
Heat generation capacity taken into account: 10 MW of new geothermal (perhaps biomass) heat source and 18 MW of gas engine cogeneration heat capacity.



Budapest Kispest-Kőbánya	Kispest-Kőbánya, Budapest
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 26 – Kispest-Kőbánya District Heating System, Budapest

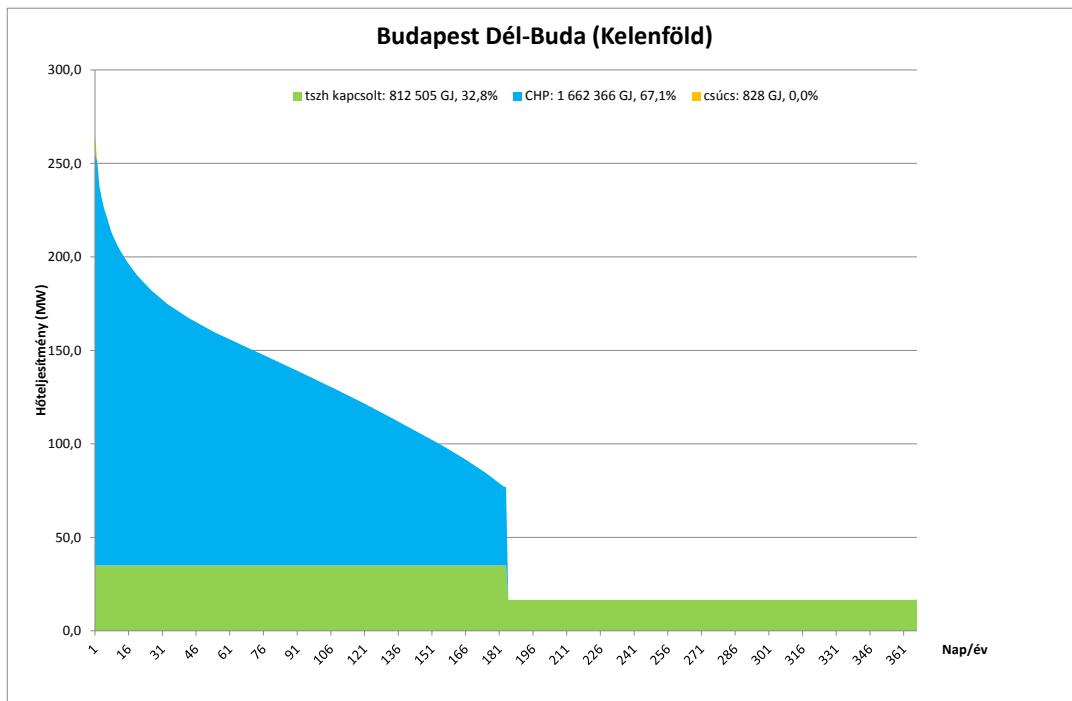
Heat generation capacities taken into account: a new 40 MW biomass (wood chips) boiler and 114 MW combined cycle power plant + gas engines (cogeneration).



Budapest Csepel-Pesterzsébet	Csepel-Pesterzsébet, Budapest
tszh kapcsolt	MSW, cogeneration
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 27 – Csepel-Pesterzsébet Heating District, Budapest

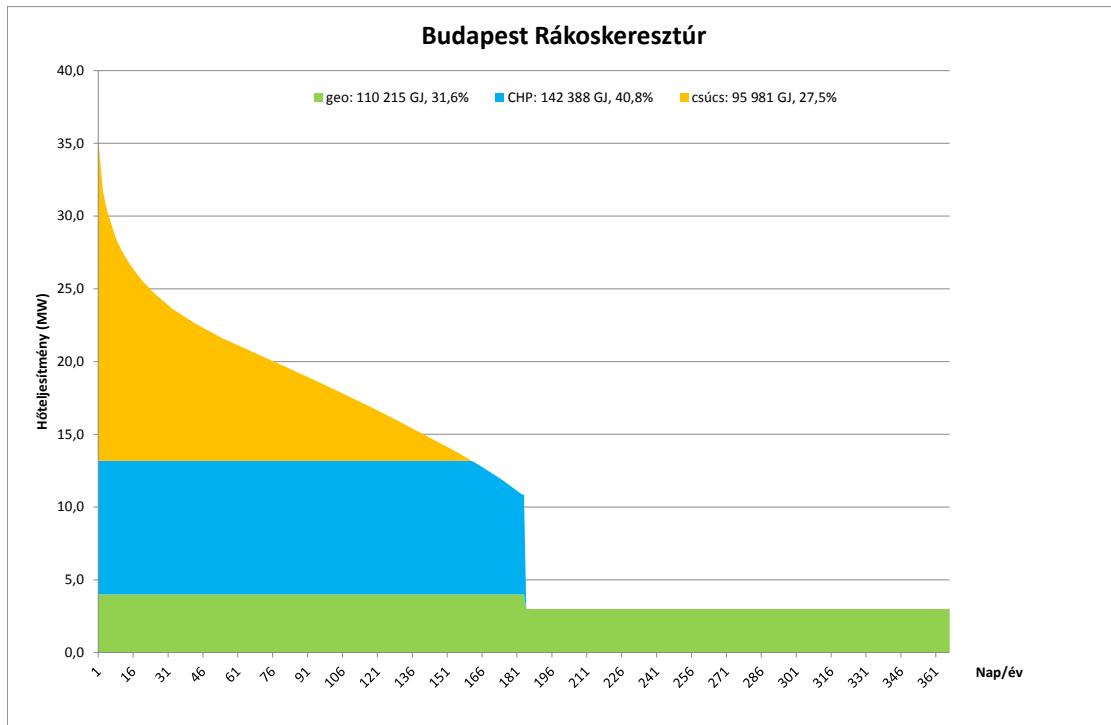
Heat generation capacities taken into account: 22 MW municipal solid waste (Waste-to-heat Plant II (HUHA II), to be newly constructed) and a 128 MW combined cycle power plant.



Budapest Dél-Buda (Kelenföld)	South Buda (Kelenföld), Budapest
tszh kapcsolt	MSW, cogeneration
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 28 – South Buda (Kelenföld) District Heating System, Budapest

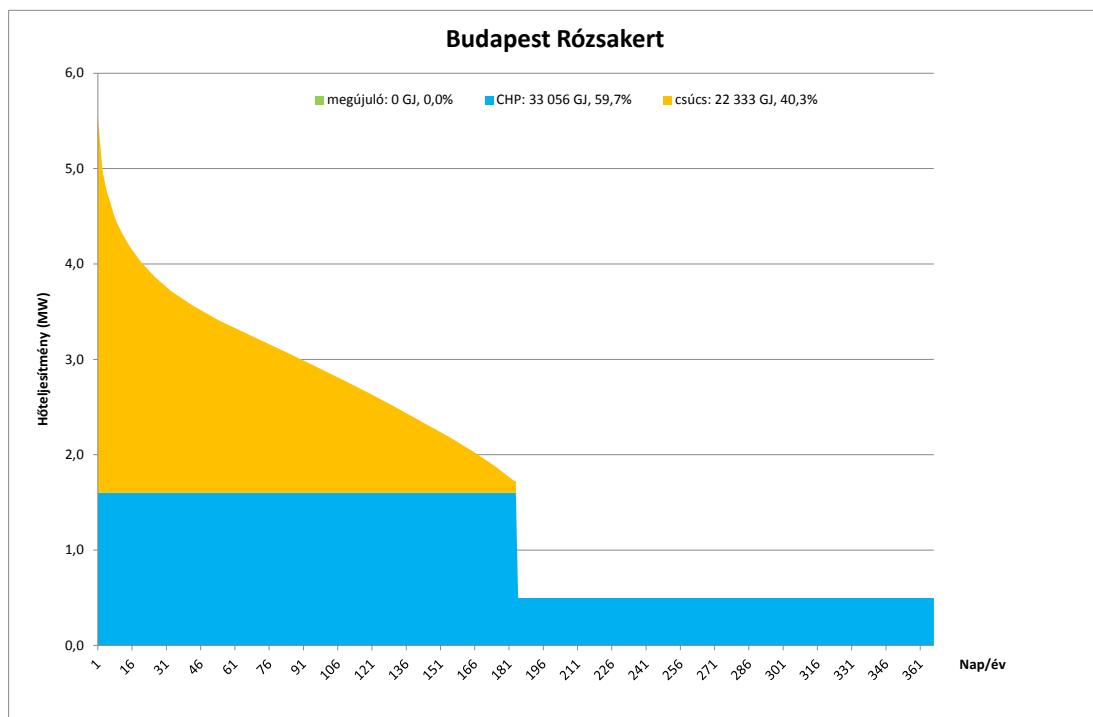
Heat generation capacities taken into account: 35 MW municipal solid waste (Waste-to-heat Plant II (HUHA II), to be newly constructed) and a 220 MW combined cycle power plant.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

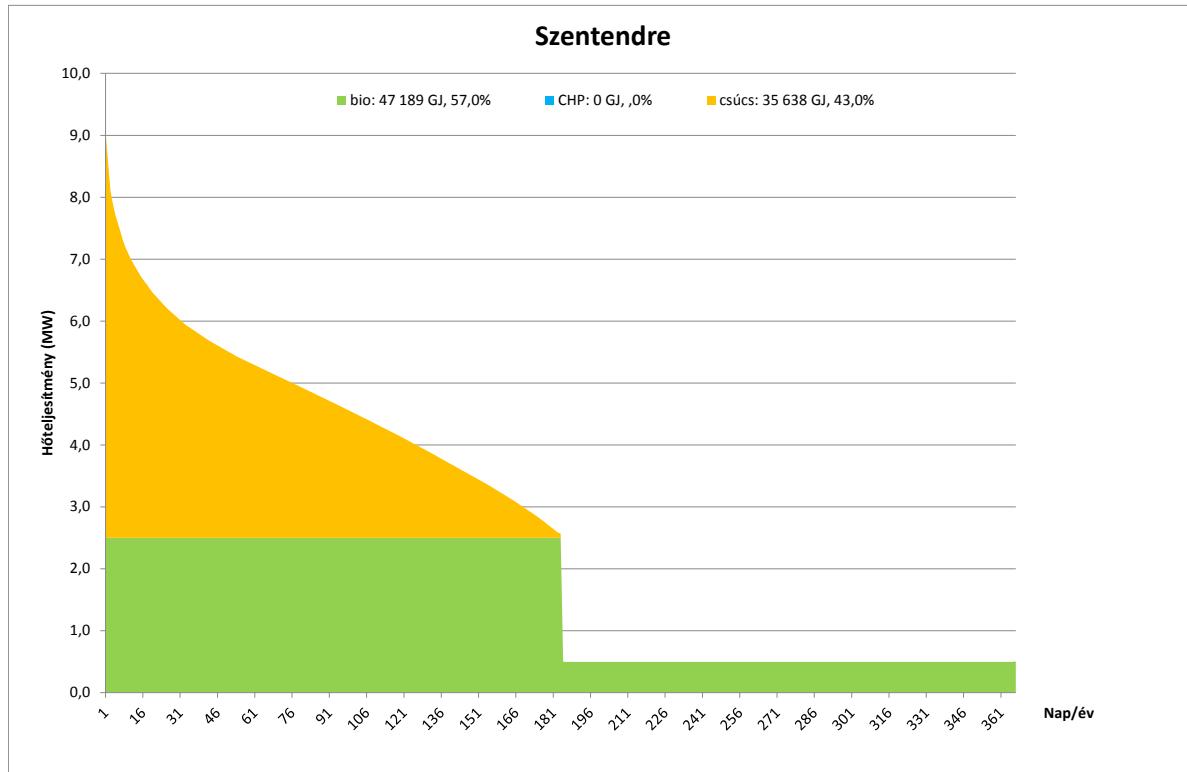
**Figure 29 – Rákoskeresztúr Heating District, Budapest**

Heat generation capacities taken into account: 4 MW of new geothermal thermal capacity and 9 MW of gas engine cogeneration capacity



Budapest Rózsakert	Rózsakert, Budapest
megújuló	renewable
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

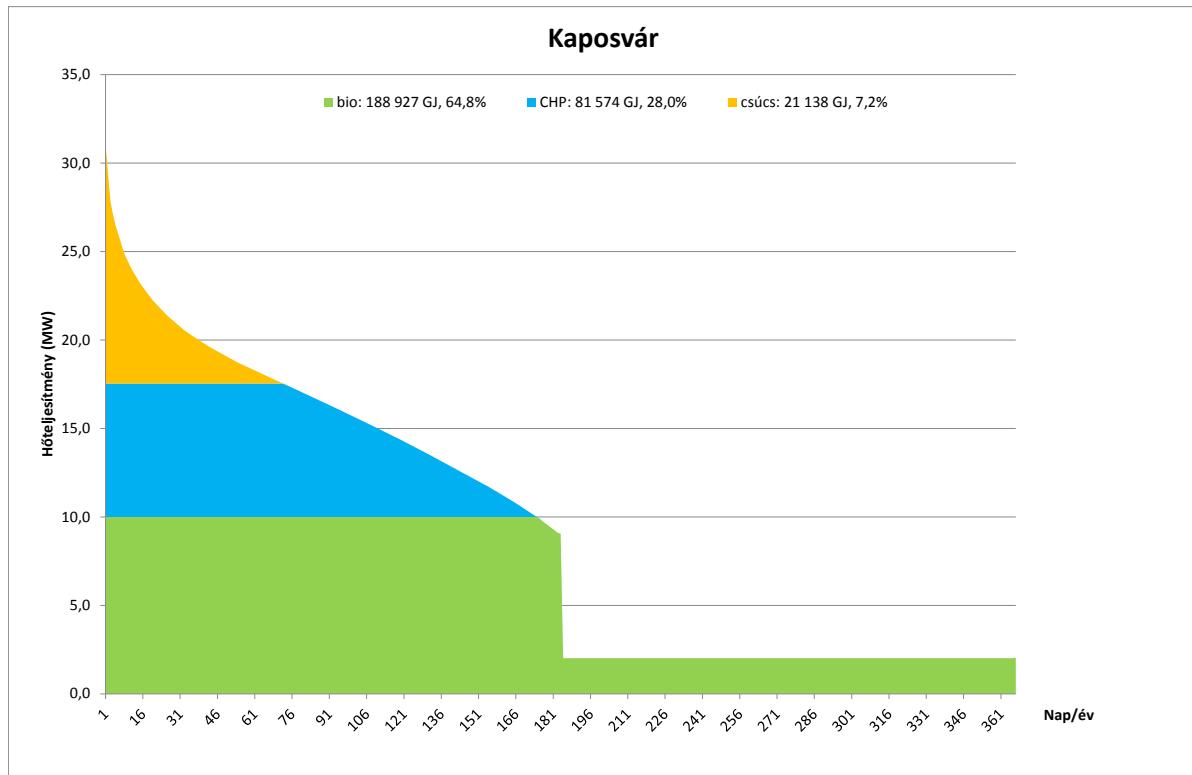
Figure 30 – Rózsakert Heating District, Budapest



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

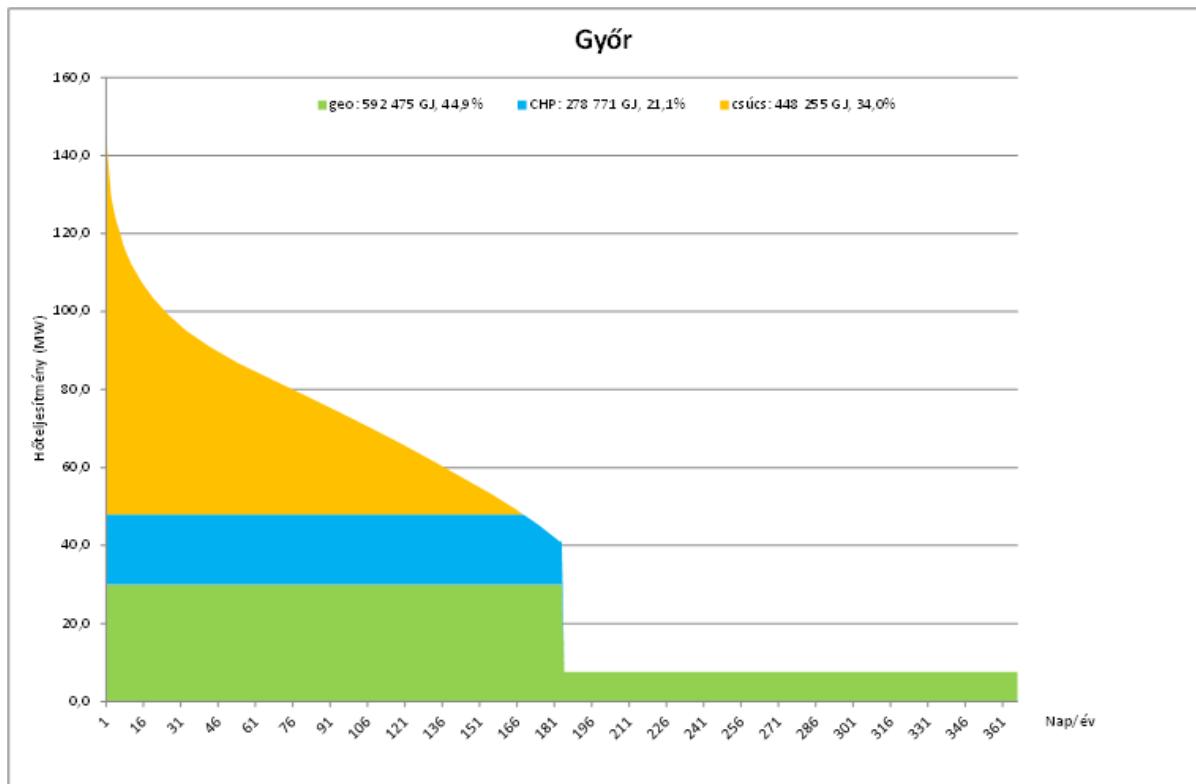
Figure 31 – District heating system, Szentendre

With the establishment of a 2.5 MW new biomass boiler.



**Figure 32 – District heating system, Kaposvár**

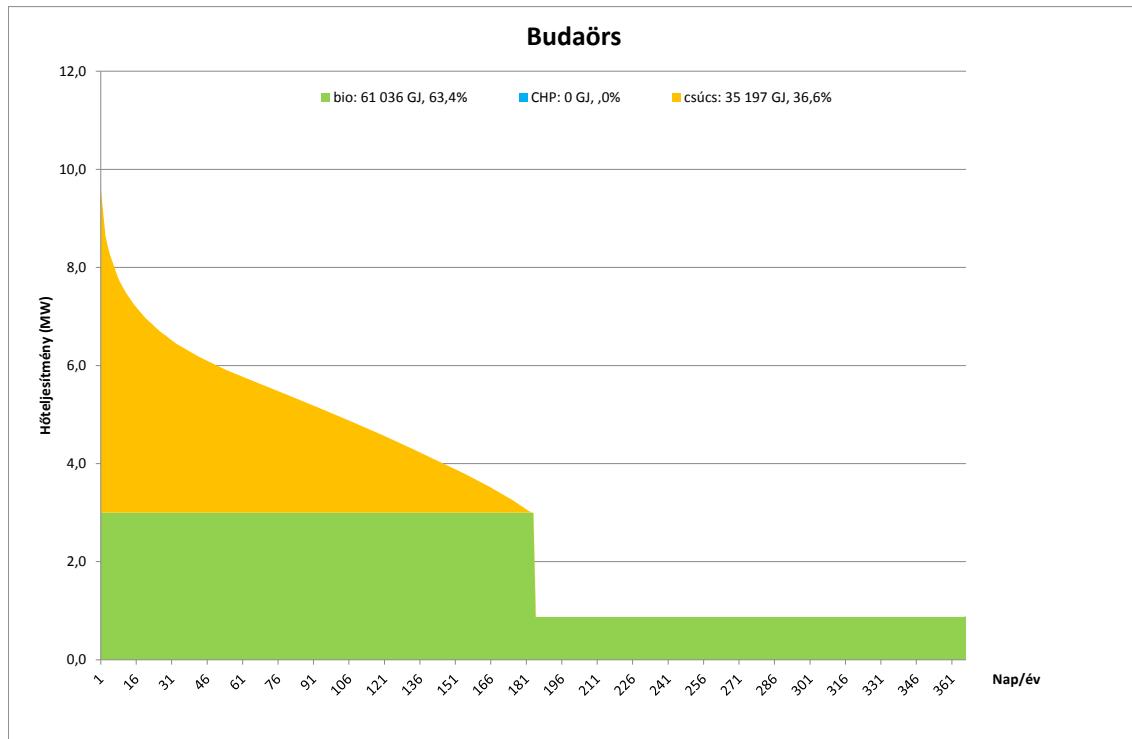
With the installation of a new 10 MW wood chips-fired boiler.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 33 – District heating system, Győr**

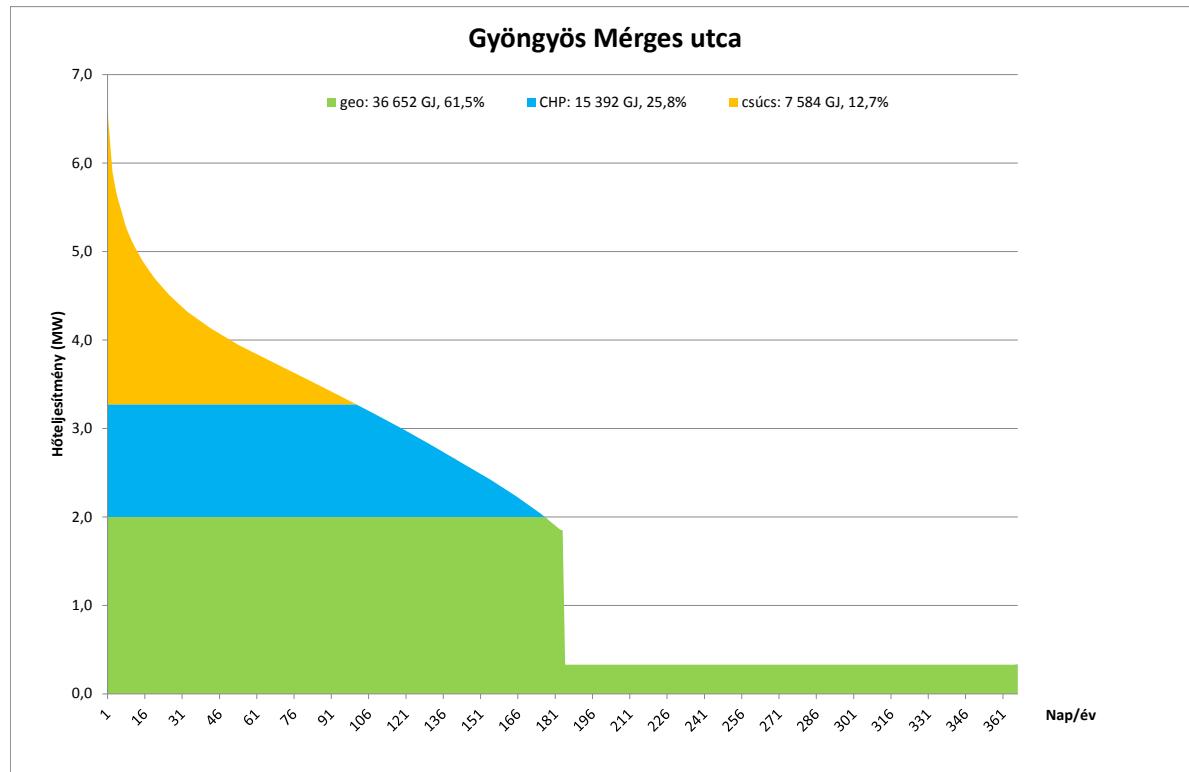
Heat generation capacities taken into account: 30 MW of average geothermal capacity (which can be considered existing) and 18 MW of gas engine cogeneration capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 34 – District heat supply system, Budaörs**

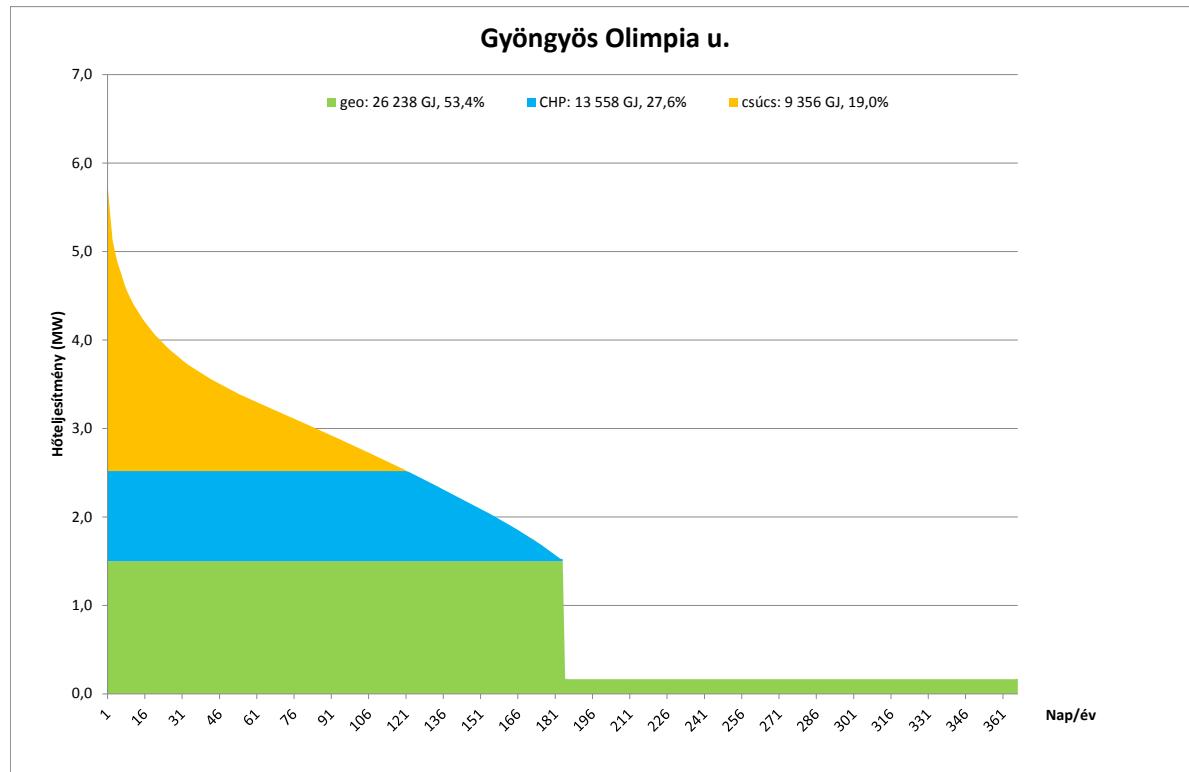
In the event of the installation of a 3 MW biomass boiler.



Gyöngyös Mérges utca	Mérges utca, Gyöngyös
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 35 – Mérges utca Boiler Building System, Gyöngyös

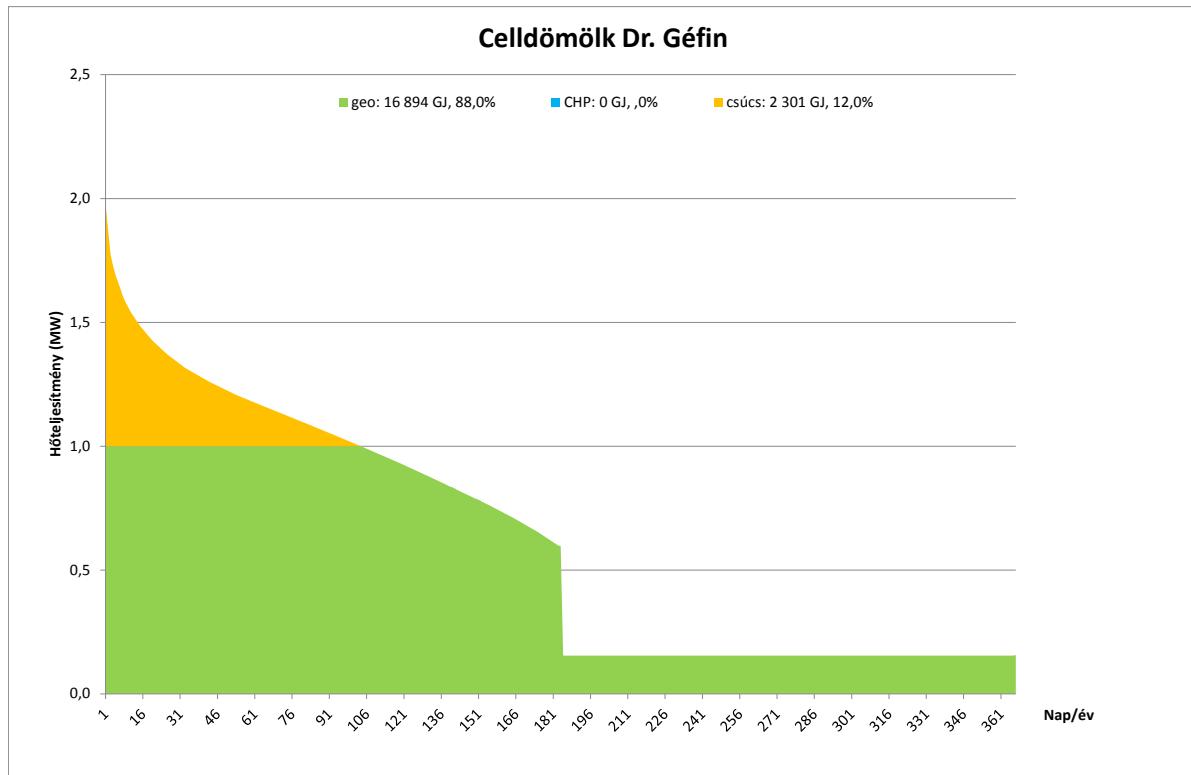
In the event of the establishment of 2 MW of geothermal capacity.



Gyöngyös Olimpia u.	Olimpia u., Gyöngyös
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 36 – Olimpia utca Boiler Building System, Gyöngyös

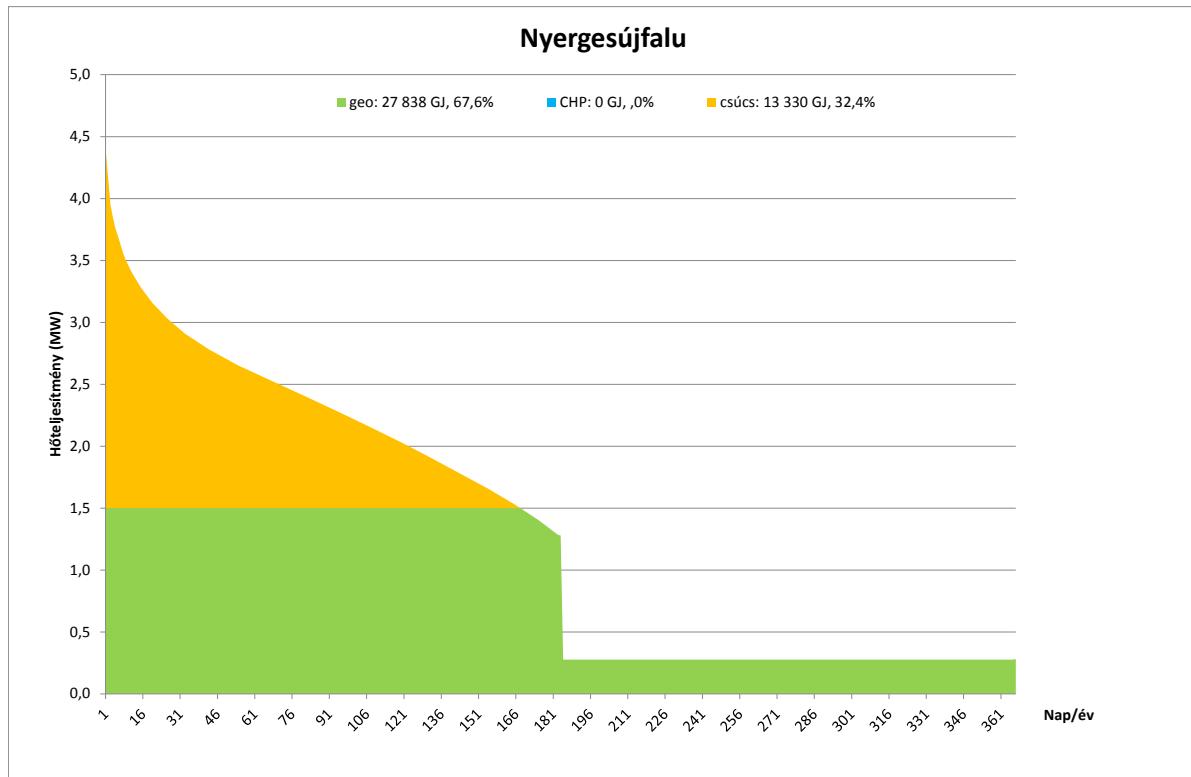
Assuming the establishment of 1.5 MW of geothermal capacity.



Celldömölk Dr. Géfin	Dr Géfin, Celldömölk
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 37 – Dr Géfin System, Celldömölk**

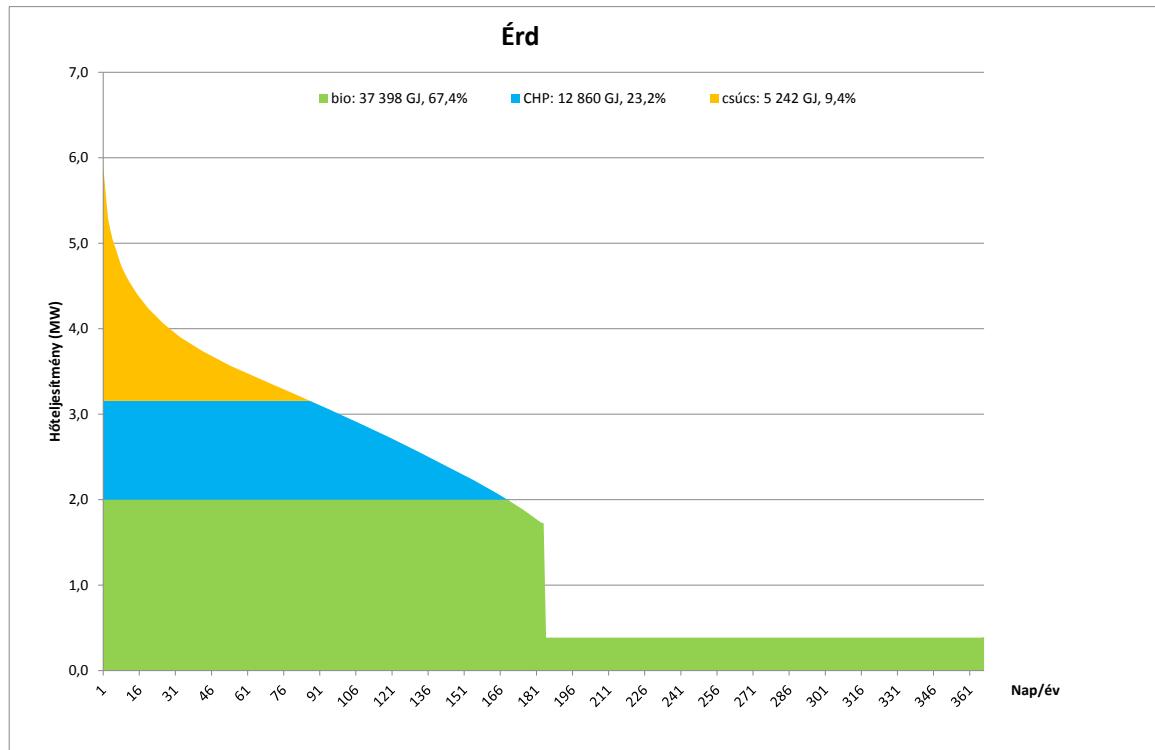
With a planned geothermal capacity of 1 MW.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 38 – District heating system, Nyergesújfalu**

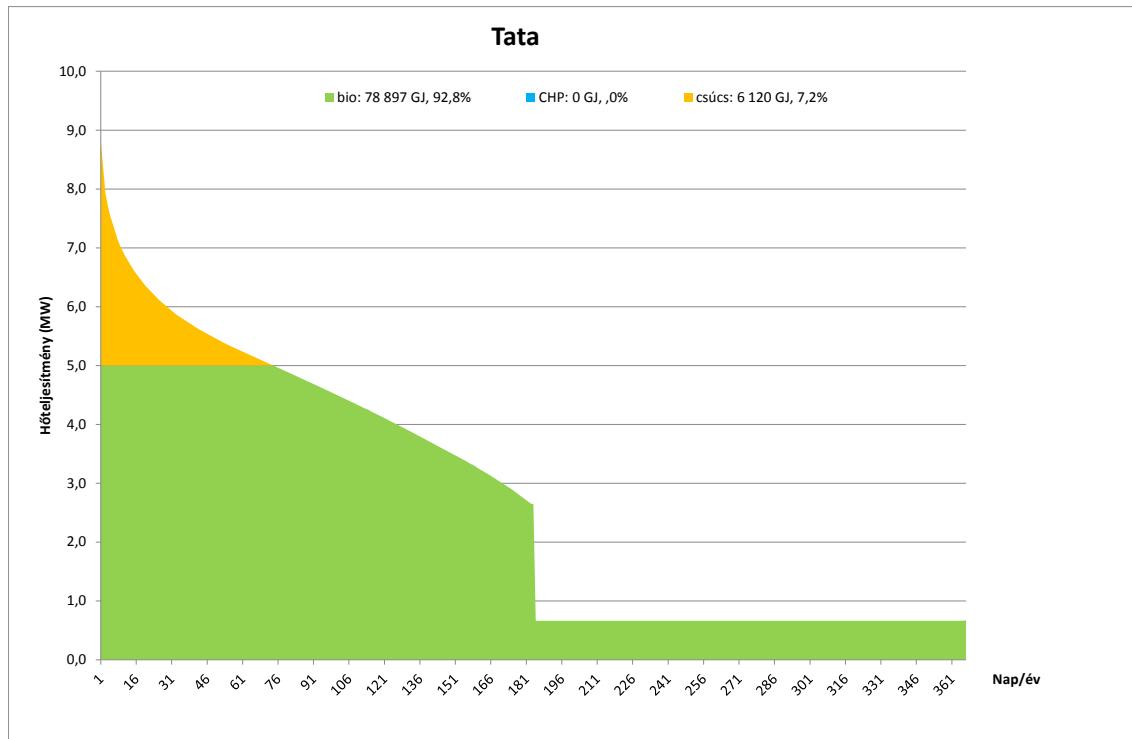
With a geothermal capacity of 1.5 MW to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 39 – District heating system, Érd

With 2 MW of biomass capacity to be newly established and utilising the existing gas engine thermal capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 40 – District heating system, Tata**

Capacity of the existing wood chips-fired boiler: 5 MW.

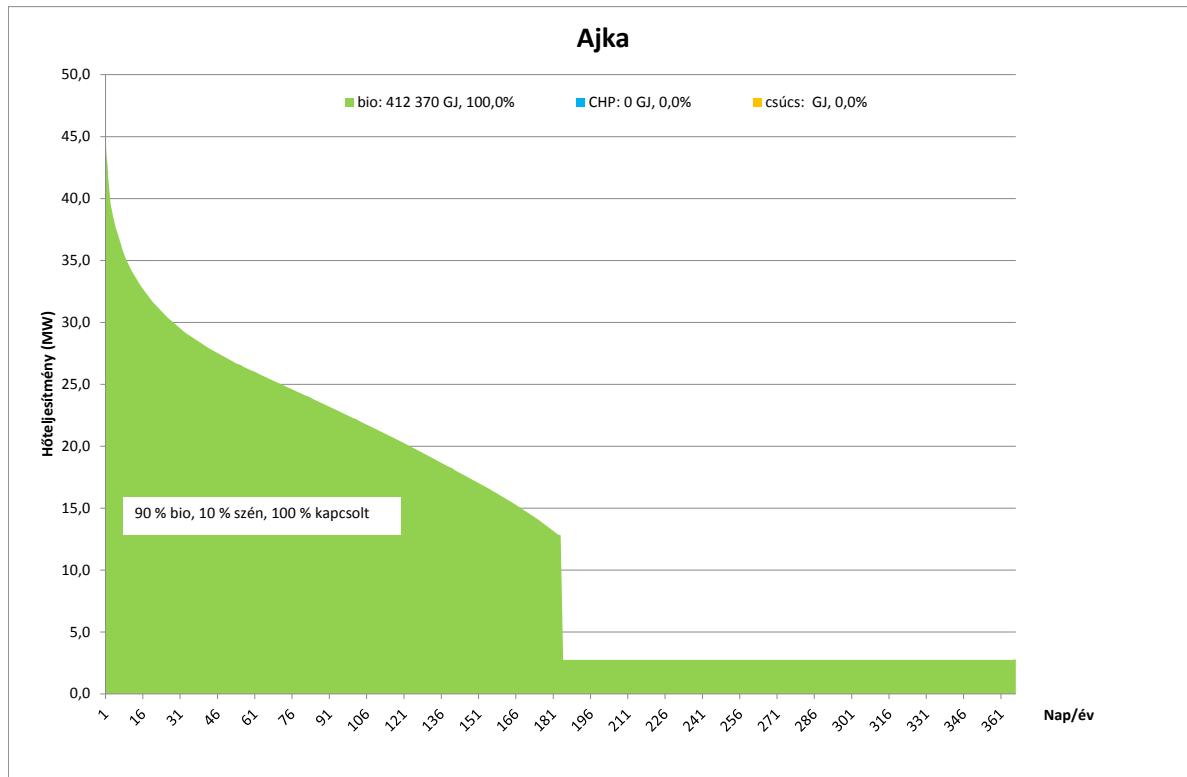
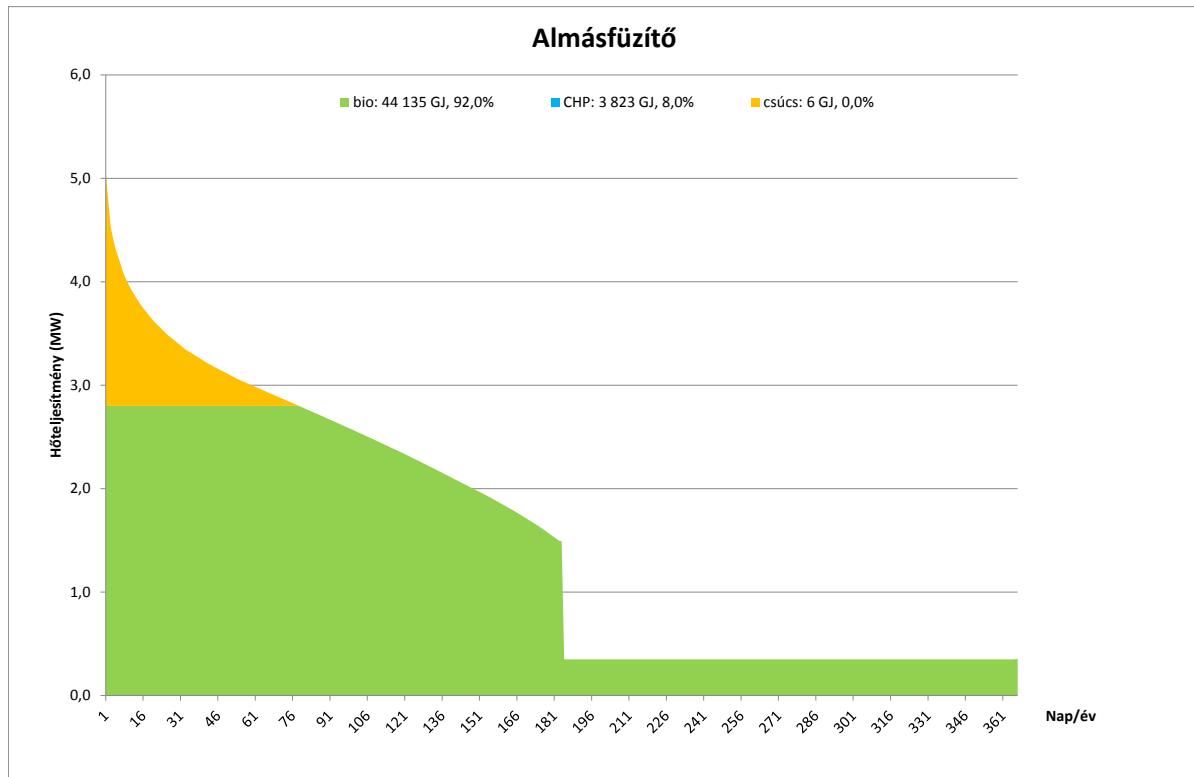


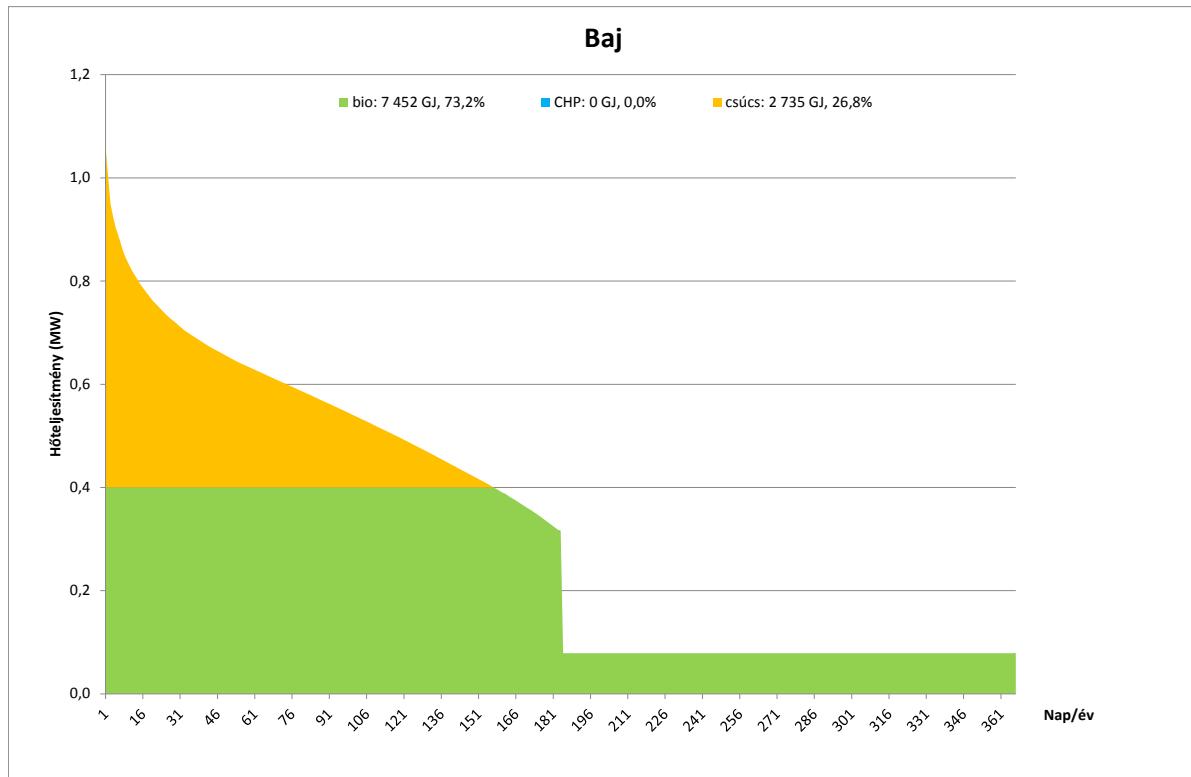
Figure 41 – District heating system, Ajka



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 42 – District heating system, Almásfüzítő**

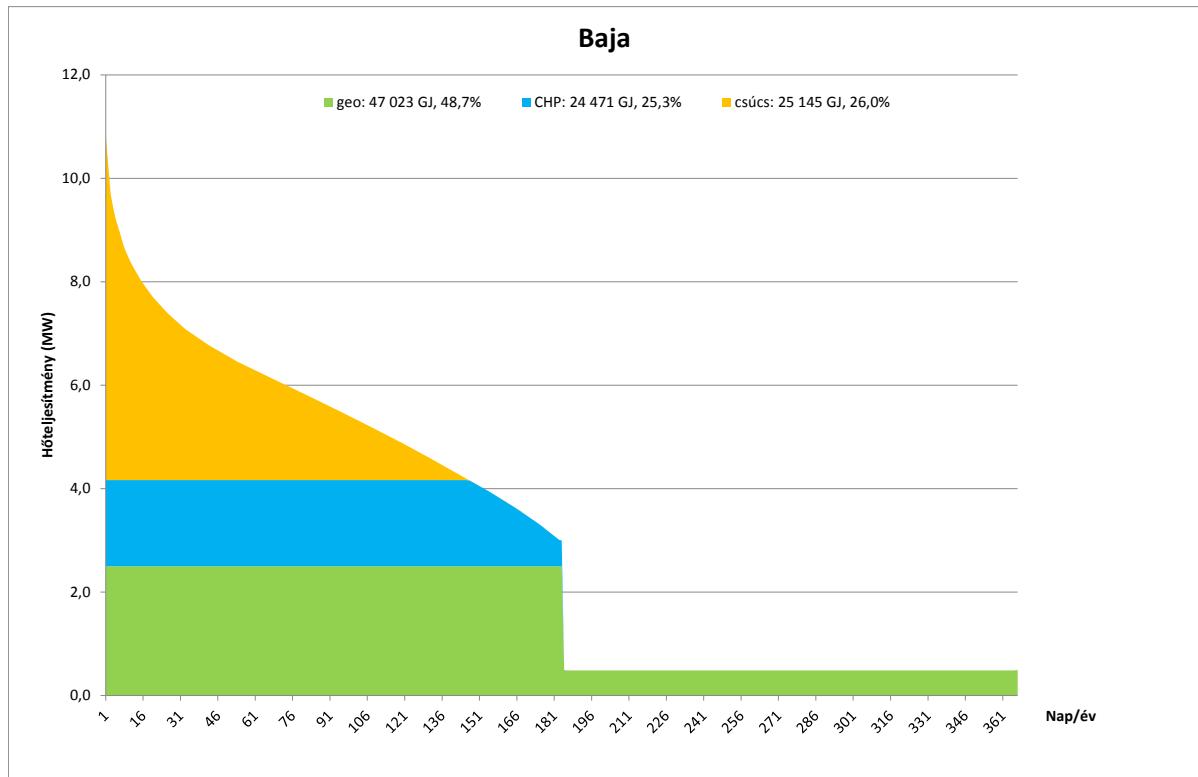
Existing 2.8 MW wood chips-fired boiler.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

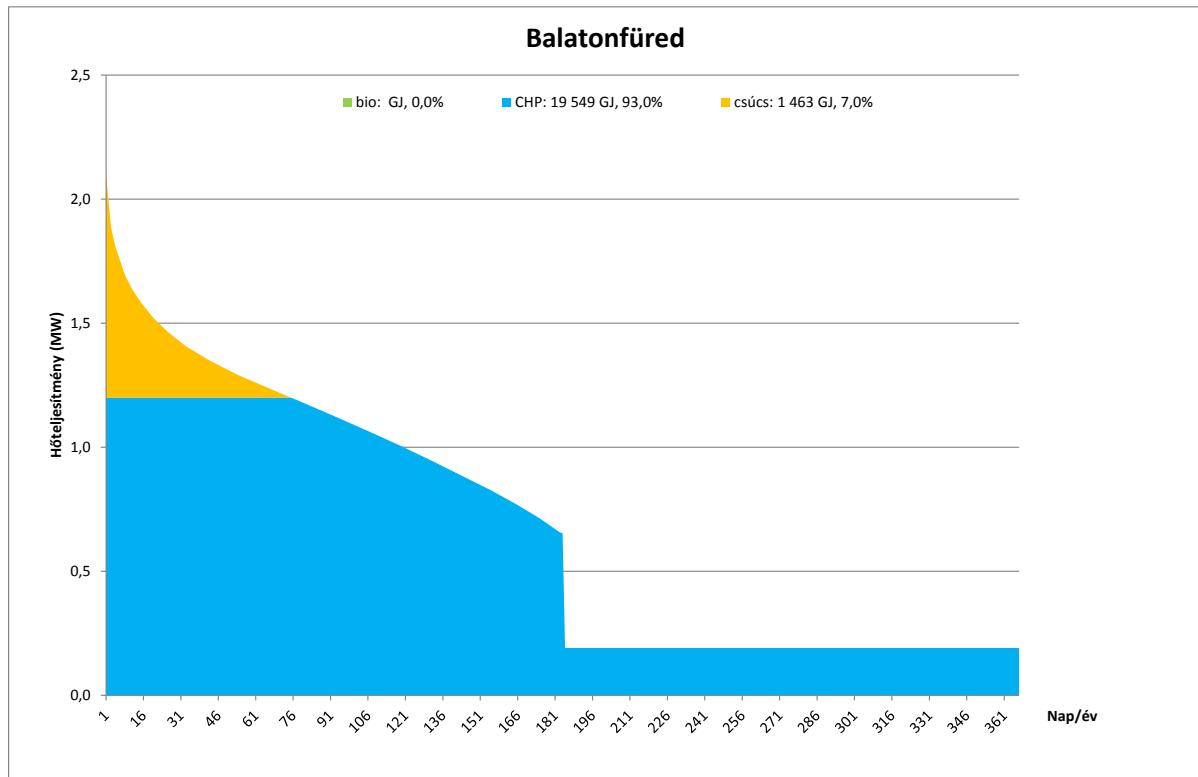
**Figure 43 – District heating system, Baj**

With the entry of a new 400 kW<sub>th</sub> biomass boiler.



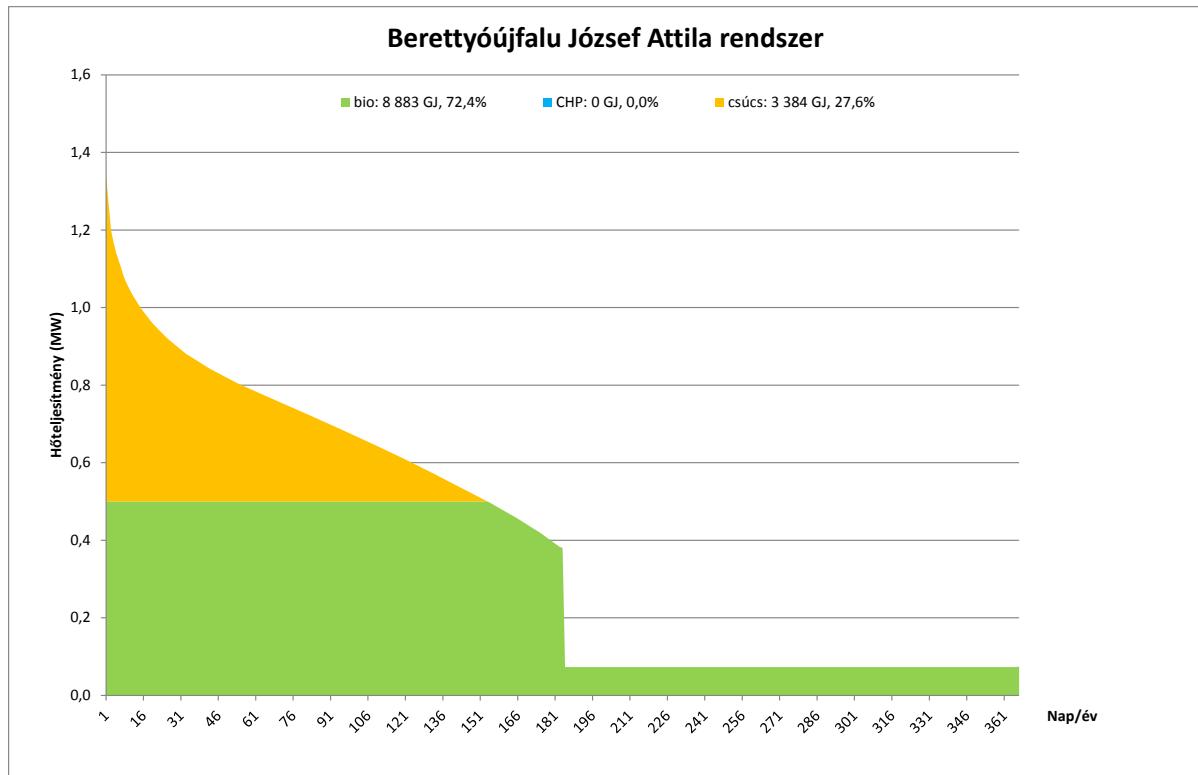
**Figure 44 – Municipal district heating system, Baja**

With 2.5 MW biomass-based heat generation equipment to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

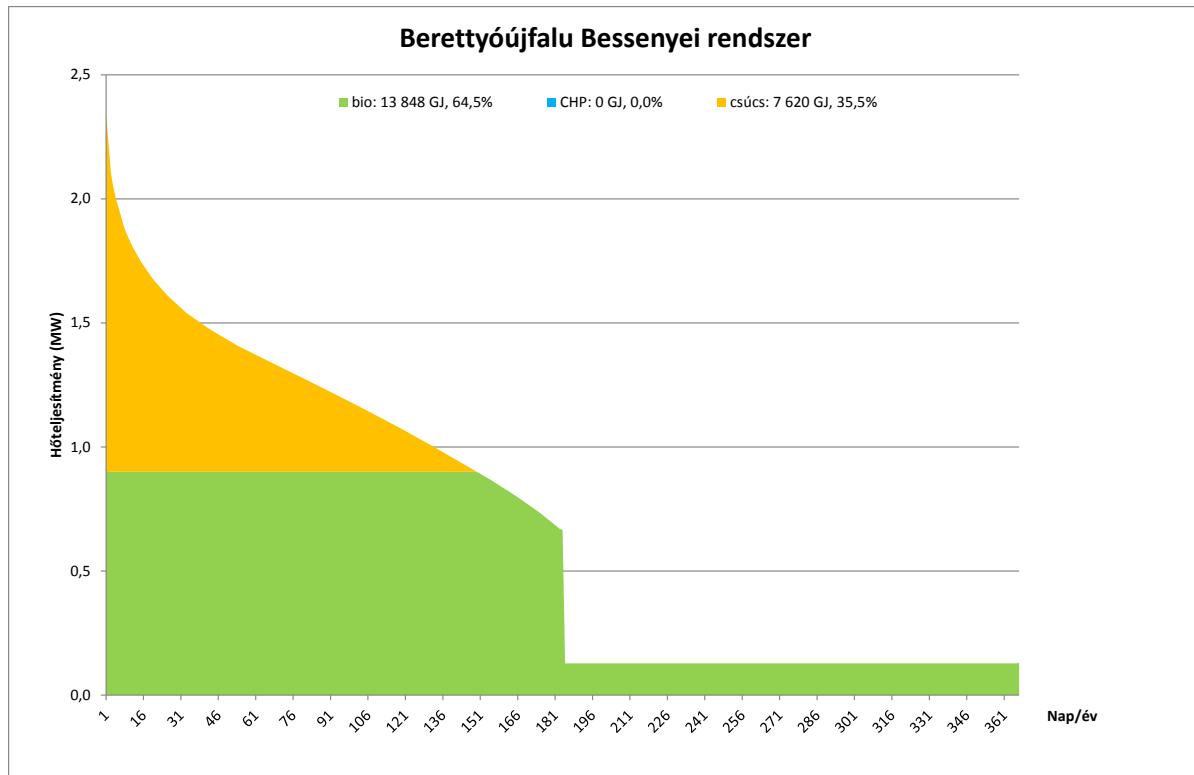
**Figure 45 – District heating system, Balatonfüred**



Berettyóújfalu József Attila rendszer	József Attila System, Berettyóújfalu
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 46 – József Attila System, Berettyóújfalu**

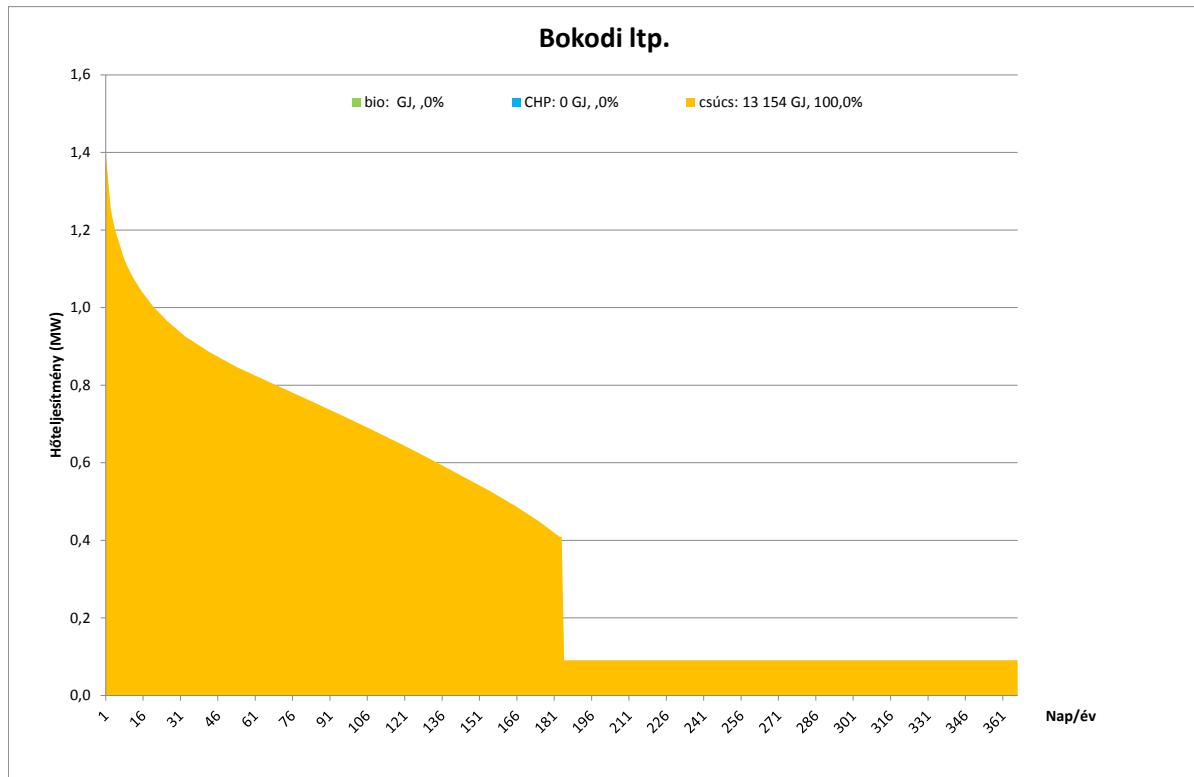
With the establishment of 500 kW new biomass-based capacity.



Berettyóújfalu Bessenyei rendszer	Bessenyei System, Berettyóújfalu
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 47 – Bessenyei System, Berettyóújfalu**

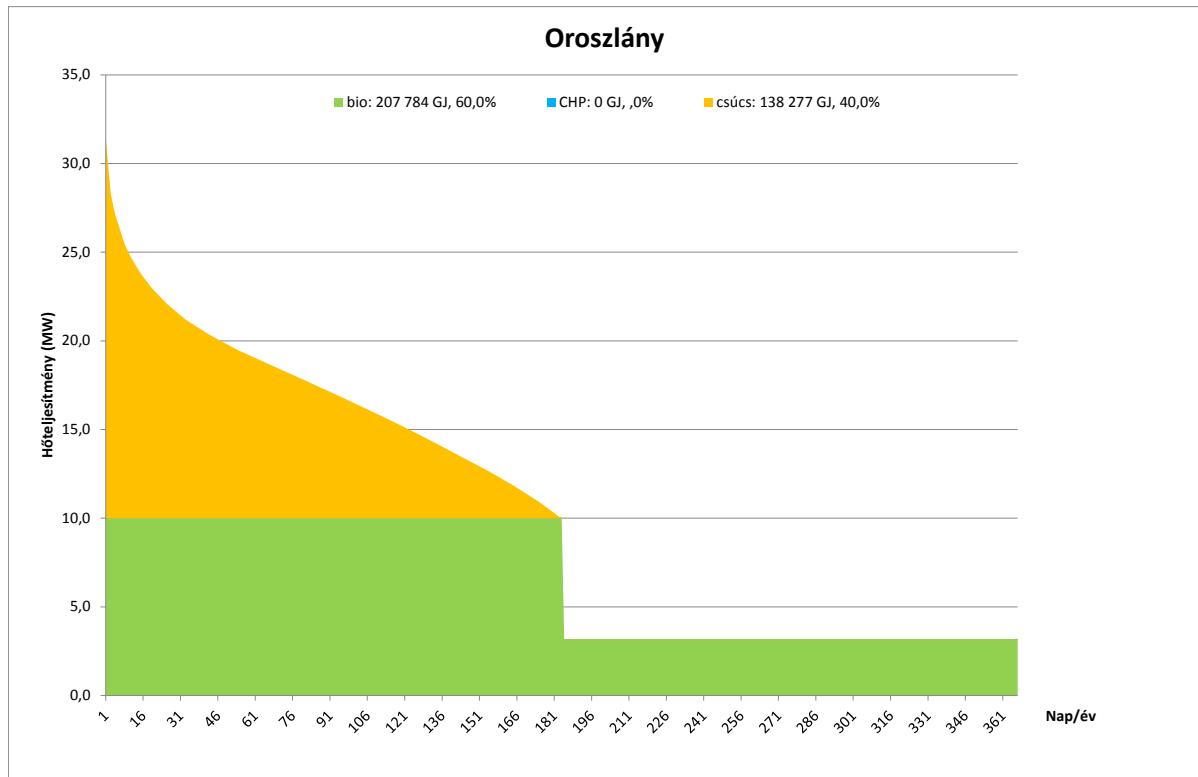
With a 900 kW biomass boiler.



Bokodi Itp.	Bokodi Housing Estate
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 48 – District heating system of the Bokodi Housing Estate**

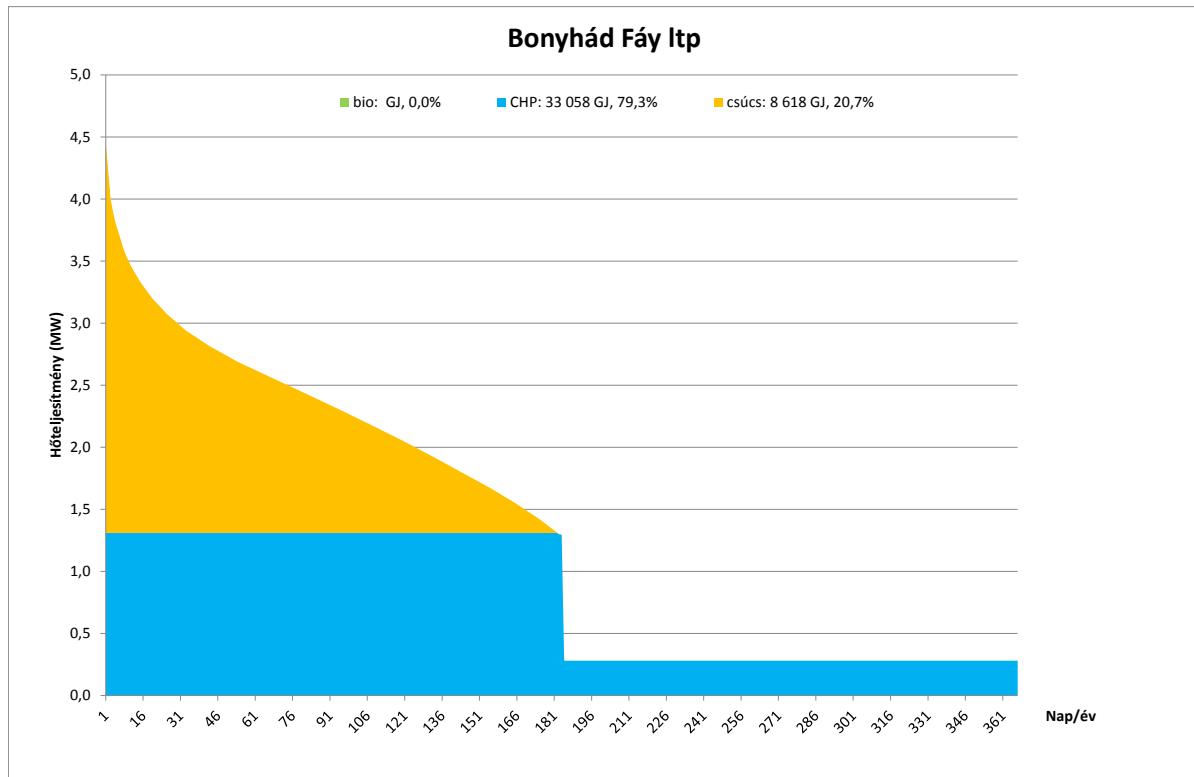
It may change depending on the long-term fate of the Oroszlány Power Plant.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

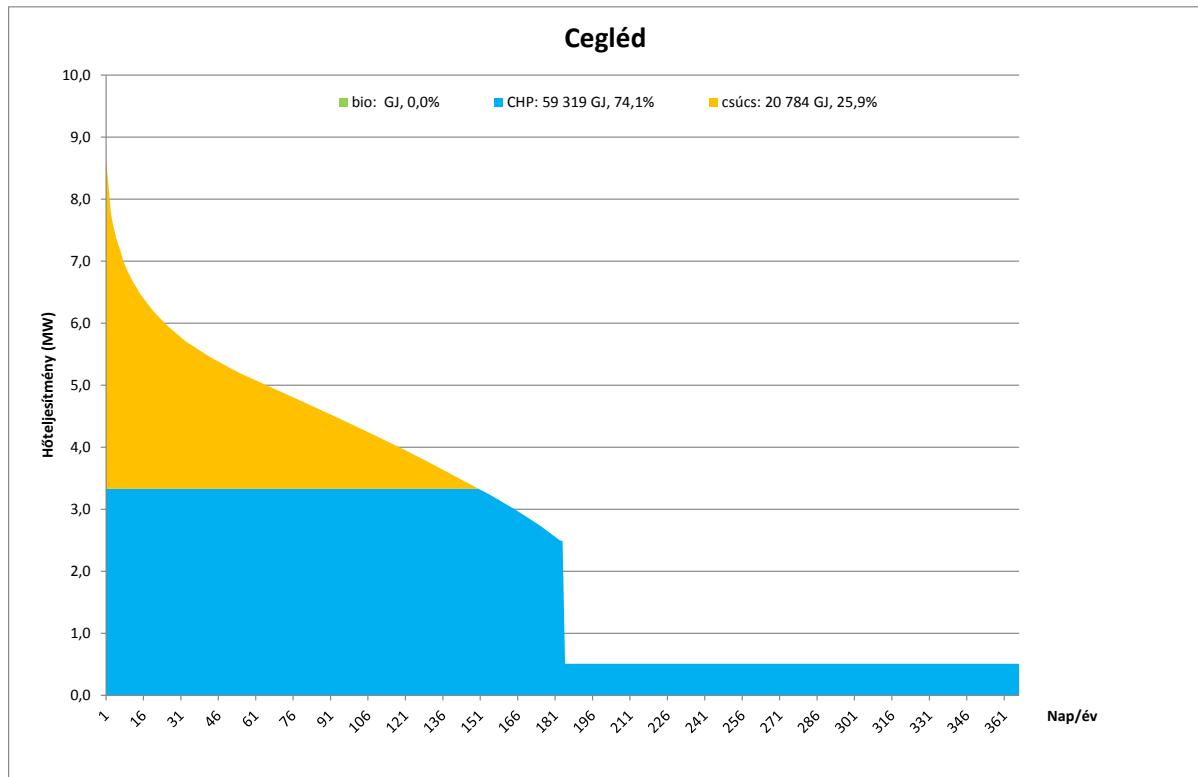
**Figure 49 – Municipal district heating system, Oroszlány**

With the putting into service of a 10 MW wood chips-fired boiler.



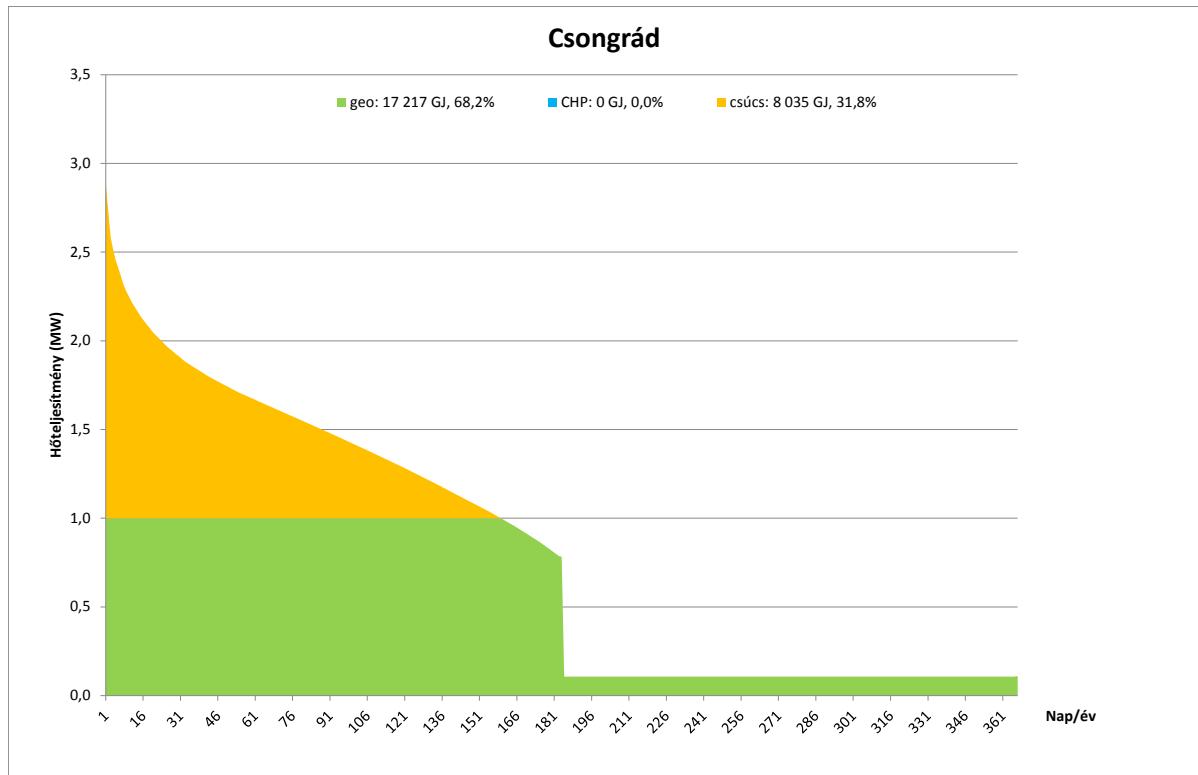
Bonyhád Fáy Itp	Fay Housing Estate, Bonyhád
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 50 – Fay district heating system of Bonyhád



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

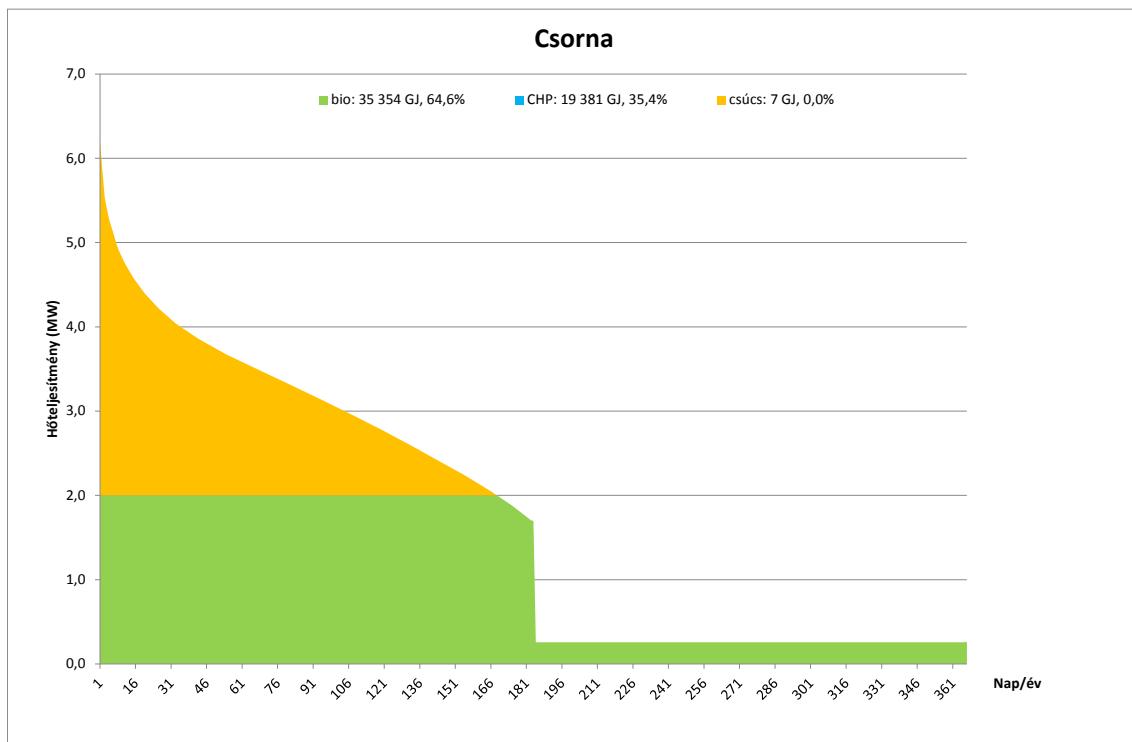
Figure 51 – District heating supply system, Cegléd



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 52 – District heating system, Csongrád**

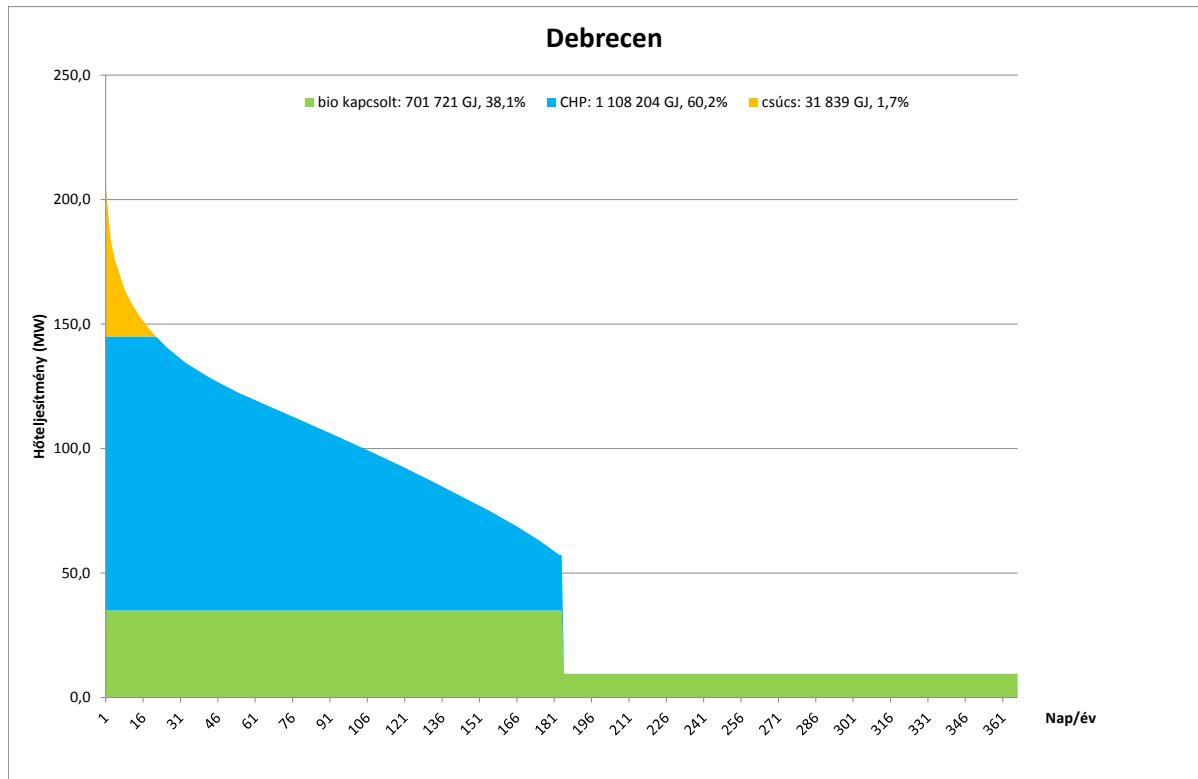
With the establishment of 1 MW of new geothermal capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 53 – District heating system, Csorna**

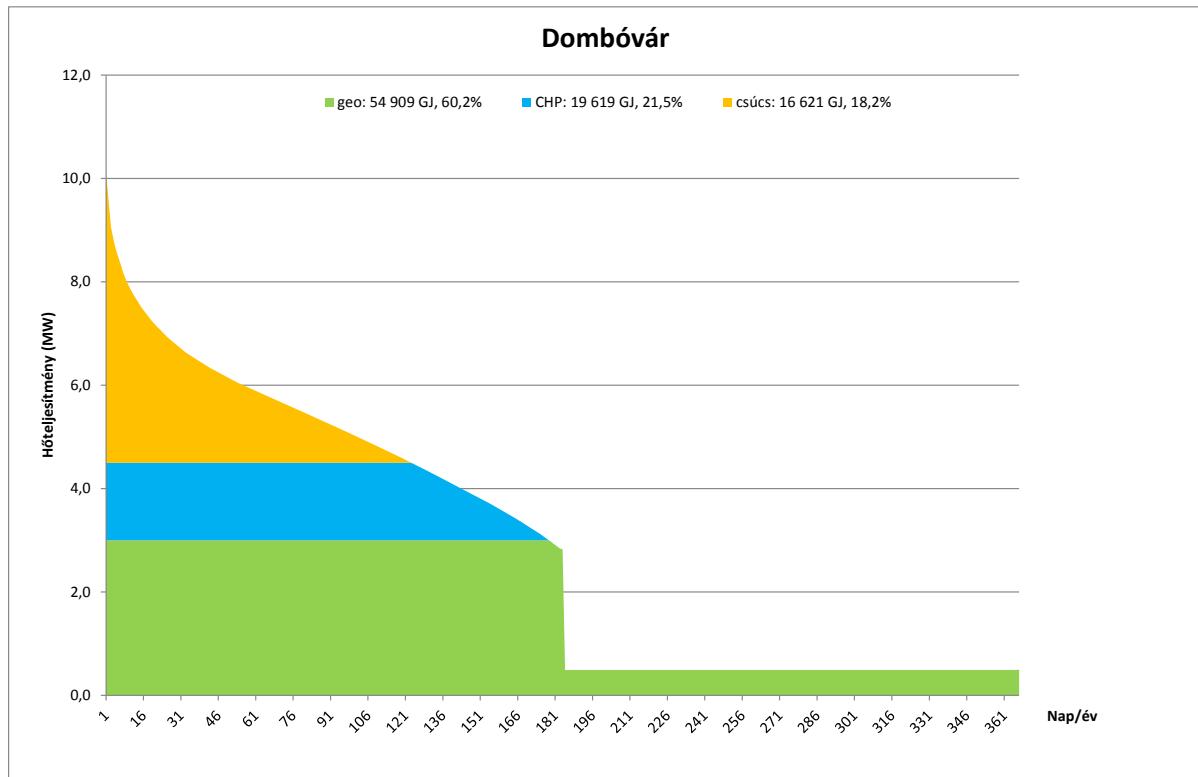
Foreseeing the establishment of 2 MW of new biomass-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 54 – District heating system, Debrecen**

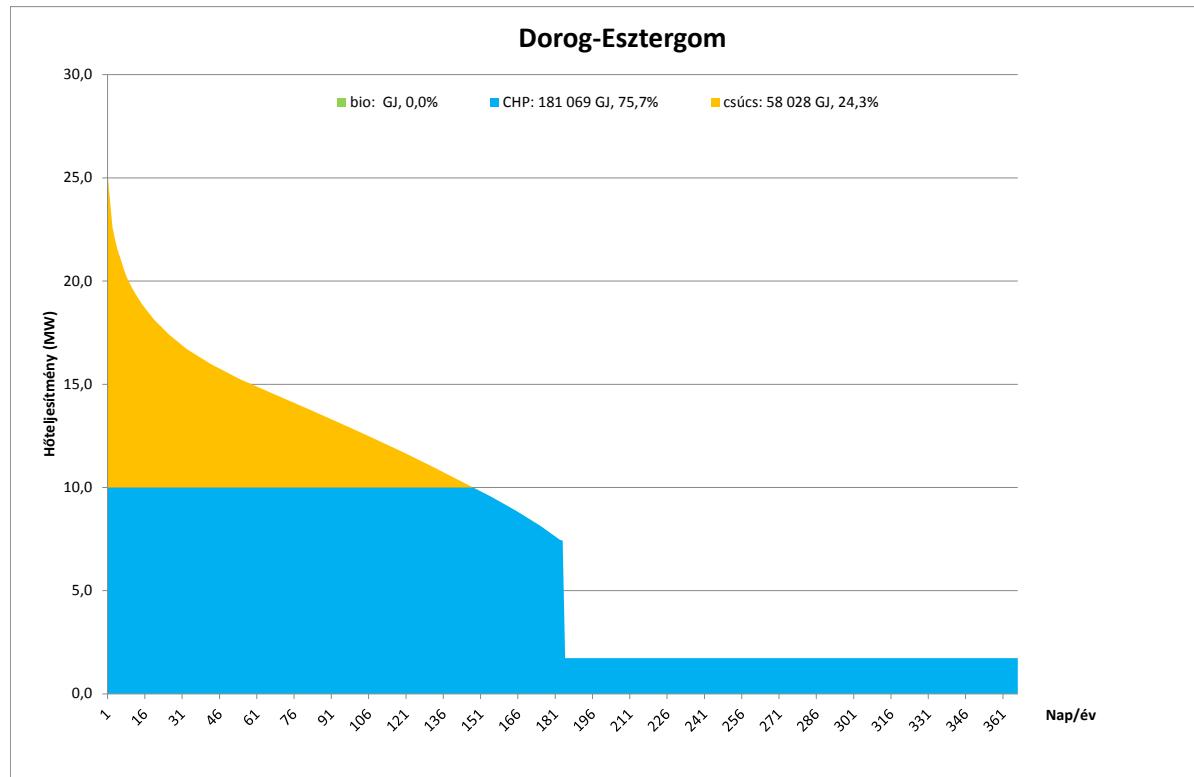
Heat generation capacities taken into account: 35 MW of new biomass (or MSW) capacity and a 110 MW combined cycle power plant (DKCE).



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

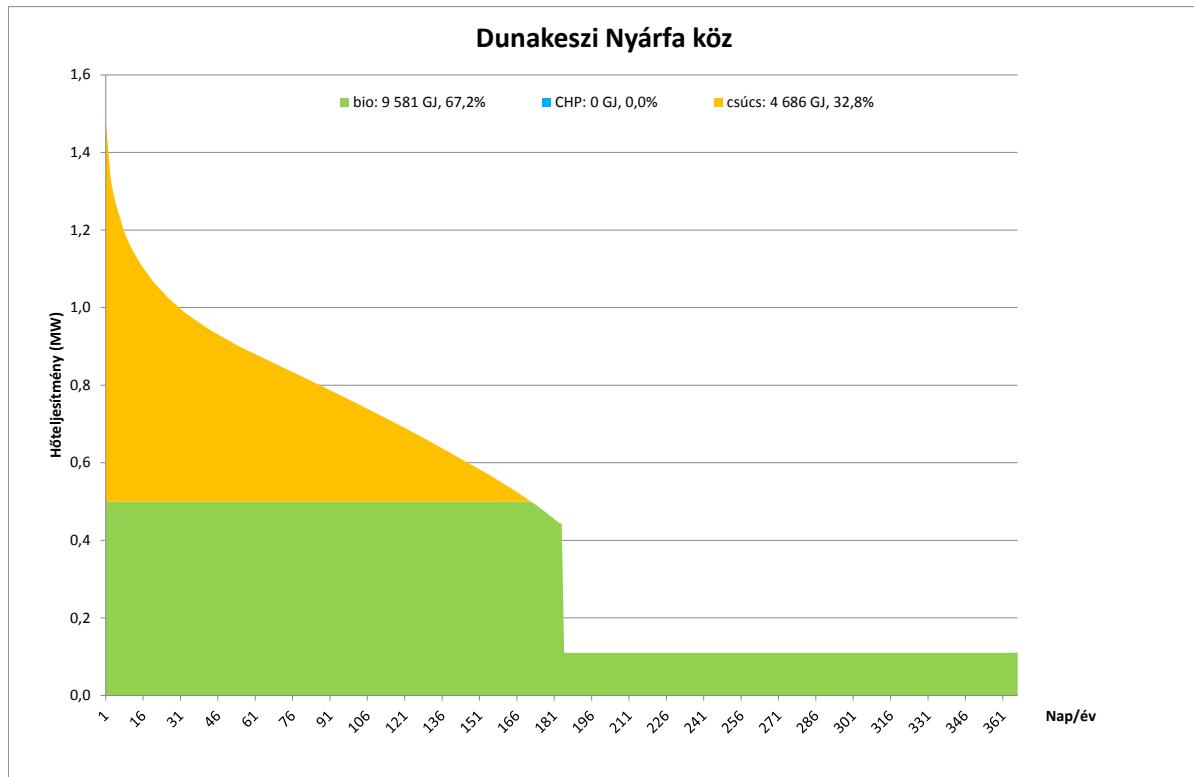
**Figure 55 – District heating system, Dombóvár**

With a geothermal capacity of 3 MW to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

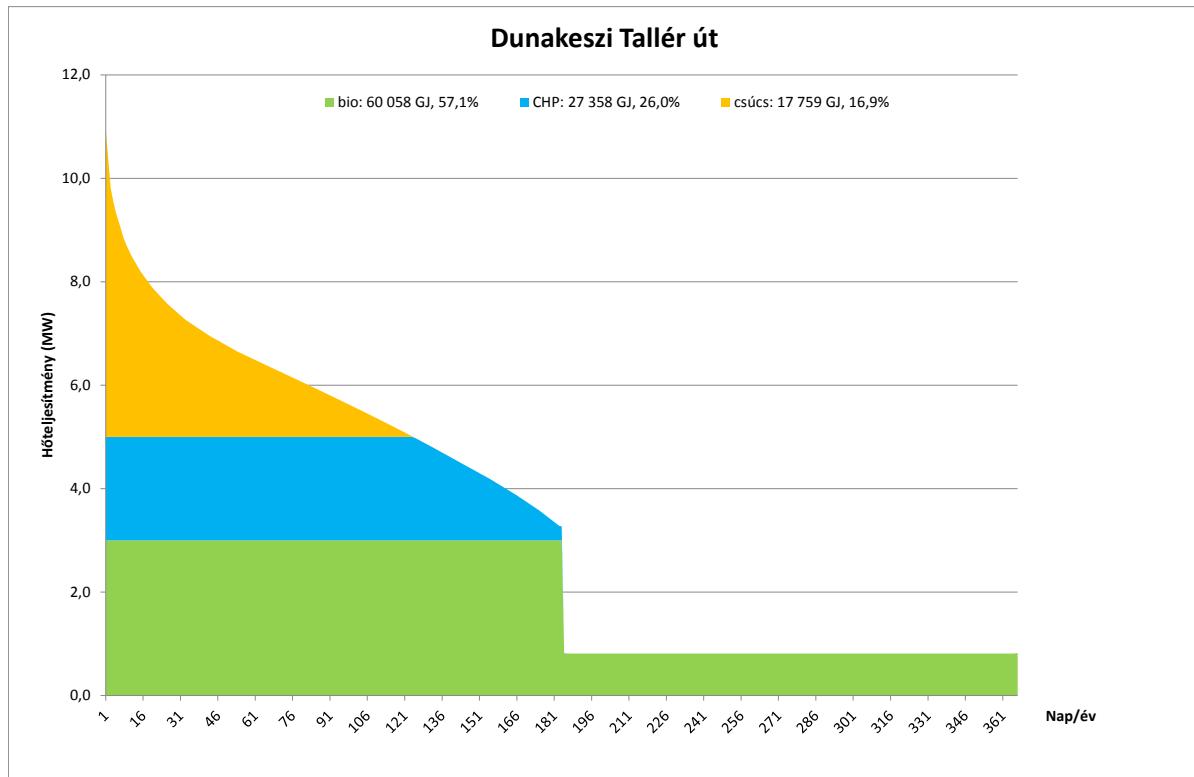
**Figure 56 – District heating system, Dorog and Esztergom**



Dunakeszi Nyárfa köz	Nyárfa köz, Dunakeszi
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 57 – Nyárfa köz System, Dunakeszi**

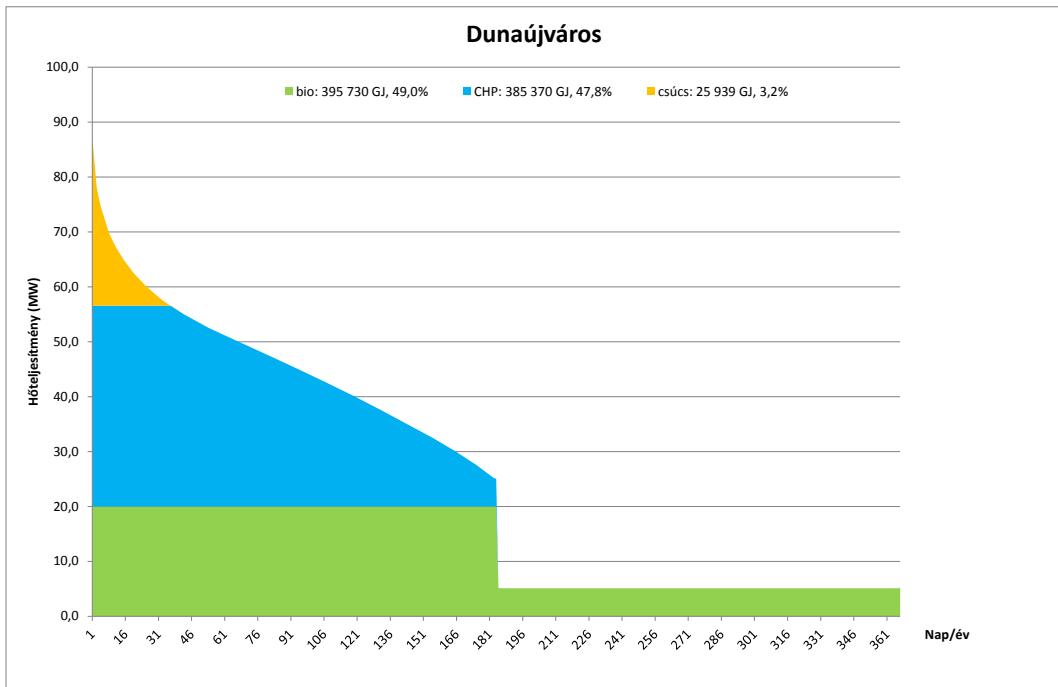
In the event of the entry of 500 kW of biomass-based heat generation capacity.



Dunakeszi Tallér út	Tallér út, Dunakeszi
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 58 – Tallér út System, Dunakeszi**

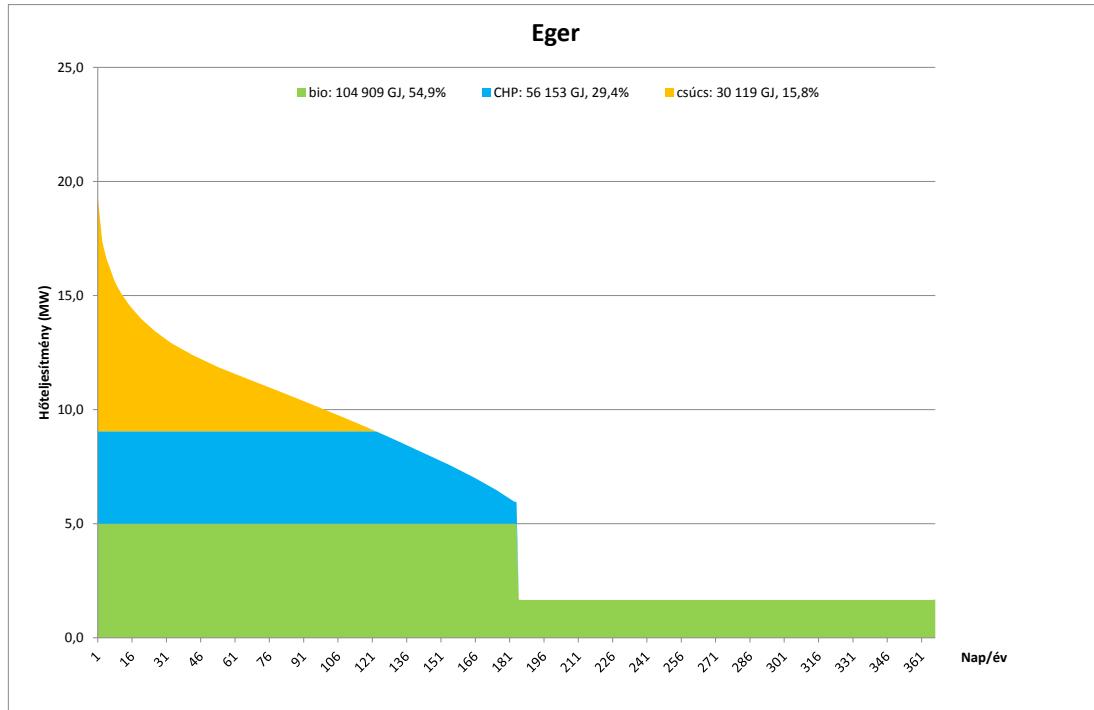
In the event of the establishment of 3 MW of biomass-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 59 – District heating system, Dunaújváros**

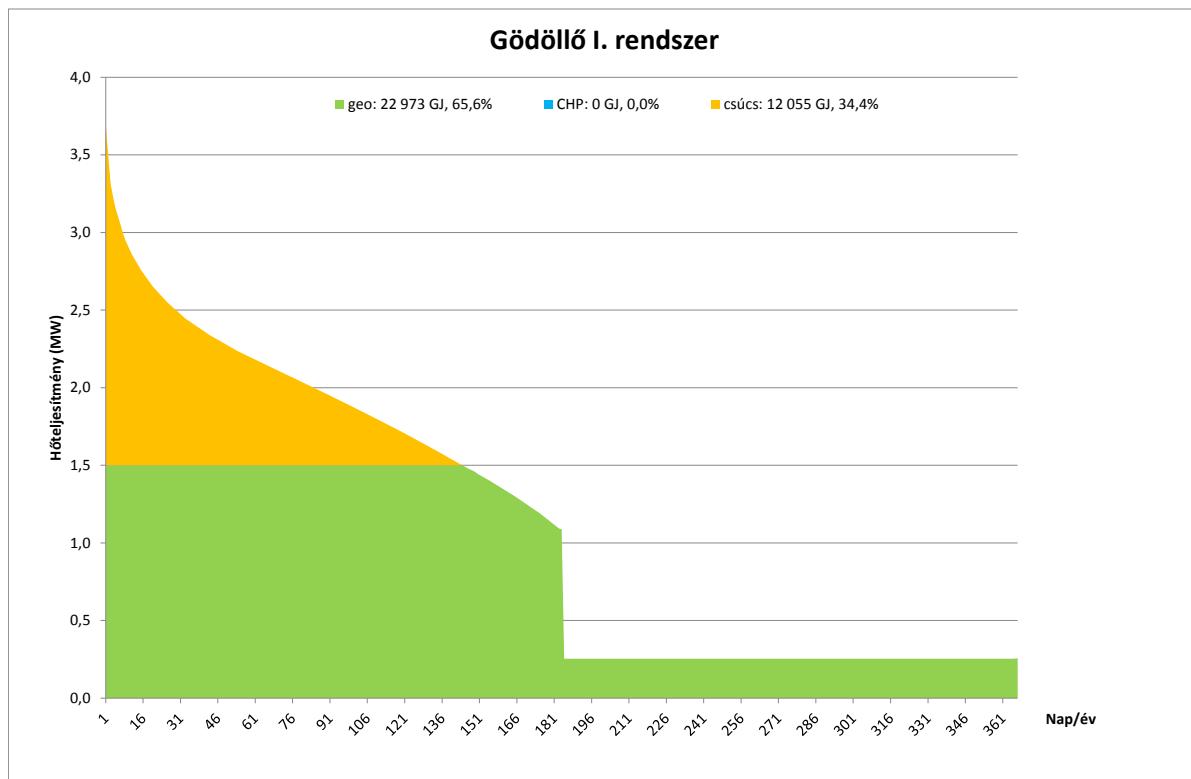
In the event of the establishment of 20 MW of new biomass capacity. (At present, DunaFerr, which also has a cogeneration capacity based on waste heat and process by-product gases, does not take part in heat generation.)



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 60 – District heating system, Eger

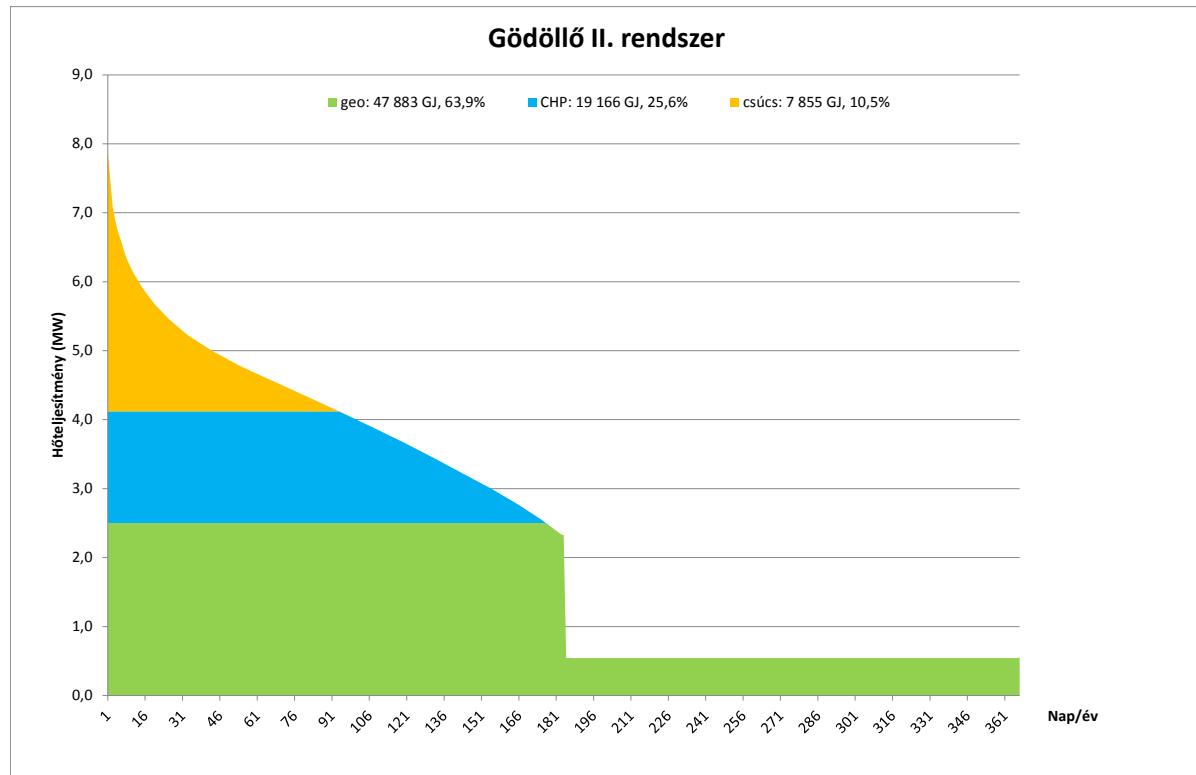
In the event of the establishment of 5 MW of geothermal capacity.



Gödöllő I. rendszer	System I, Gödöllő
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 61 – System I, Gödöllő

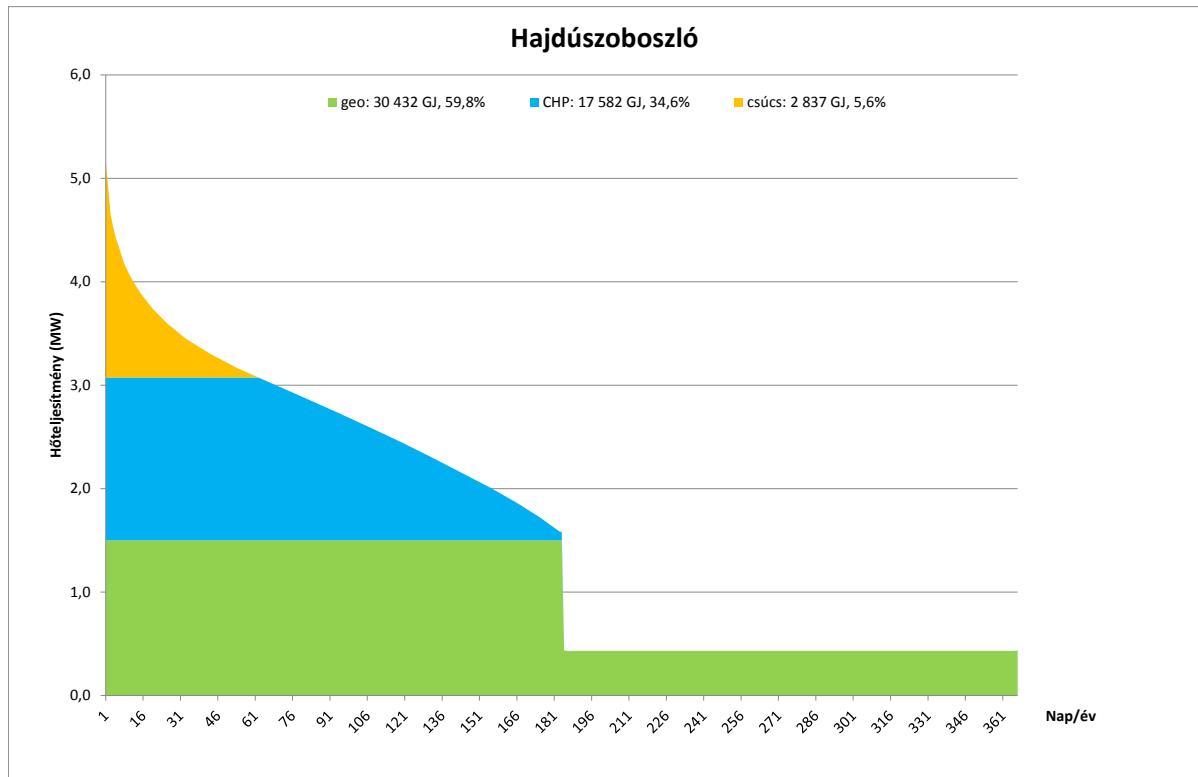
In the event of the establishment of 1.5 MW of geothermal capacity.



Gödöllő I. rendszer	System II, Gödöllő
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 62 – System II, Gödöllő

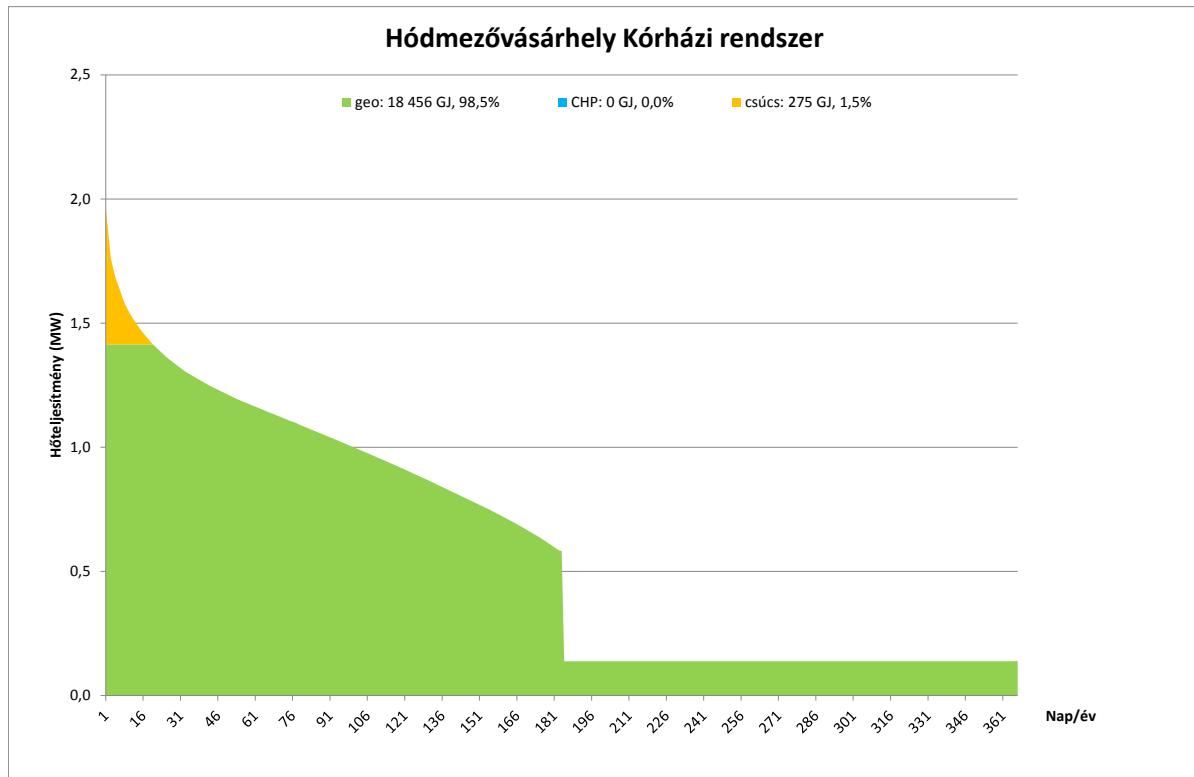
In the event of the establishment of 2.5 MW of geothermal capacity.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 63 – System of Hajdúszoboszló**

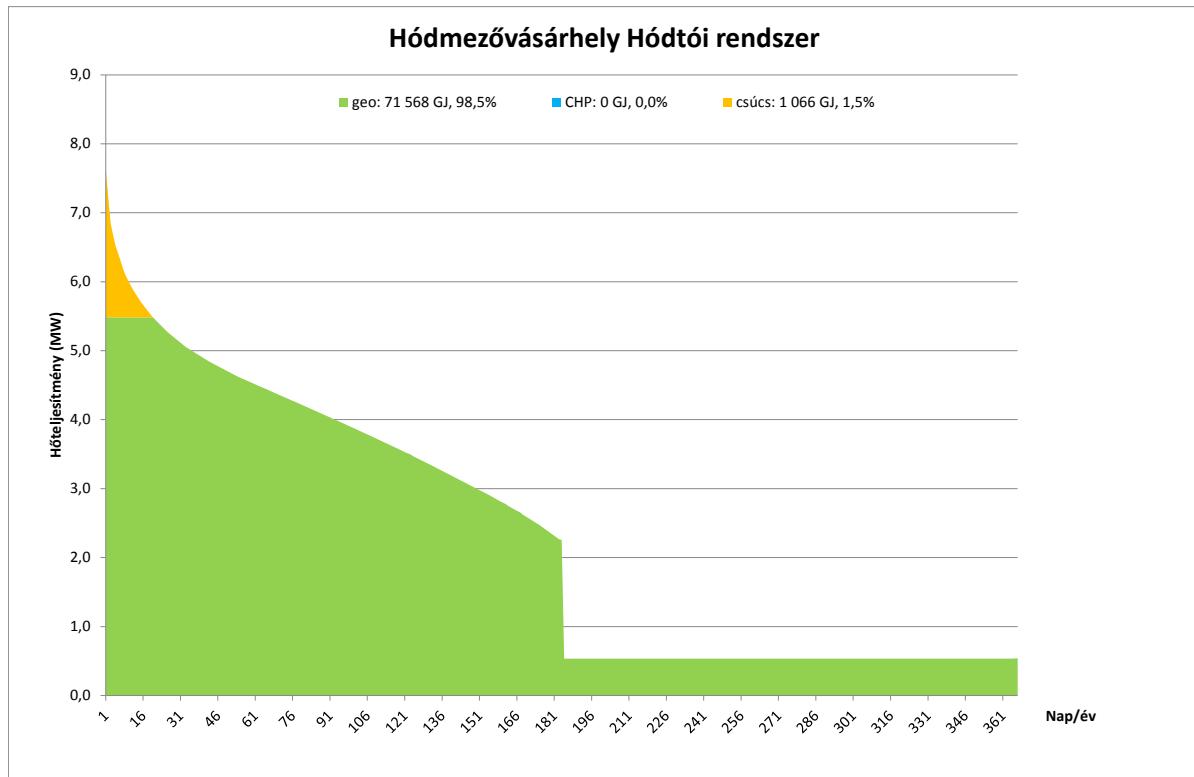
In the event of the establishment of 1.5 MW of geothermal capacity.



Hódmezővásárhely Kórházi rendszer	Hospital System, Hódmezővásárhely
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 64 – Hospital System, Hódmezővásárhely

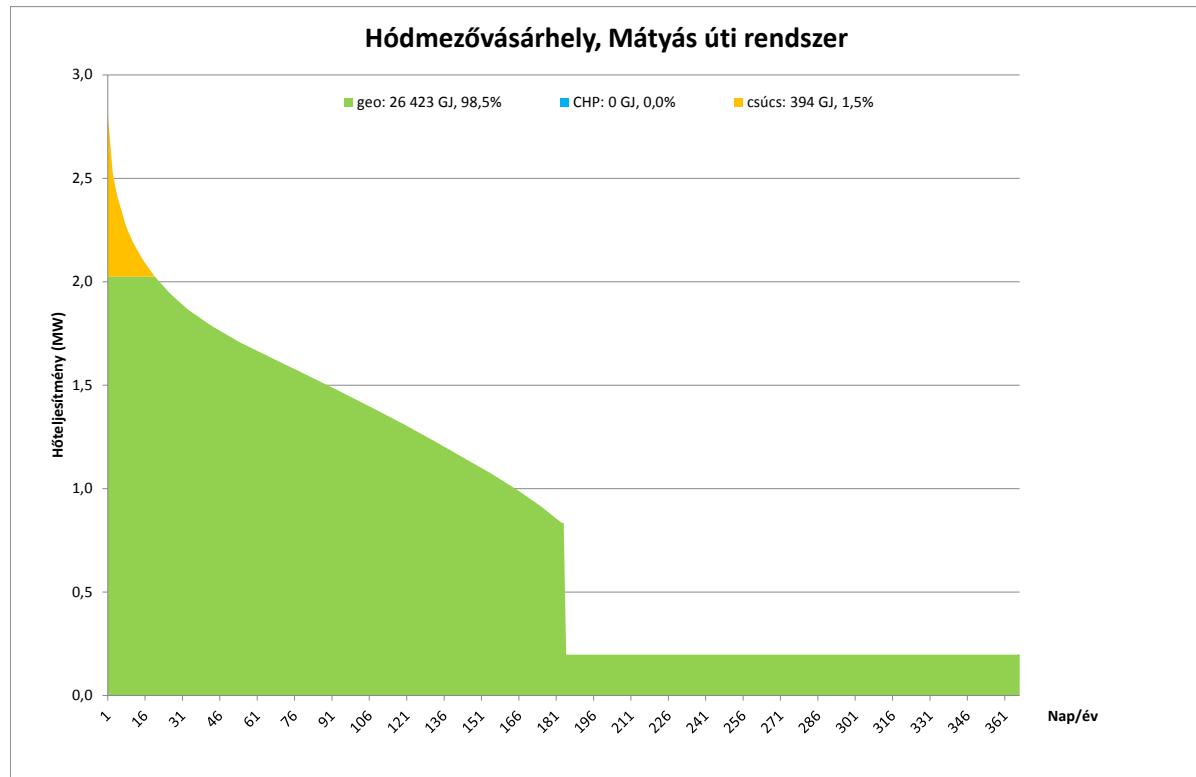
Existing geothermal heat generation.



Hódmezővásárhely Hódtói rendszer	Hódtó System, Hódmezővásárhely
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 65 – Hódtó System, Hódmezővásárhely

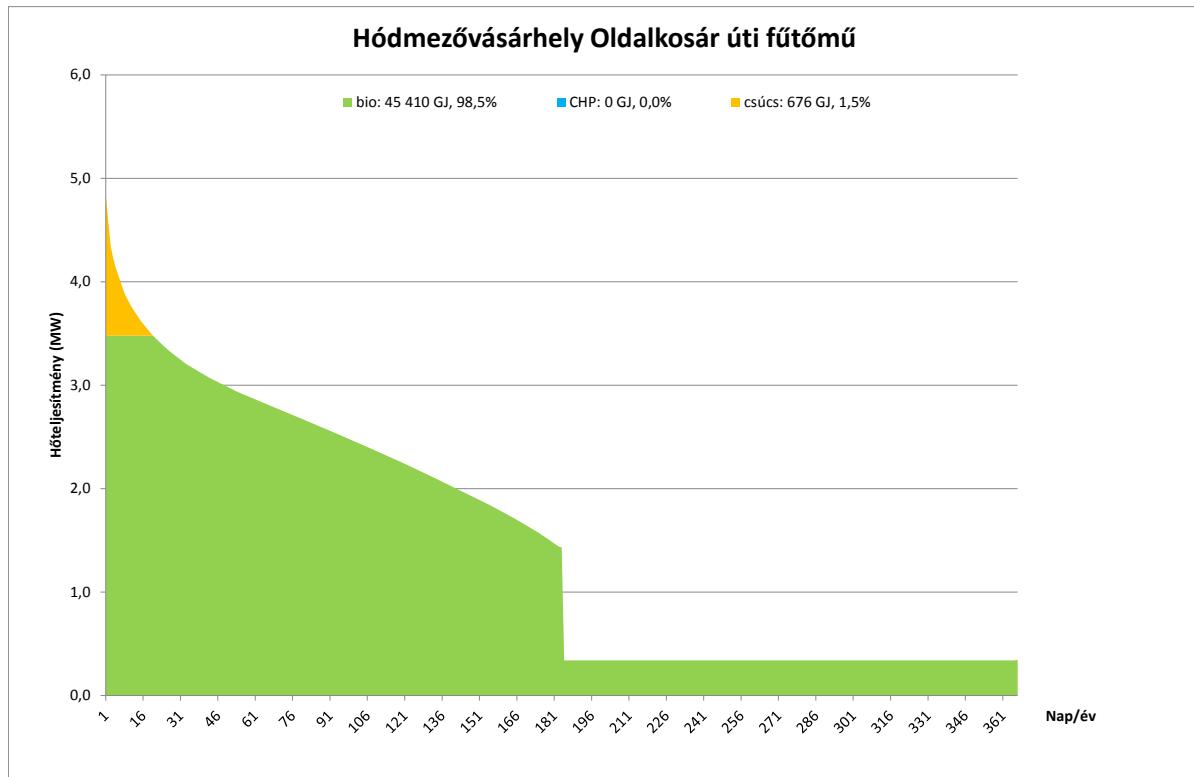
Existing geothermal supply.



Hódmezővásárhely, Mátyás úti rendszer	Mátyás út System, Hódmezővásárhely
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 66 – Mátyás út System, Hódmezővásárhely

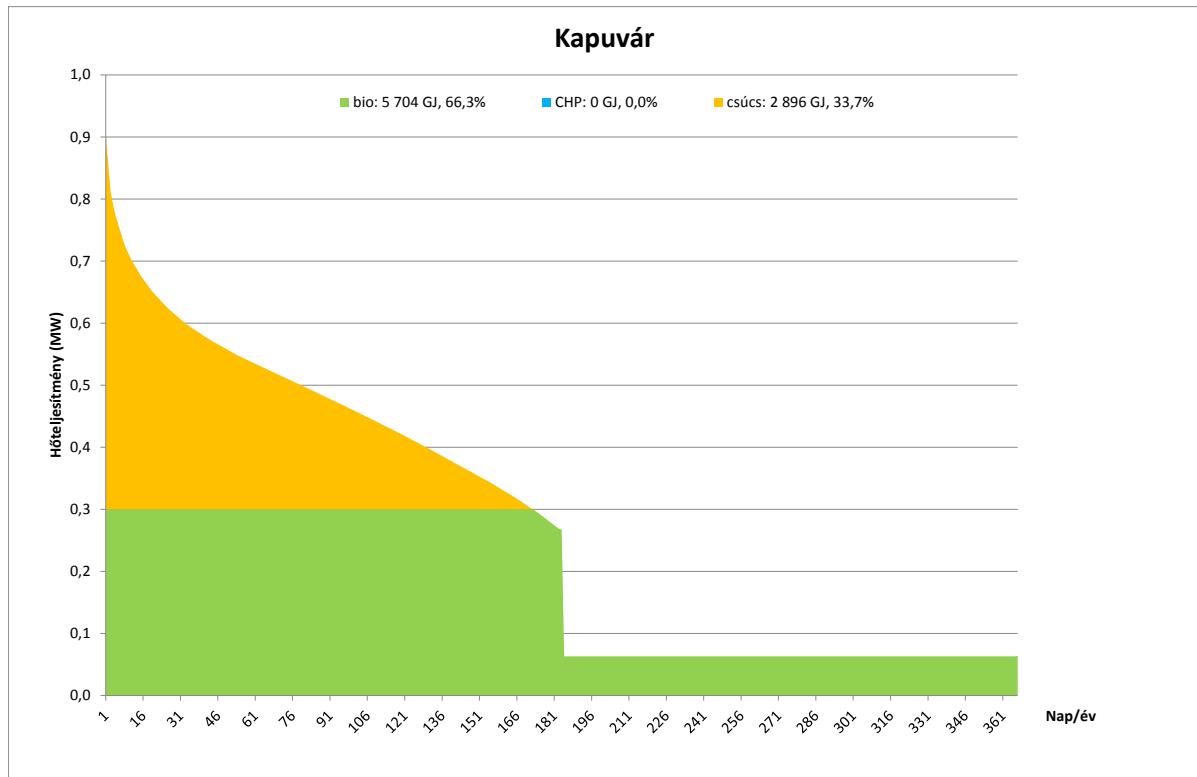
Existing geothermal heat generation.



Hódmezővásárhely Oldalkosár úti fűtőmű	Oldalkosár út Heat Plant, Hódmezővásárhely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 67 – Oldalkosár út CHP System, Hódmezővásárhely**

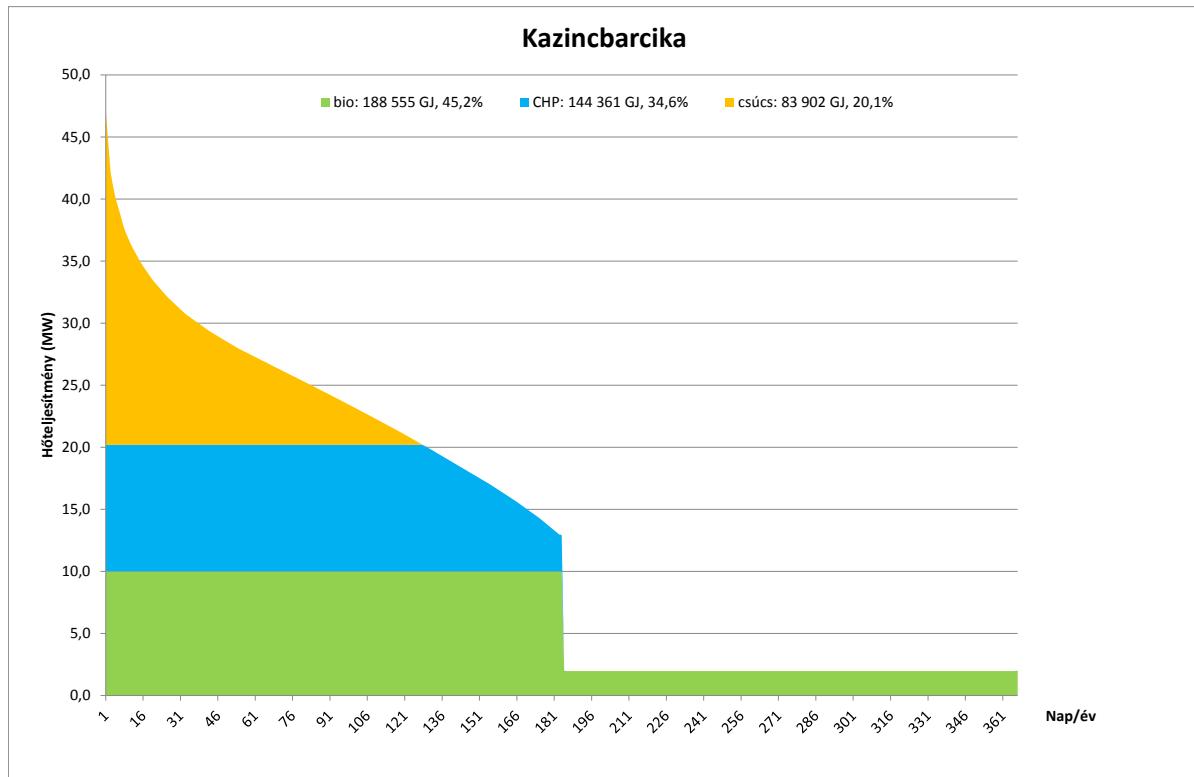
Existing geothermal heat generation.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

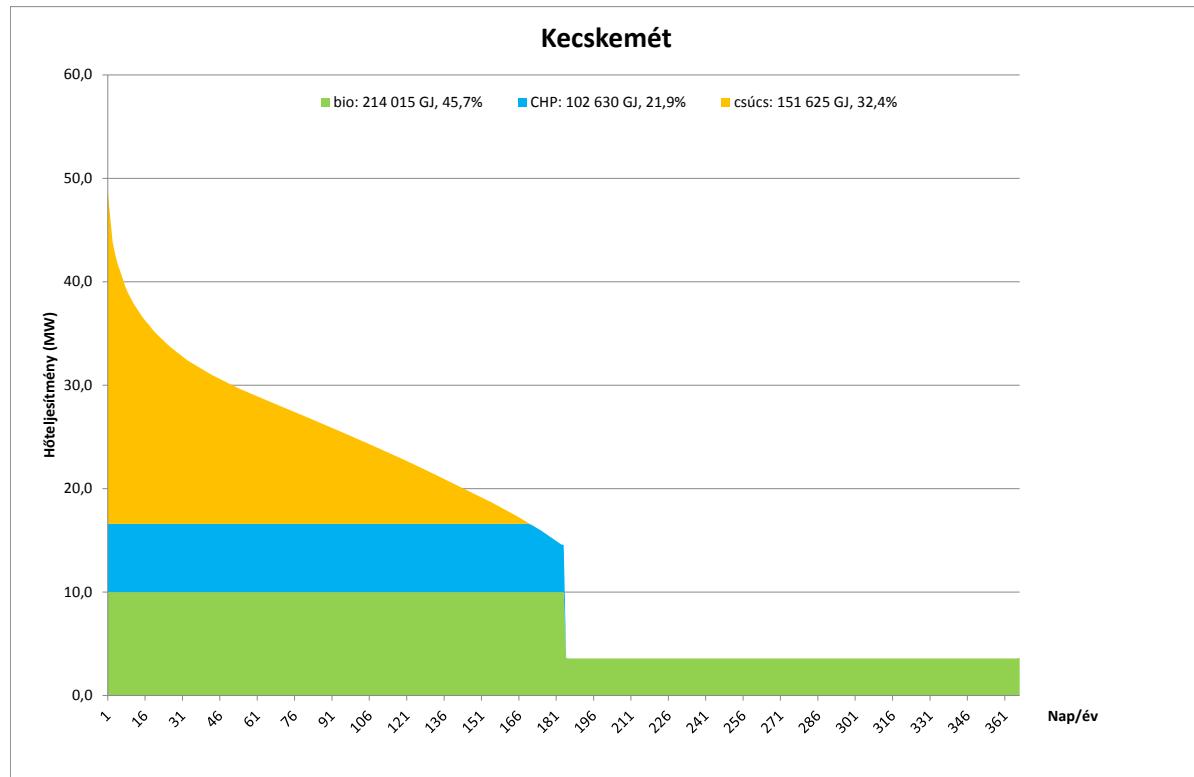
**Figure 68 – District heating system, Kapuvár**

In the event of the installation of a 300 kW of biomass-based capacity.



**Figure 69 – District heating system, Kazincbarcika**

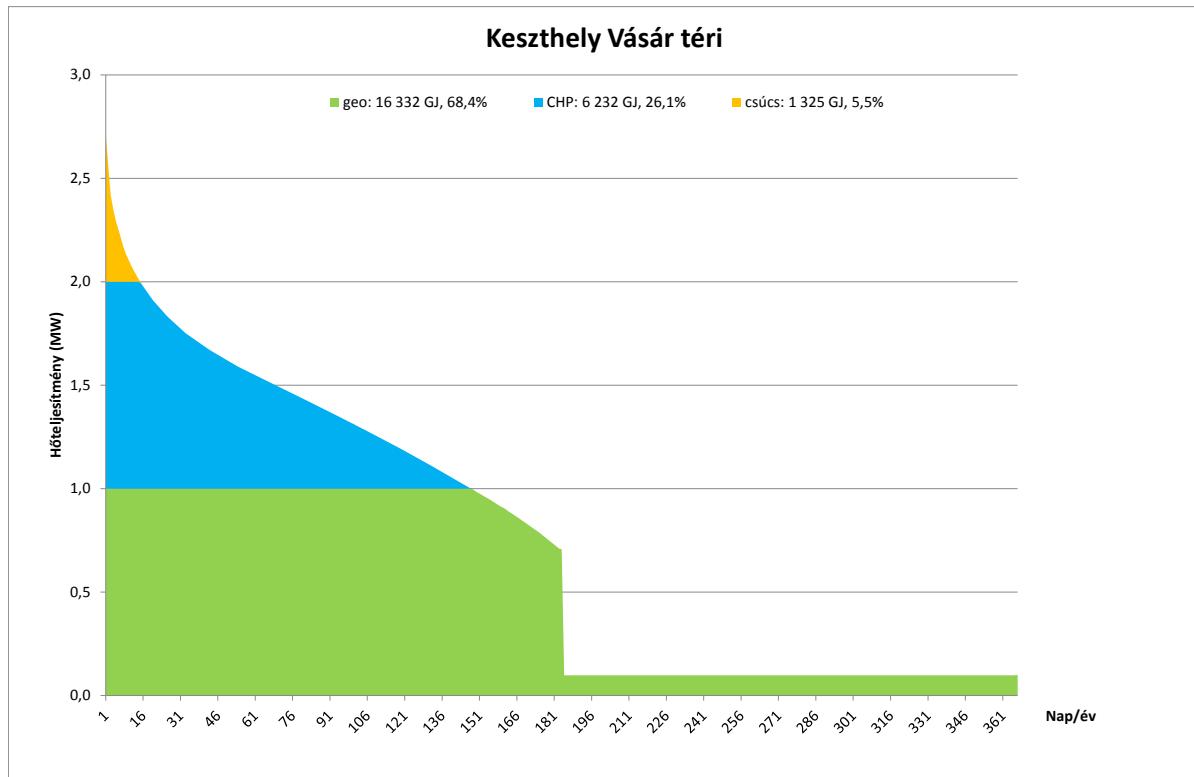
In the event of the implementation of a 10 MW biomass-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 70 – District heating system, Kecskemét**

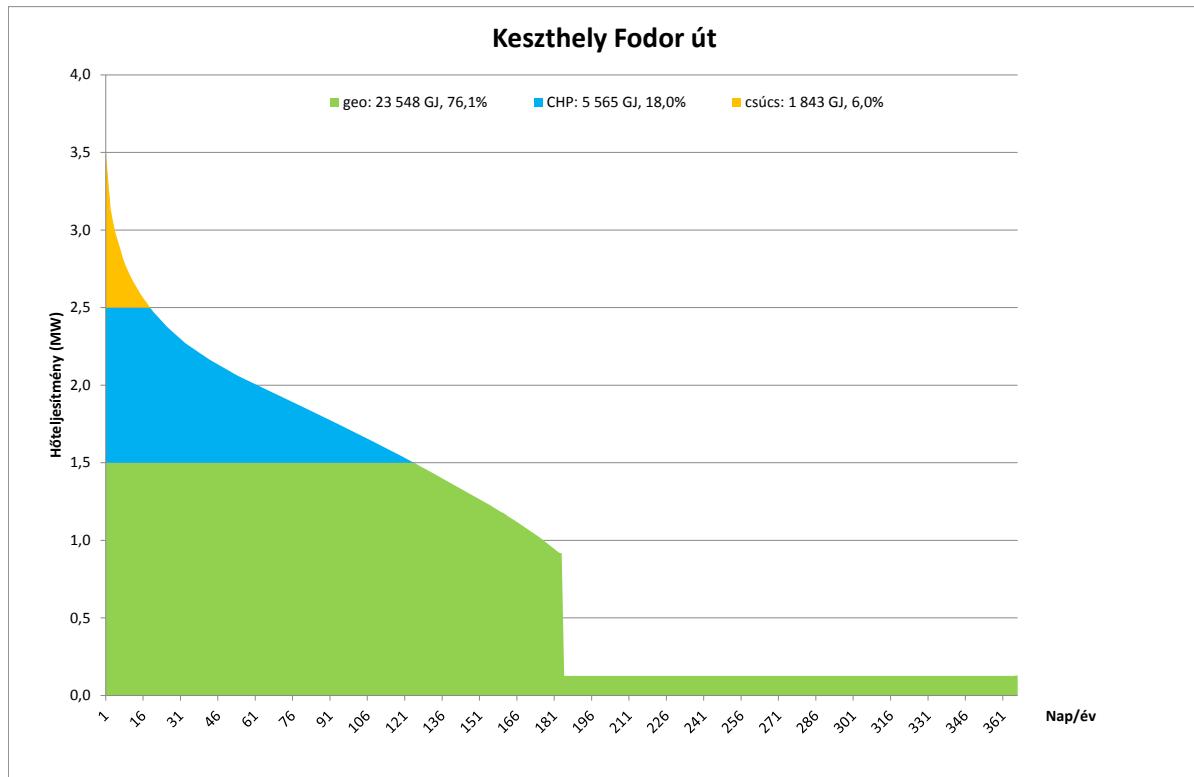
In the event of the implementation of a 10 MW biomass-based heat generation capacity.



Keszthely Vásár téri	Vásár tér, Keszthely
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 71 – Vásár tér System, Keszthely

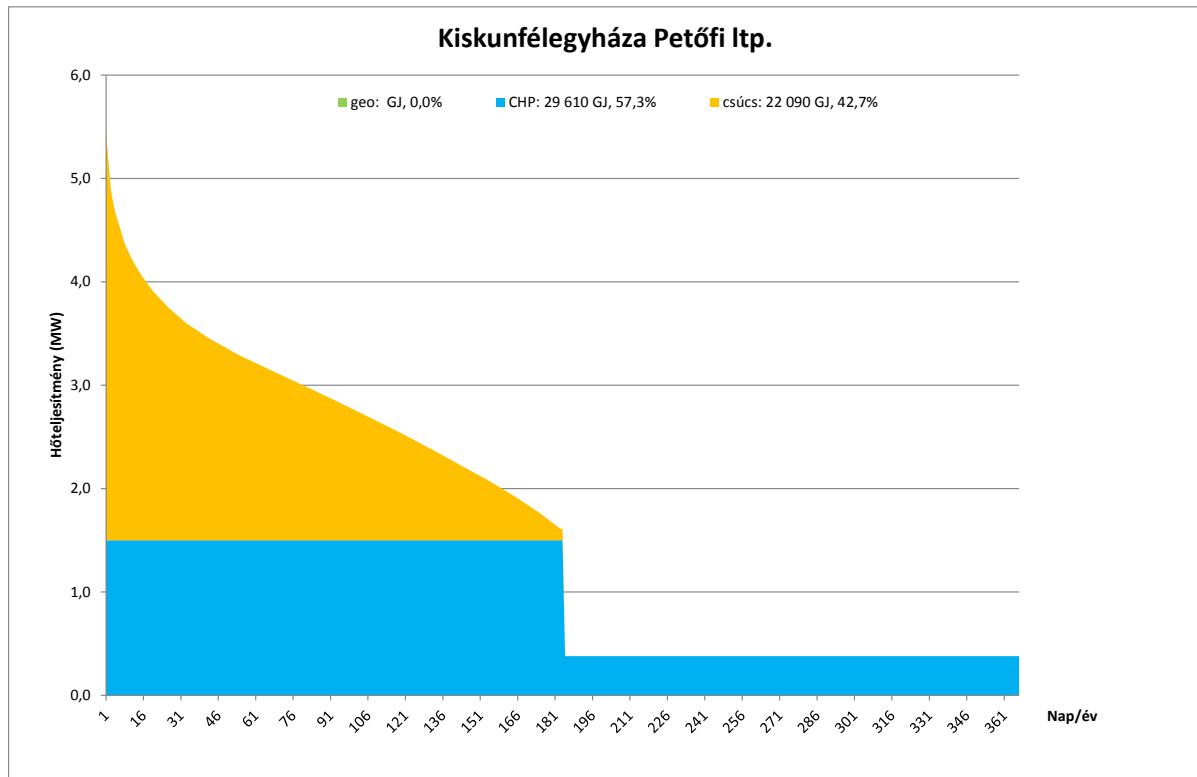
With 1 MW of new geothermal capacity.



Keszthely Fodor úti	Fodor út, Keszthely
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

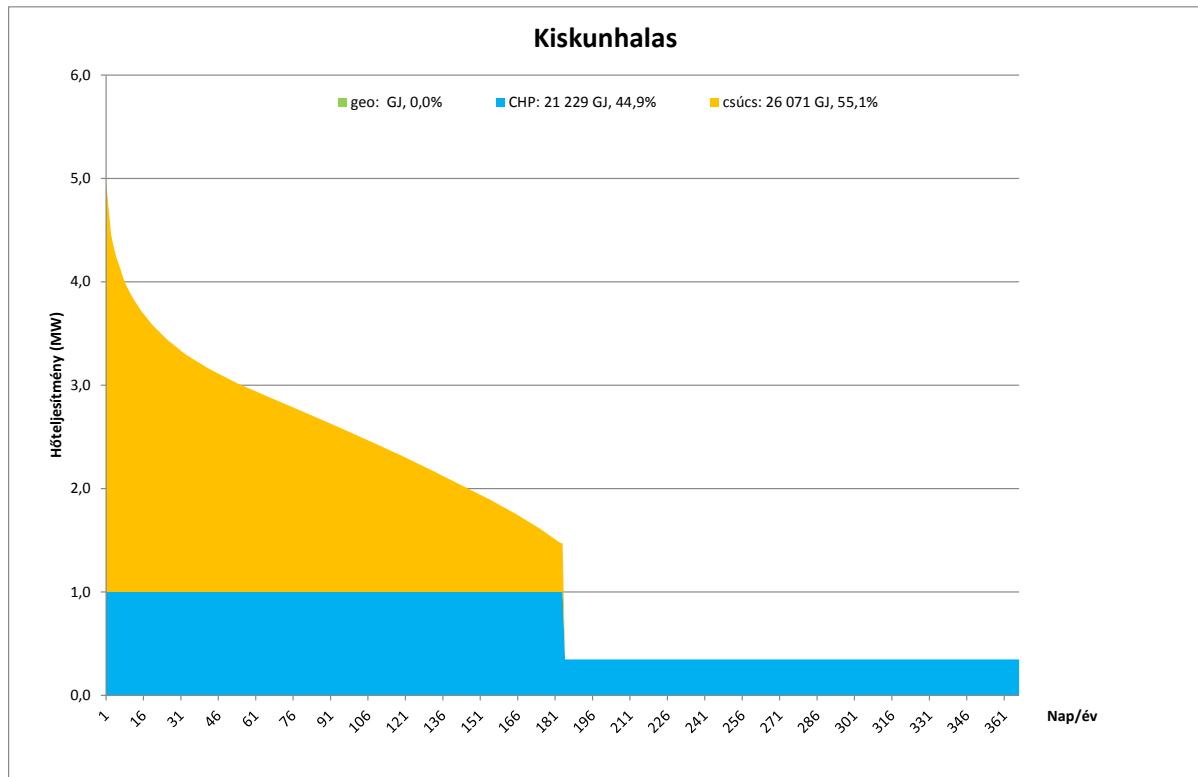
Figure 72 – Fodor út System, Keszthely

With 1.5 MW of new geothermal heat generation capacity.

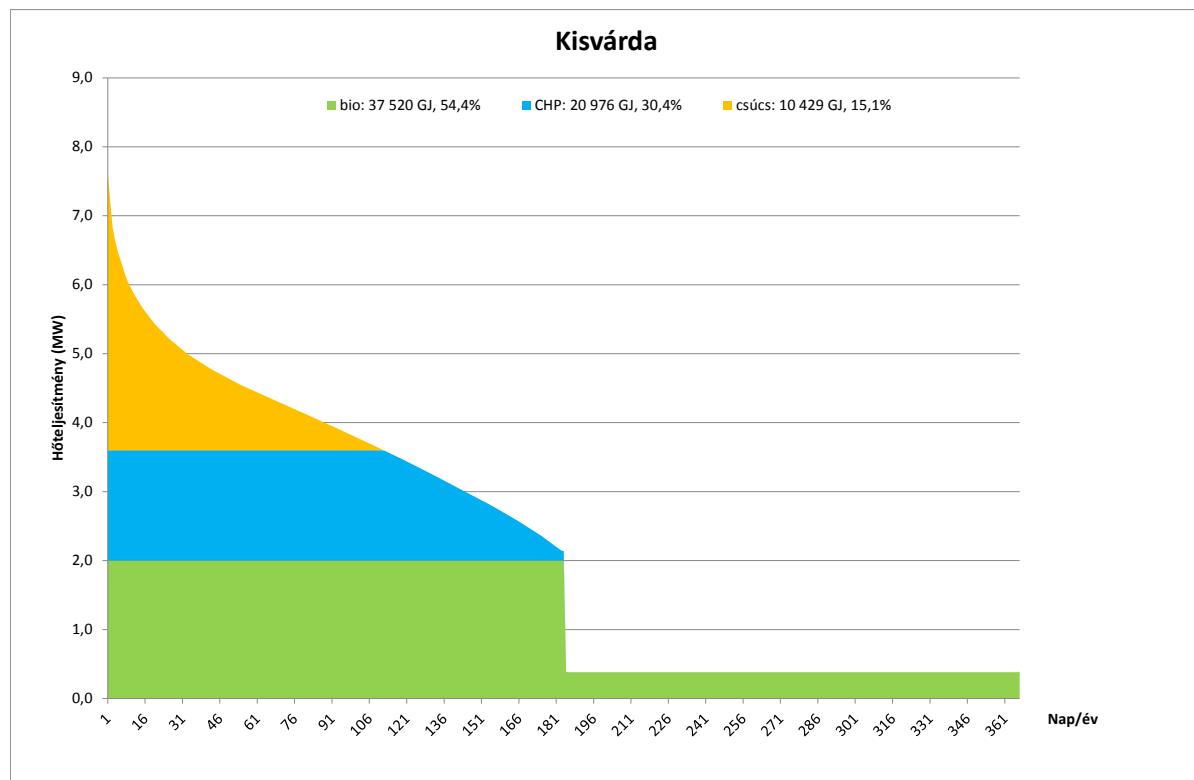


Kiskunfélegyháza Petőfi Itp.	Petőfi Housing Estate, Kiskunfélegyháza
geo	geo
CHP	CHP
csúcs	peak
Hatóteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 73 – Petőfi System, Kiskunfélegyháza



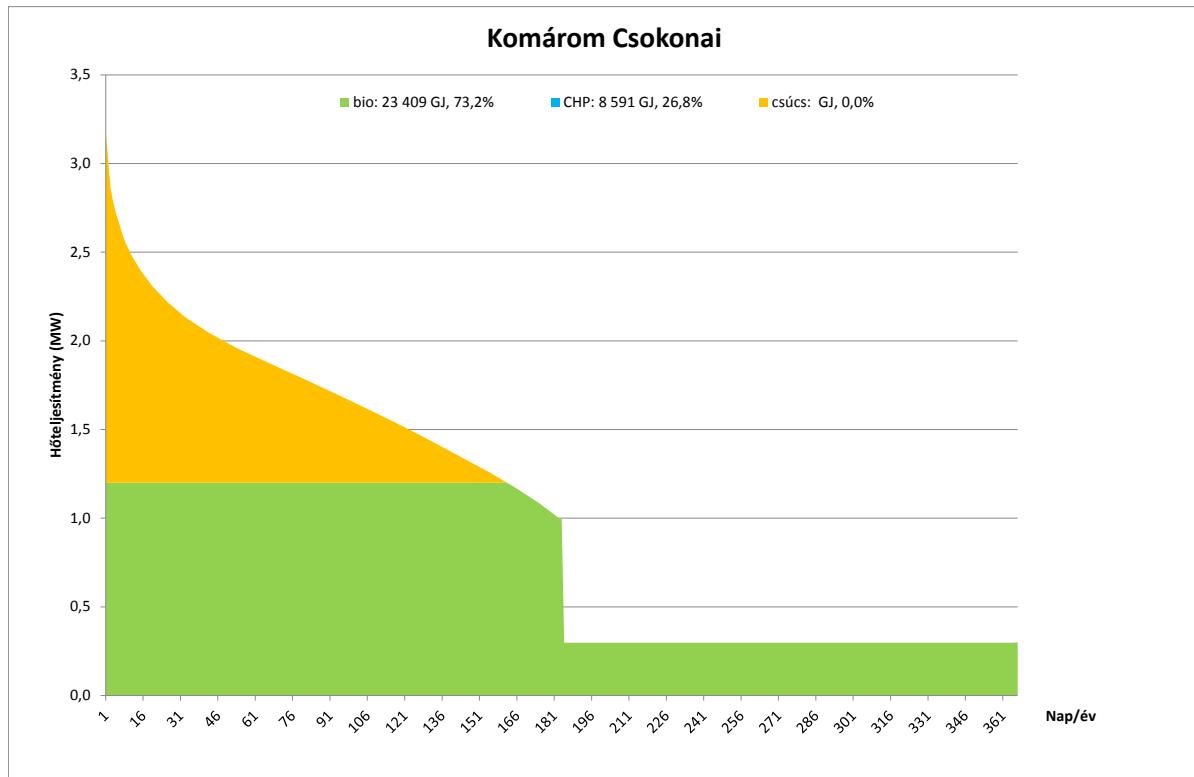
**Figure 74 – District heating system, Kiskunhalas**



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 75 – System of Kisvárda**

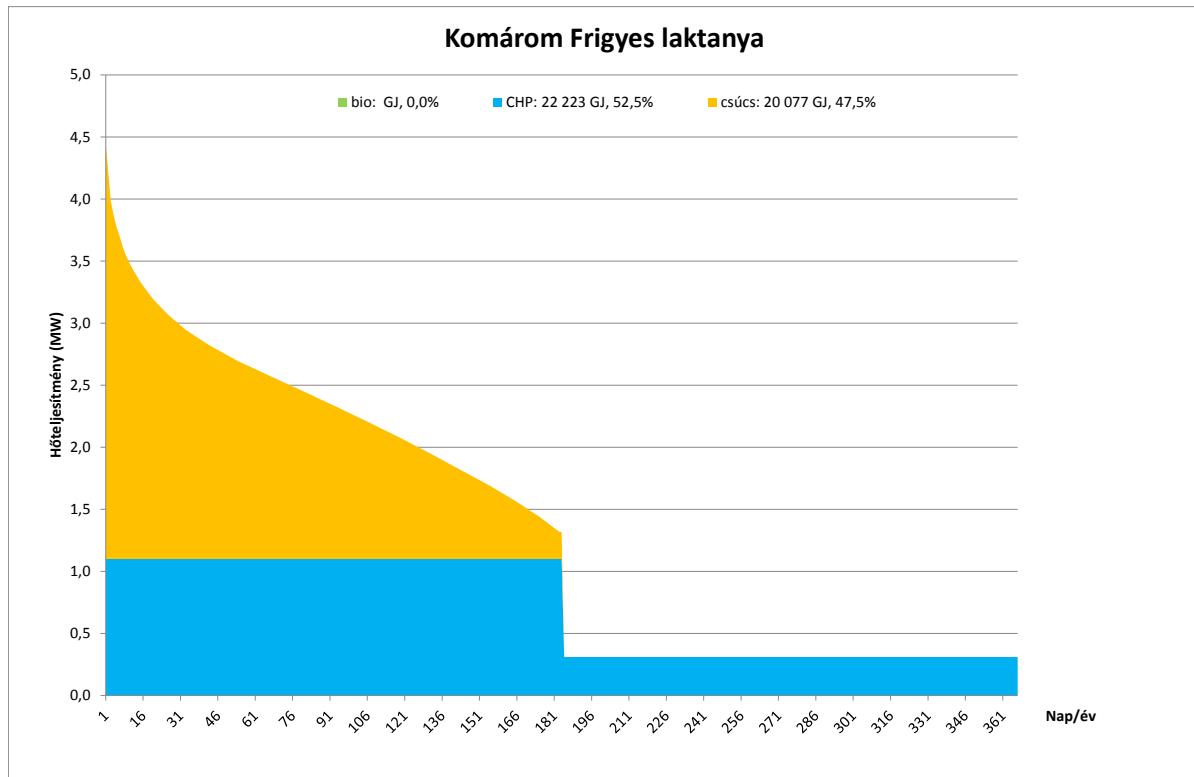
In the event of the establishment of a 2 MW biomass-based capacity.



Komárom Csokonai	Csokonai, Komárom
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

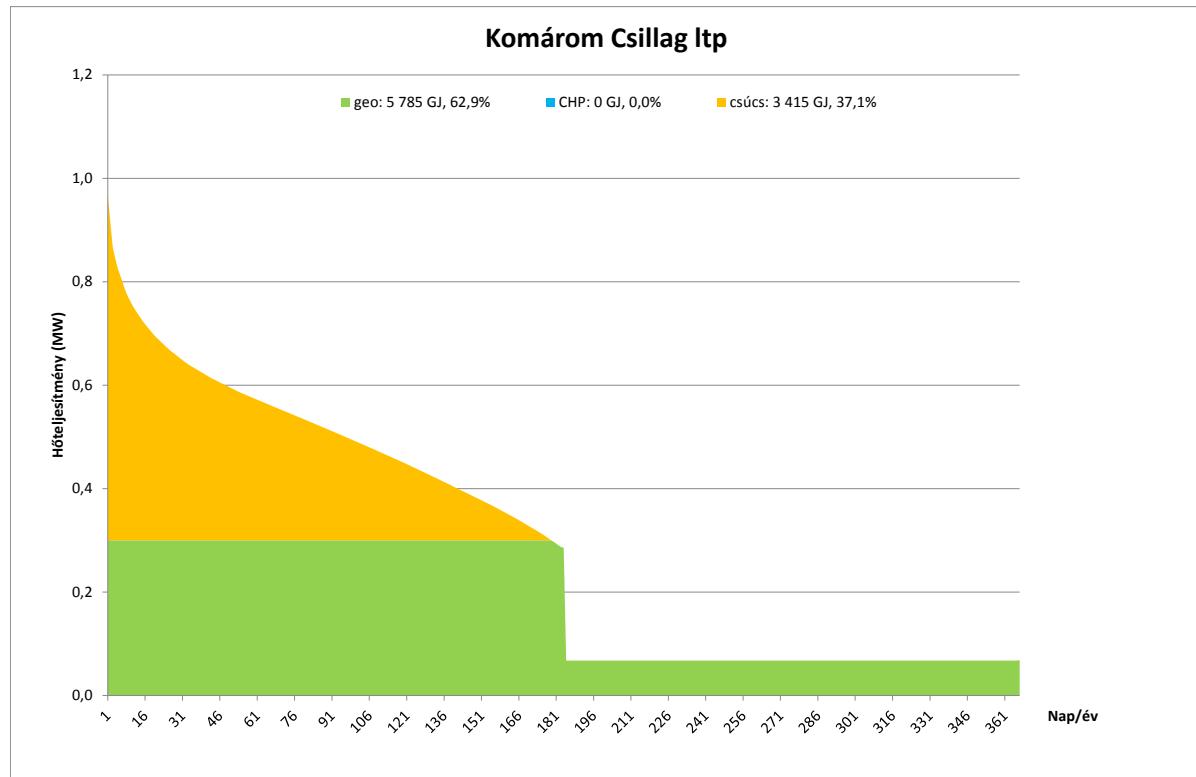
**Figure 76 – Csokonai System, Komárom**

In the event of the establishment of a 1.2 MW biomass-based heat generation unit.



Komárom Frigyes laktanya	Frigyes Barracks, Komárom
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

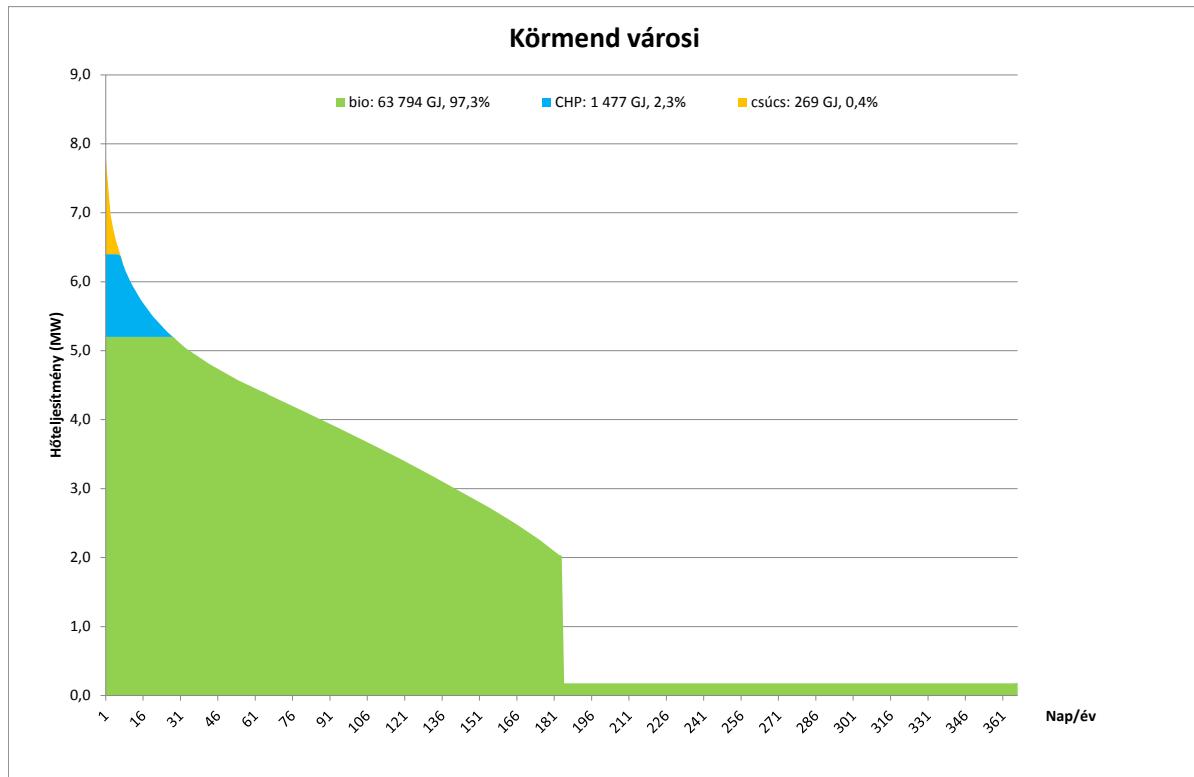
Figure 77 – Frigyes Barracks System, Komárom



Komárom Csillag Itp	Csillag Housing Estate, Komárom
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 78 – District heating system of Csillag Housing Estate, Komárom**

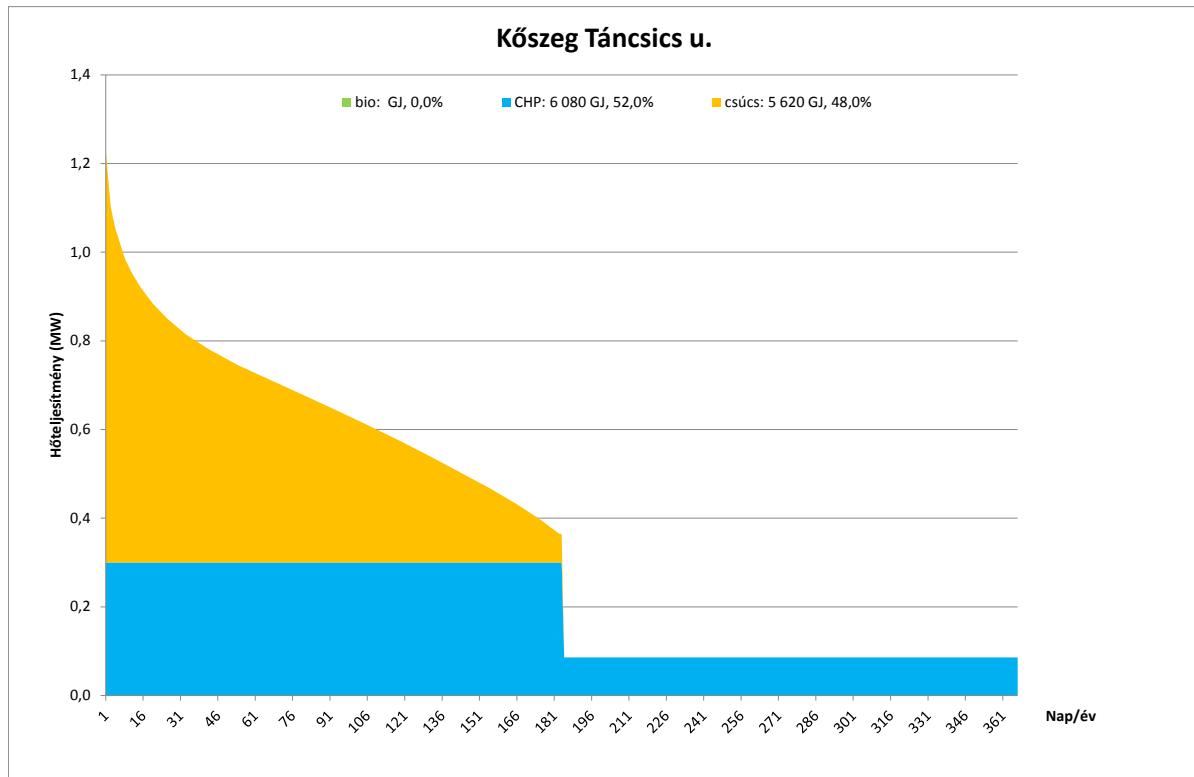
With the establishment of 300 kW of new geothermal capacity.



Kőrmend városi	Municipal, Kőrmend
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

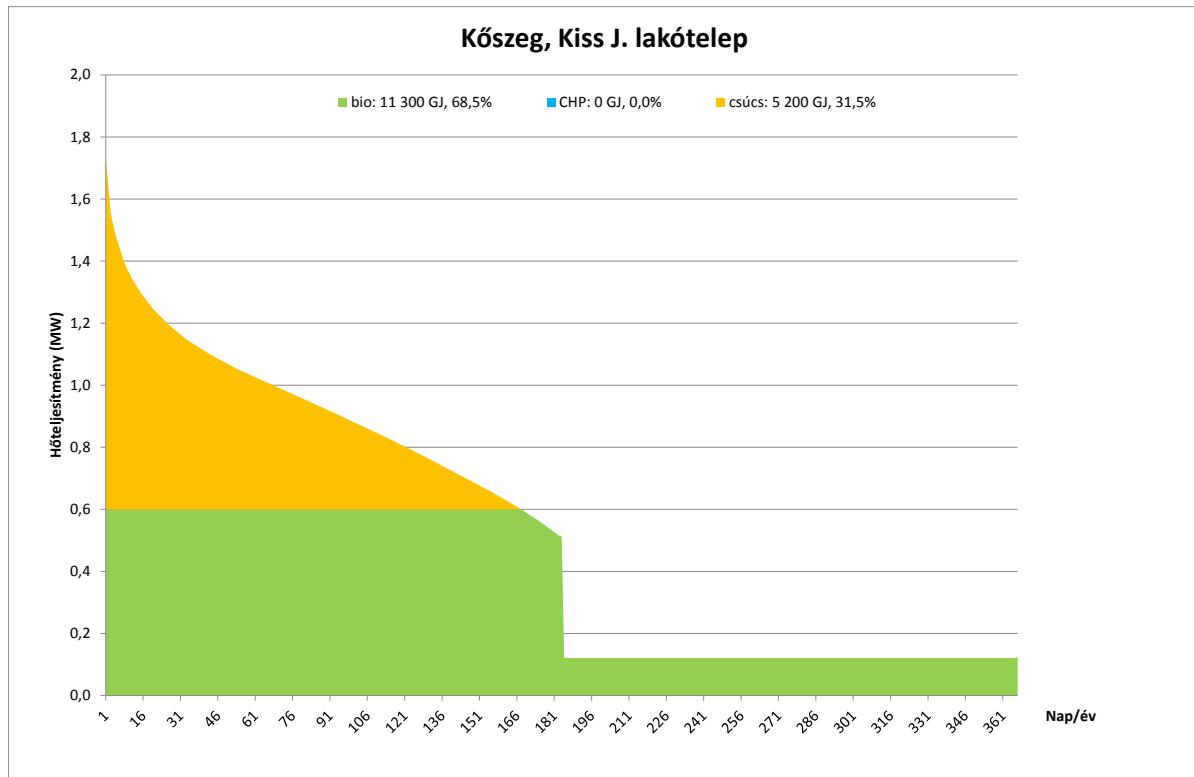
Figure 79 – Municipal district heating system, Kőrmend

Existing biomass-fired boiler.



Kőszeg Táncsics u.	Táncsics u., Kőszeg
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

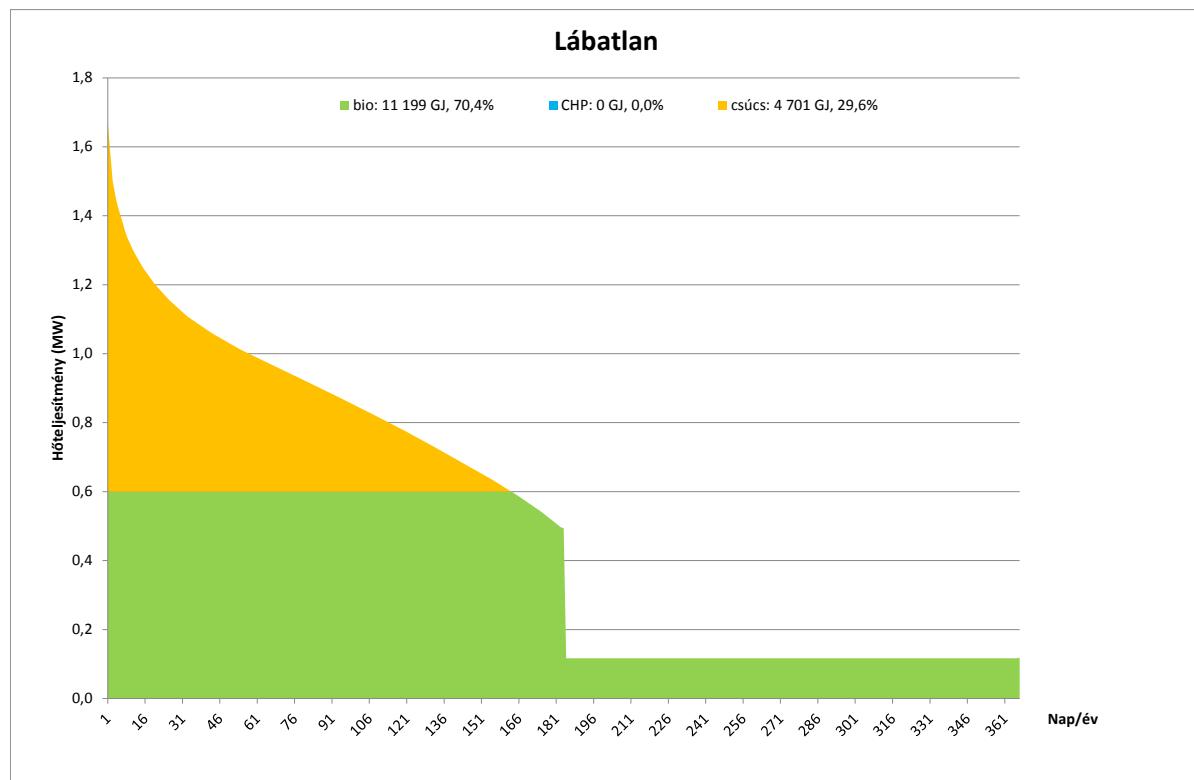
Figure 80 – Táncsics System, Kőszeg



Kőszeg Kiss J. lakótelep	Kiss J. Housing Estate, Kőszeg
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 81 – Kiss J. Housing Estate, Kőszeg**

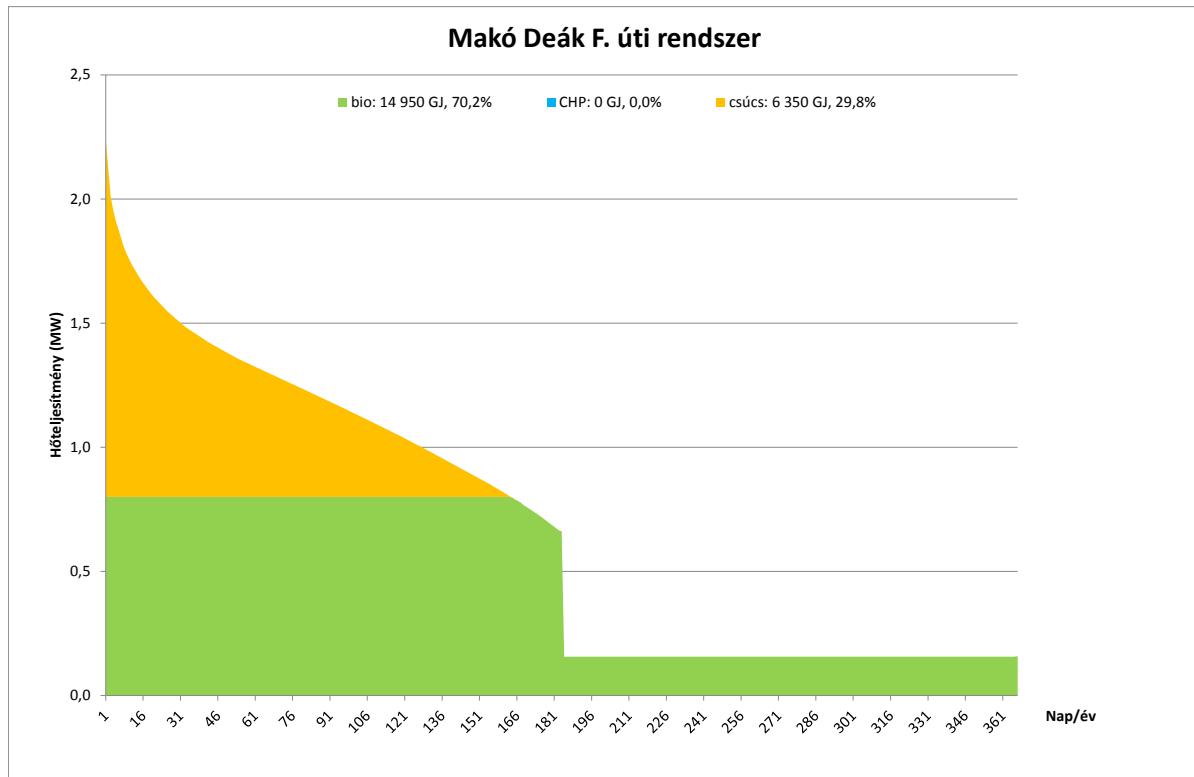
Foreseeing 600 kW of biomass-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 82 – District heating system, Lábatlan**

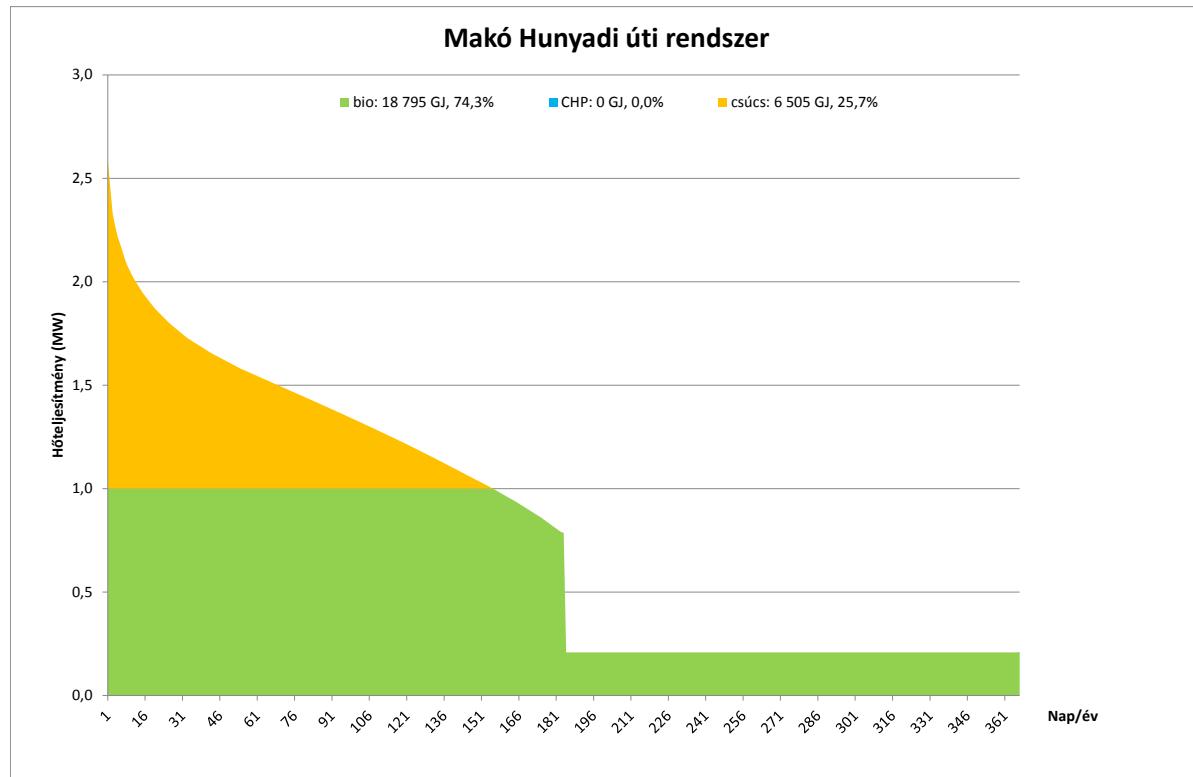
Foreseeing 600 kW of biomass-based heat generation capacity.



Makó Deák F. úti rendszer	Deák F. út System, Makó
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 83 – Deák F. út System, Makó**

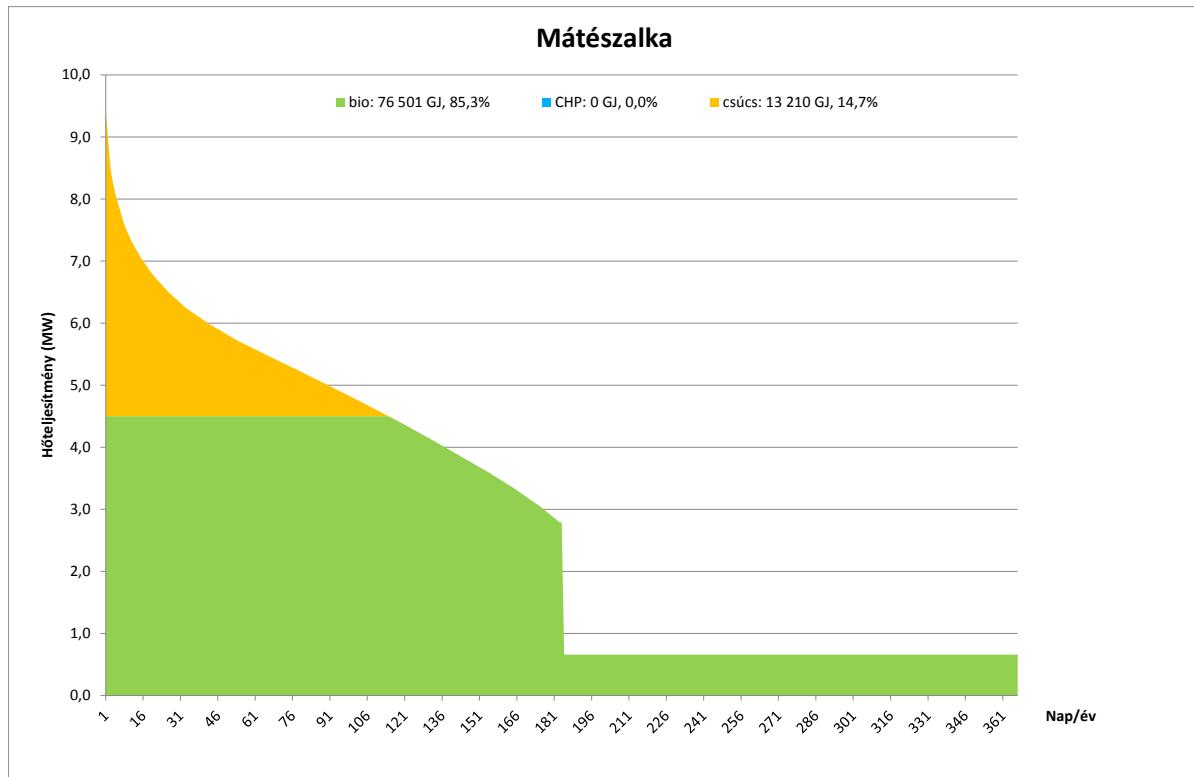
In the event of the establishment of 800 kW new biomass-based heat generation capacity.



Makó Hunyadi úti rendszer	Hunyadi út System, Makó
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 84 – Hunyadi út System, Makó

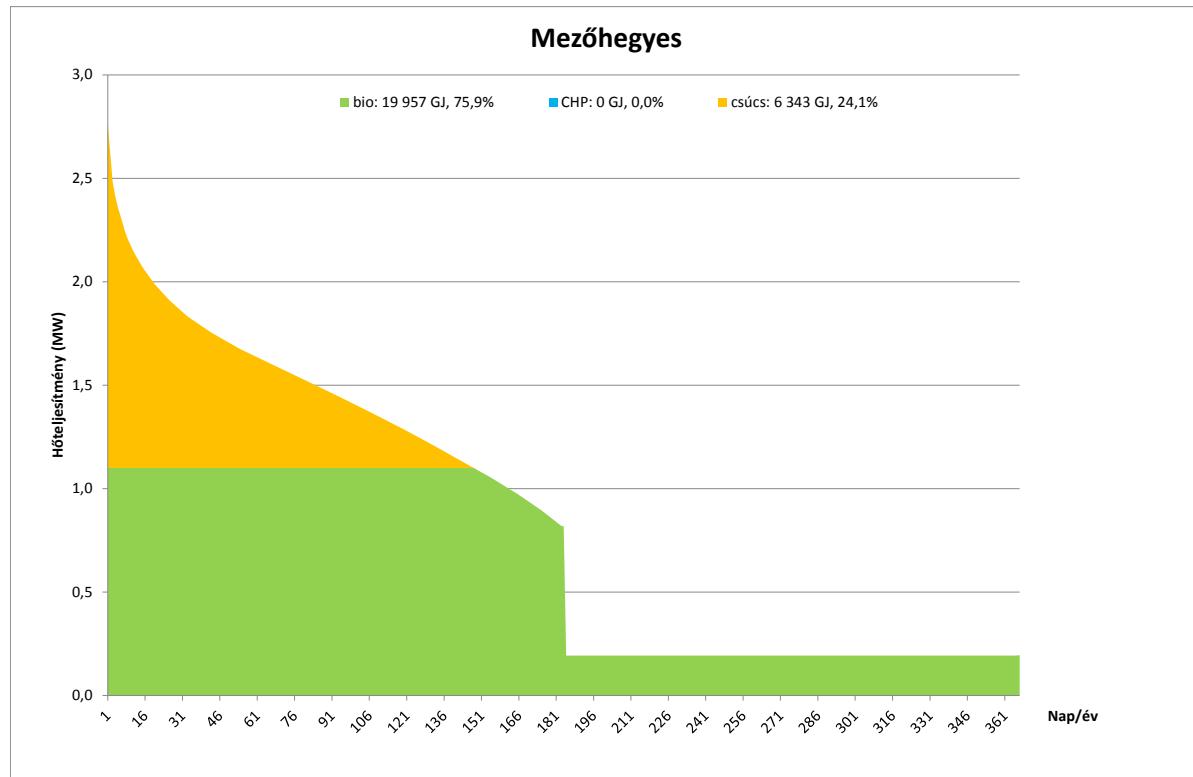
With 1 MW of new biomass-based capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 85 – District heating system, Mátészalka**

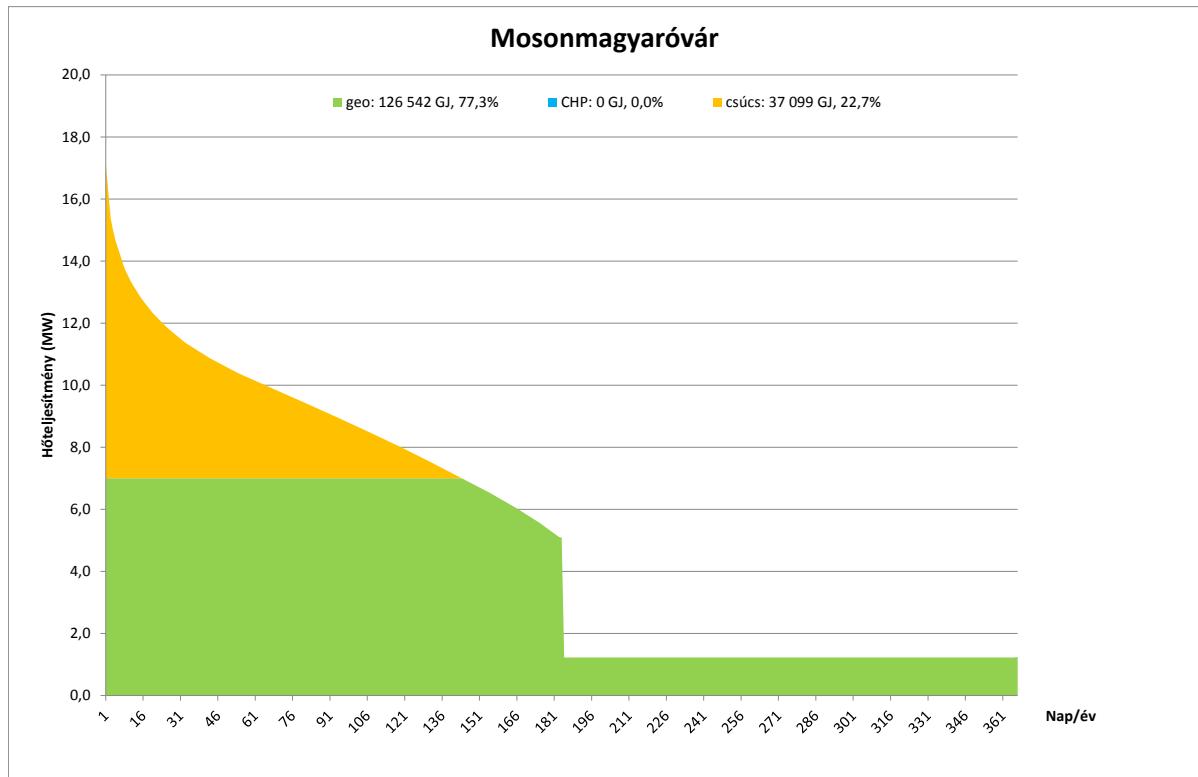
With existing wood chips-fired boiler.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 86 – District heating system, Mezőhegyes**

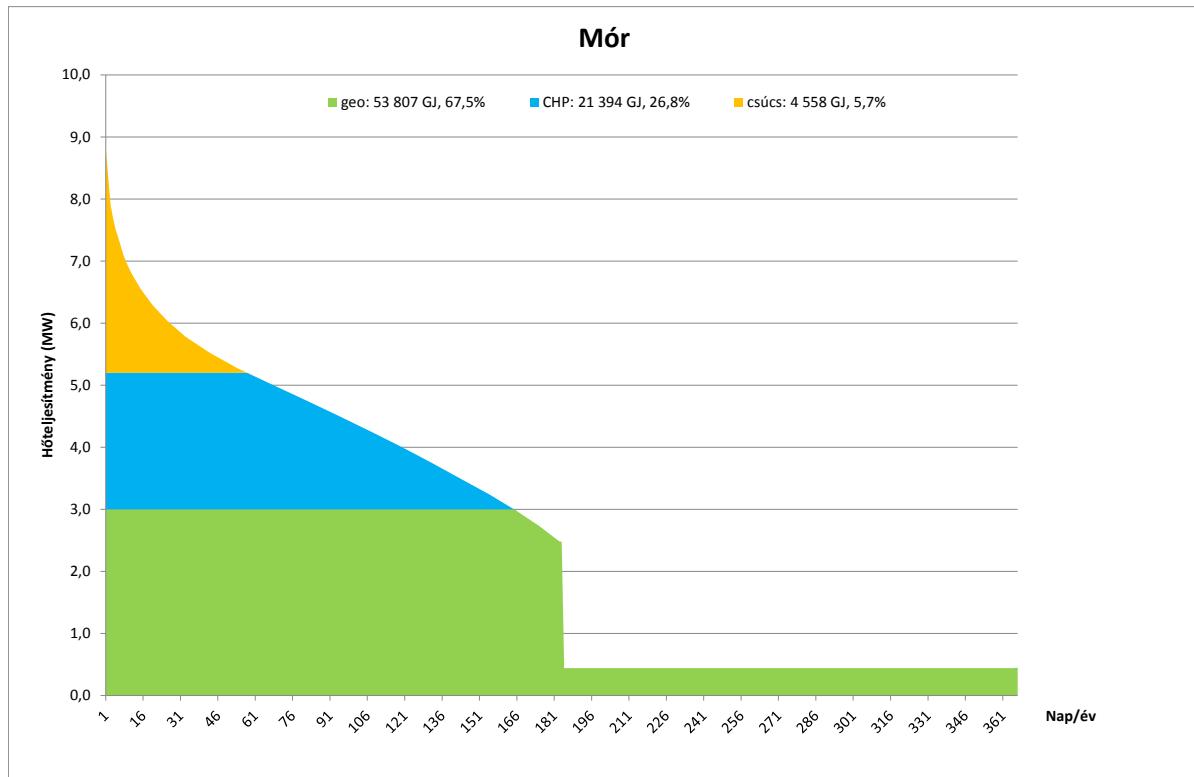
In the event of the establishment of a new 1.1 MW wood chips-fired heat source.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 87 – Municipal district heating system, Mosonmagyaróvár**

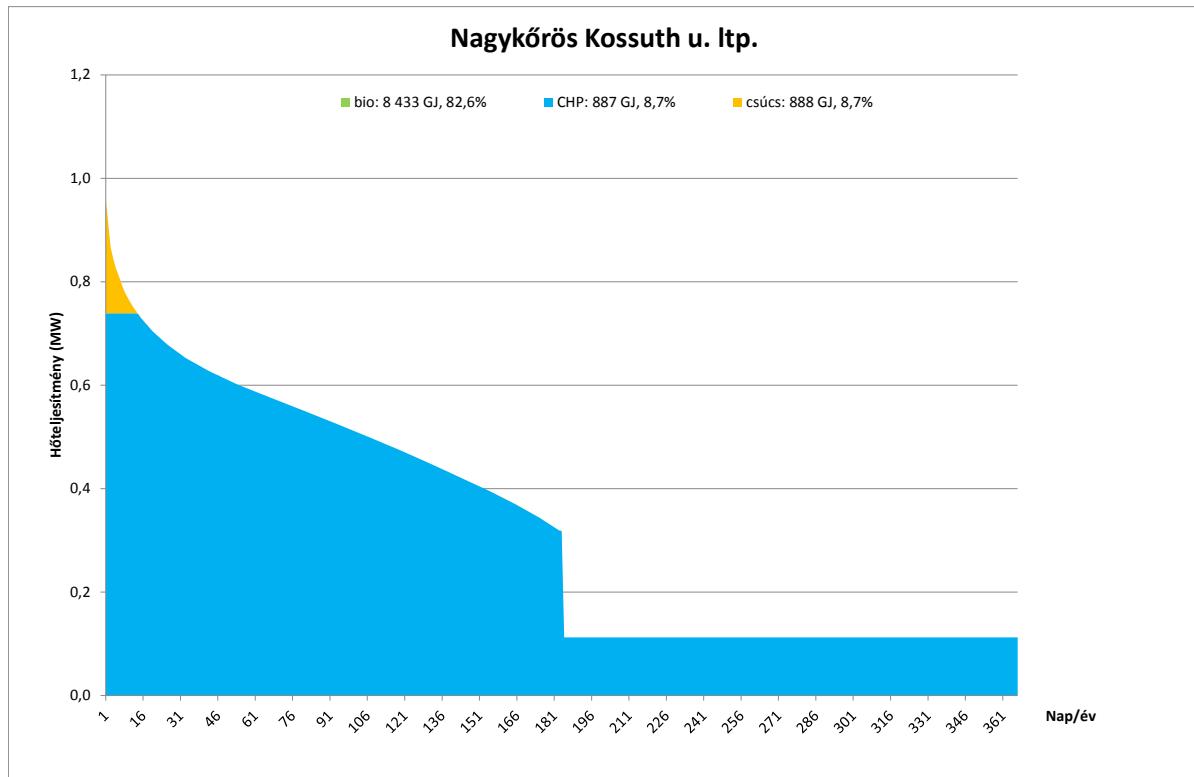
In the event of the connection of 7 MW of new geothermal capacity.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

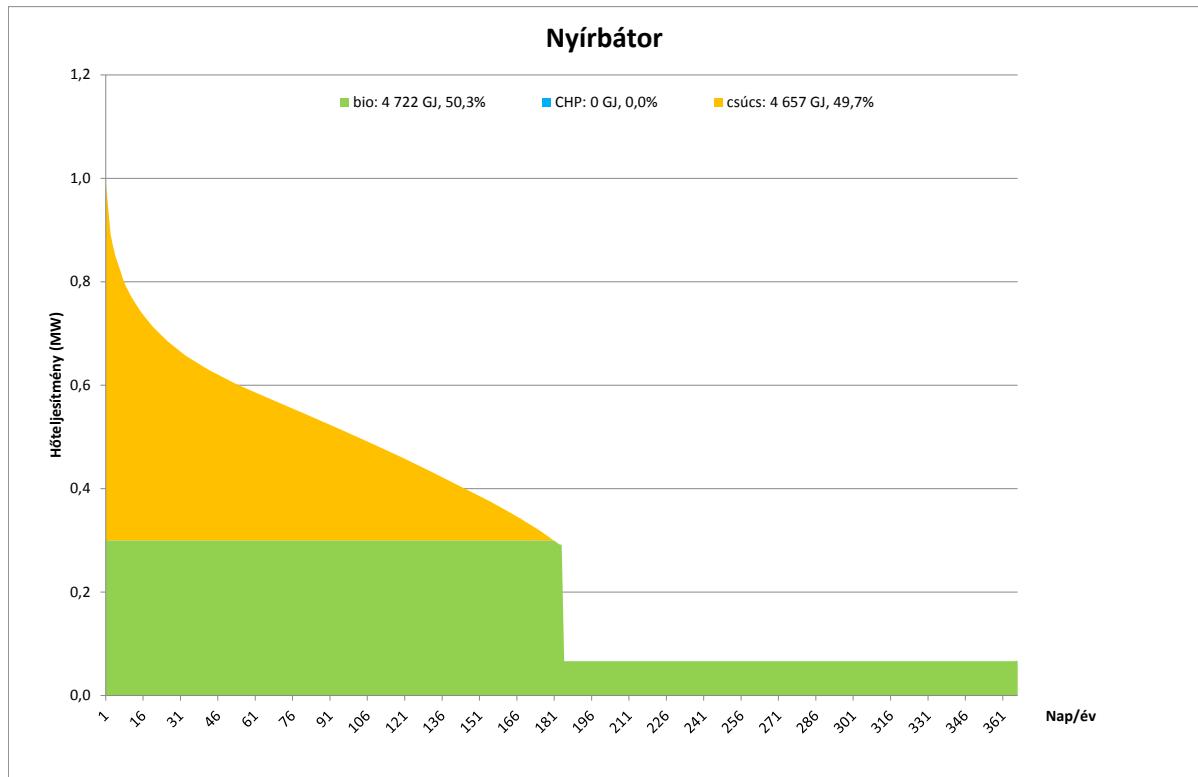
**Figure 88 – District heating system, Mór**

In the event of the establishment of 3 MW of geothermal-based heat generation capacity.



<u>Nagykőrös Kossuth u. Itp.</u>	Kossuth u. Housing Estate, Nagykőrös
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

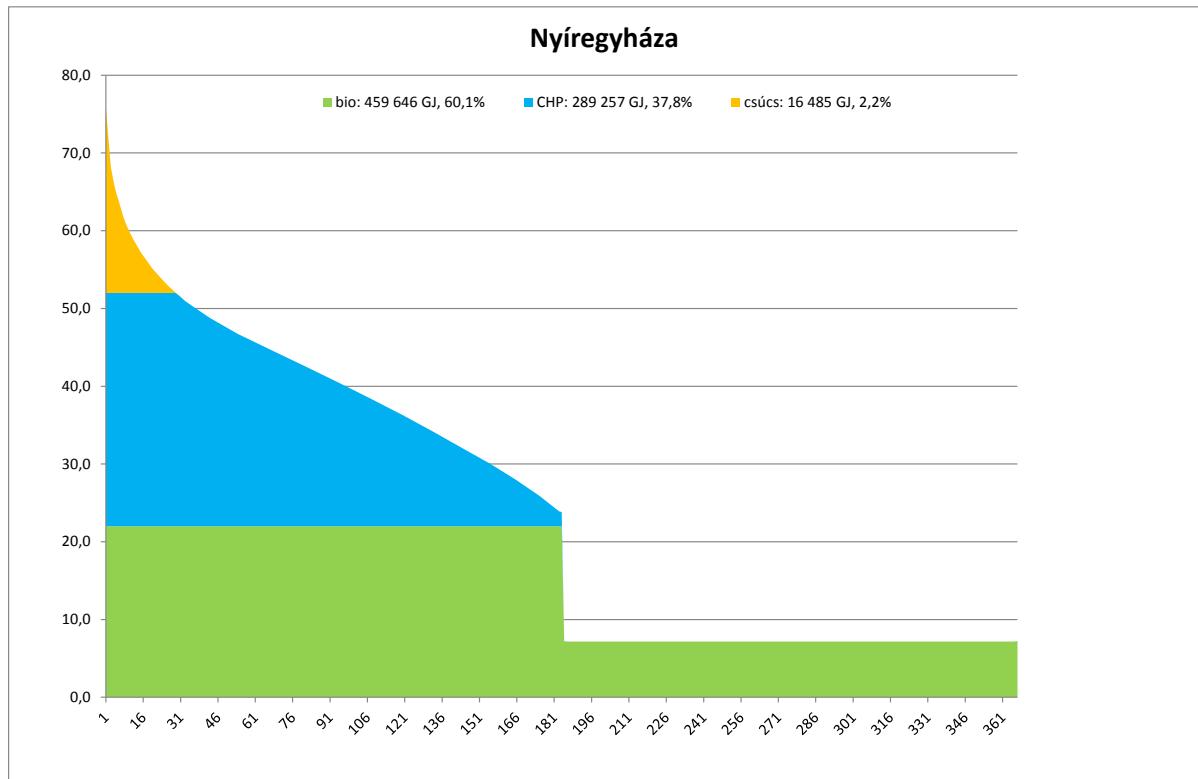
Figure 89 – District heating system of the Kossuth u. Housing Estate, Nagykőrös



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 90 – District heating system, Nyírbátor**

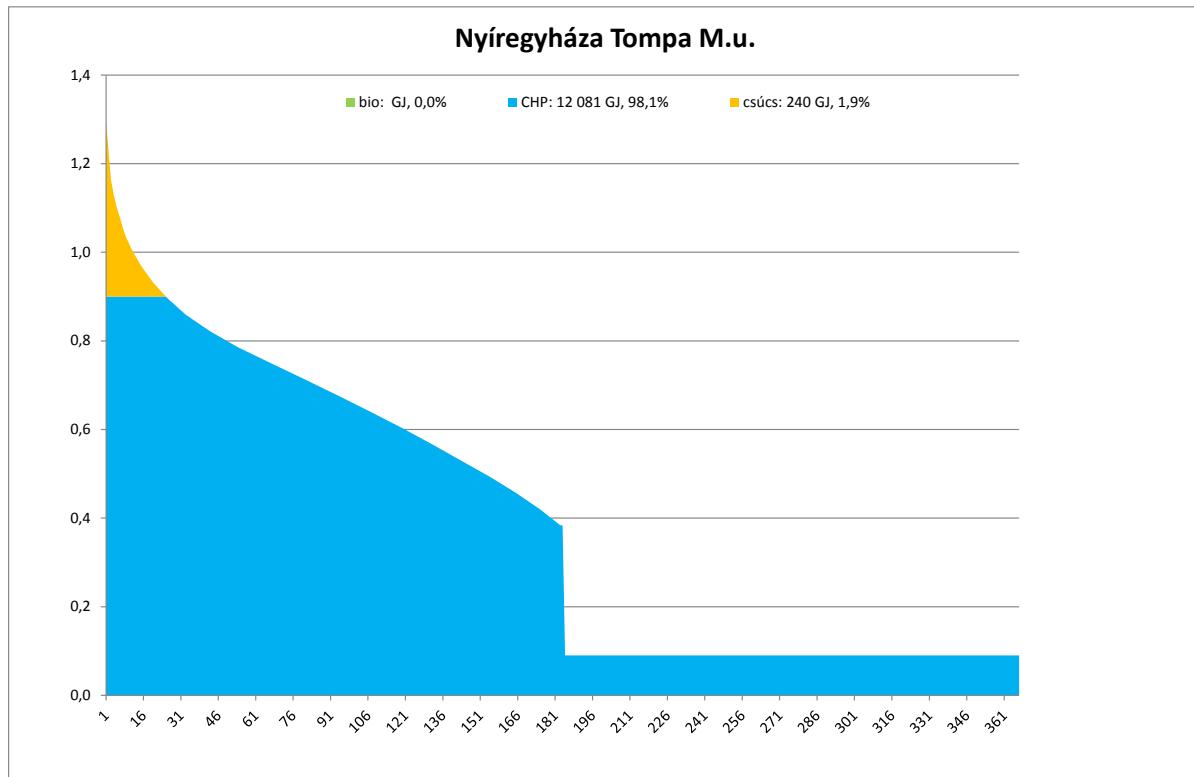
In the event of the establishment of 300 kW of new biomass-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 91 – Municipal System, Nyíregyháza**

In the event of the construction of 22 MW of new biomass (perhaps municipal solid waste)-based heat generation capacity.



<b>Nyíregyháza Tompa M. u.</b>	<b>Tompa M. u., Nyíregyháza</b>
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 92 – Tompa M. út System, Nyíregyháza

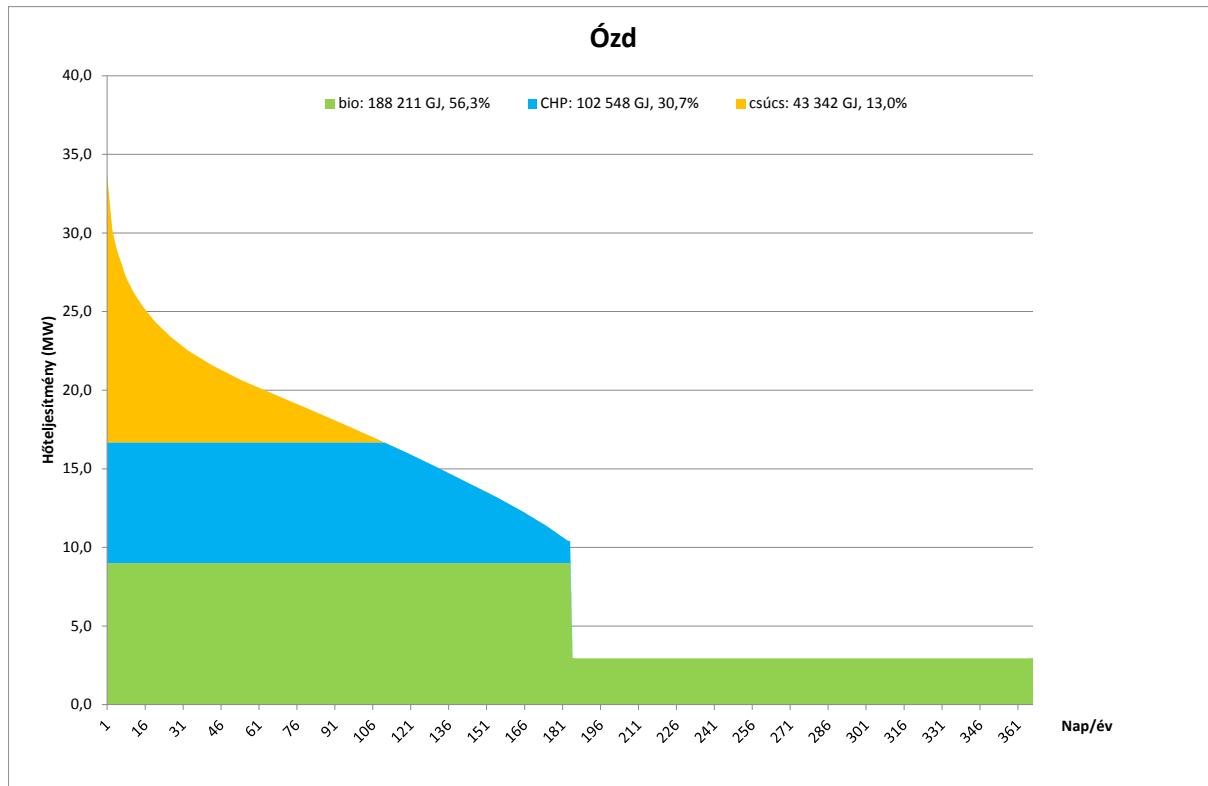
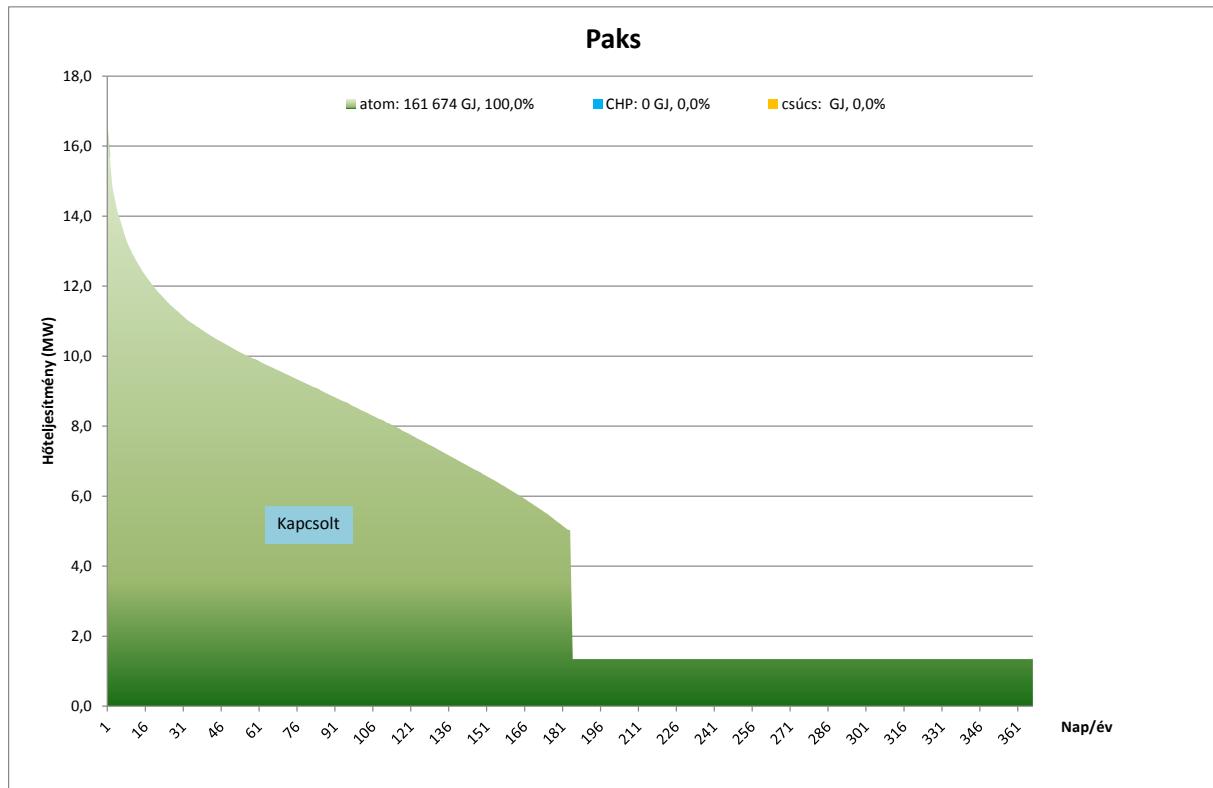


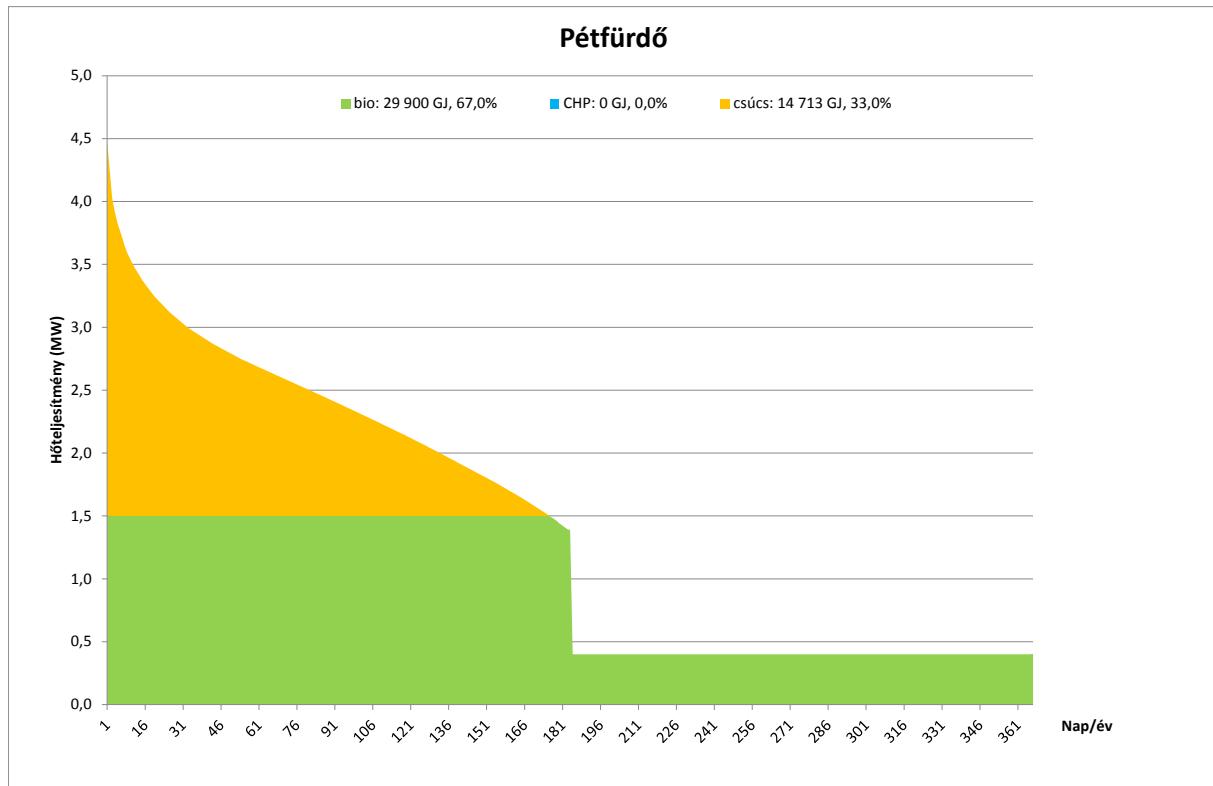
Figure 93 – District heating system, Ózd

New biomass capacity: 9 MW.



atom	nuclear
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Kapcsolt	Cogenerated
Nap/év	Days/year

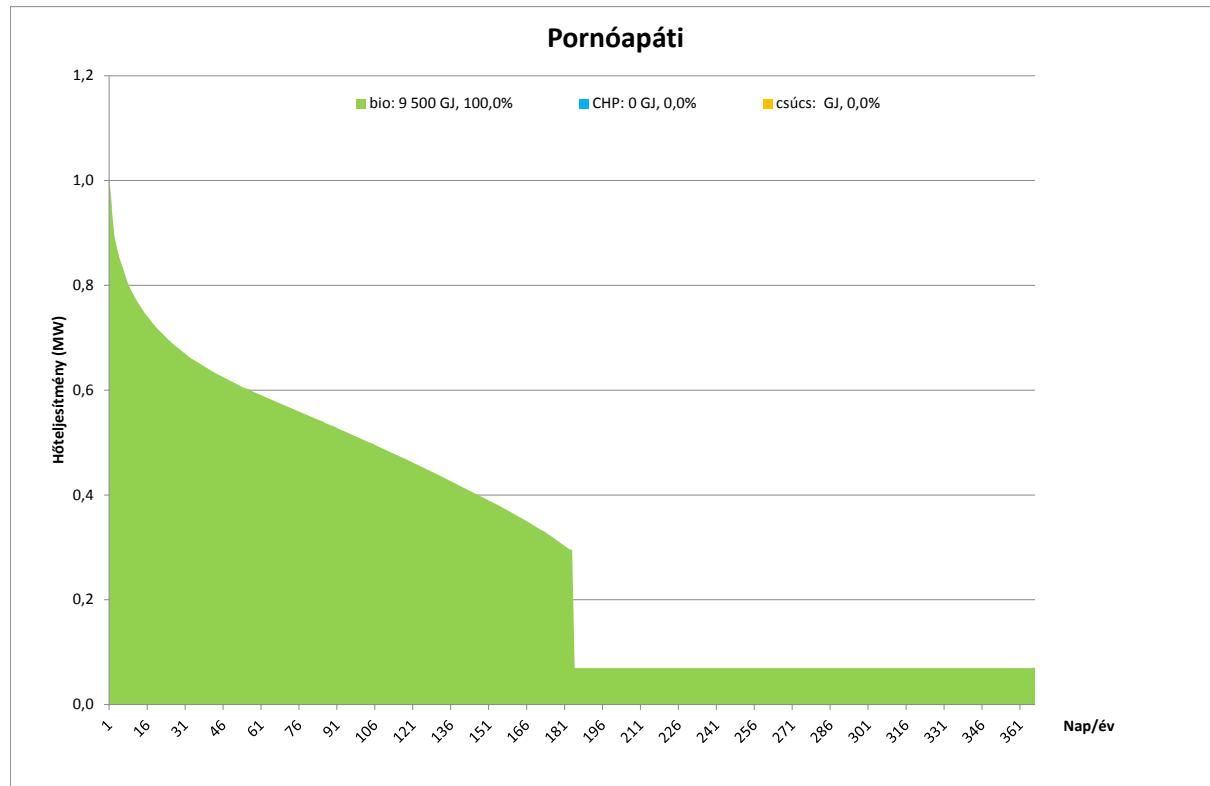
Figure 94 – District heating system, Paks



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 95 – District heating system, Pétfürdő**

In the event of the establishment of 1.5 MW of new biomass-based heat generation unit.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 96 – District heating system, Pornóapáti**

Existing wood chips combustion.

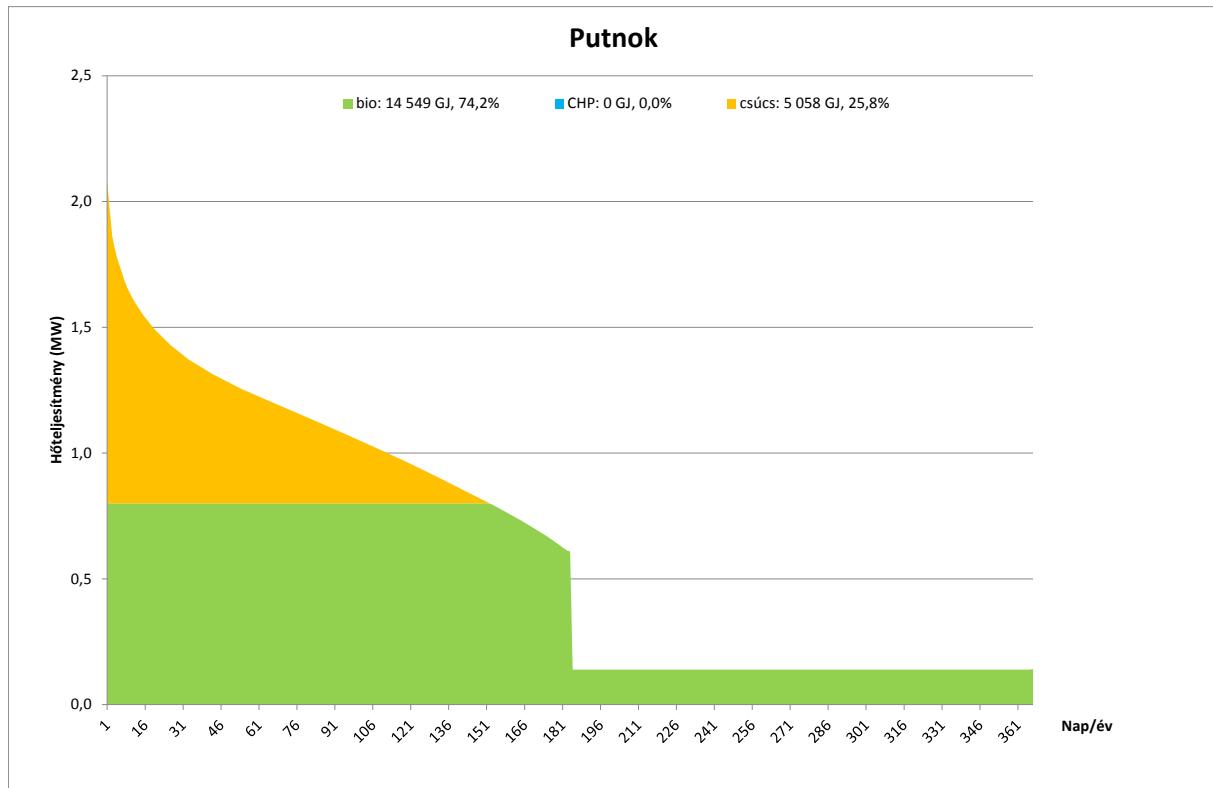
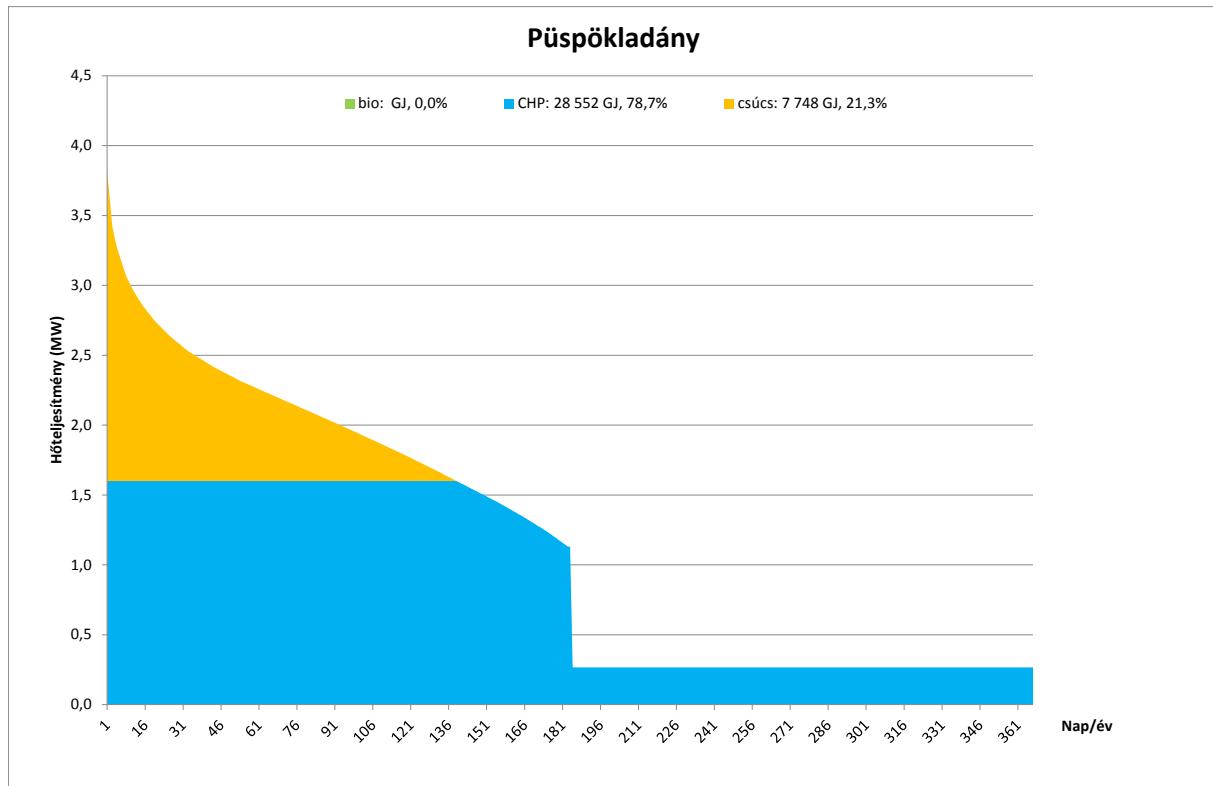


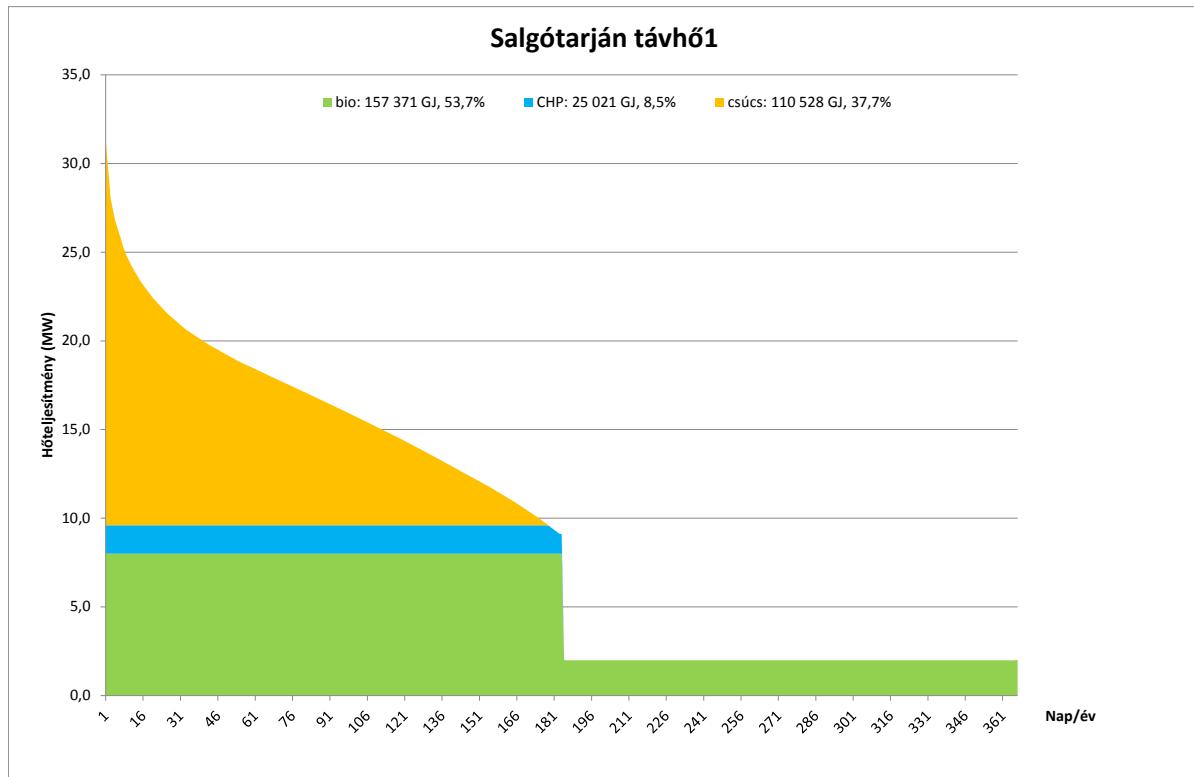
Figure 97 – District heating system, Putnok

With 800 kW new biomass-based capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

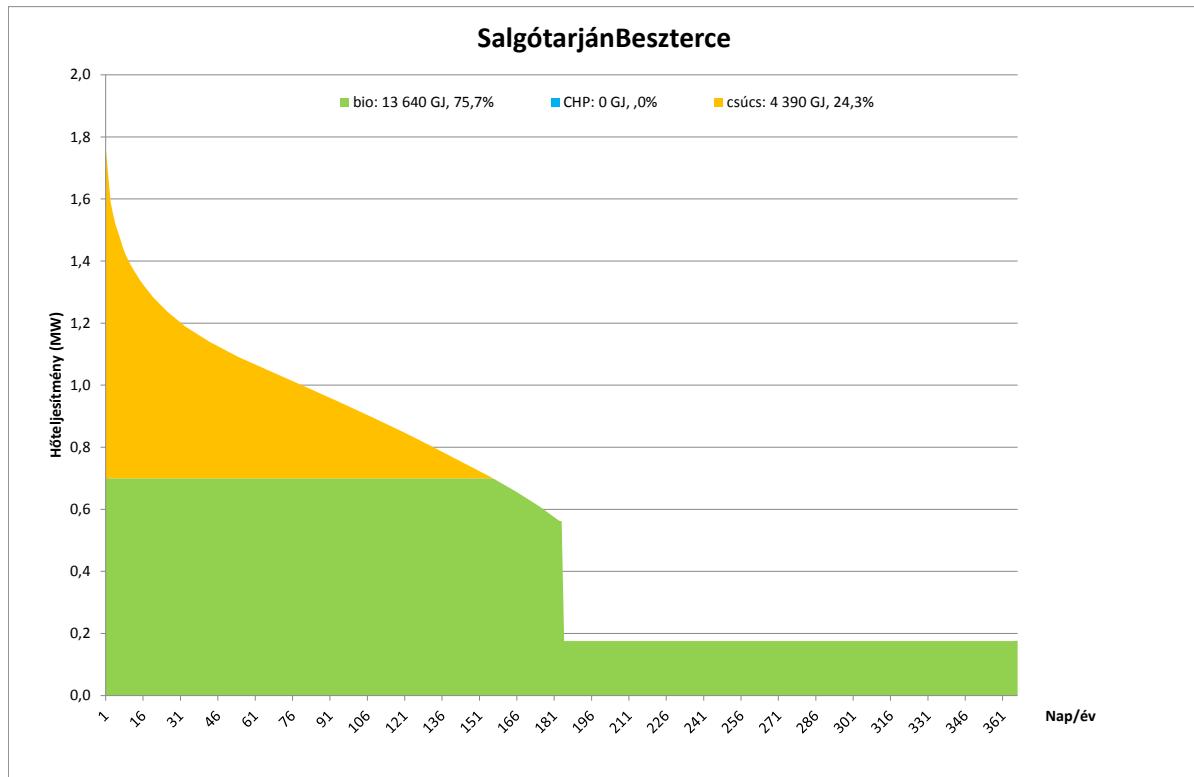
Figure 98 – District heating system, Püspökladány



Salgótarján távhő1	District heat 1, Salgótarján
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 99 – District Heating System I, Salgótarján**

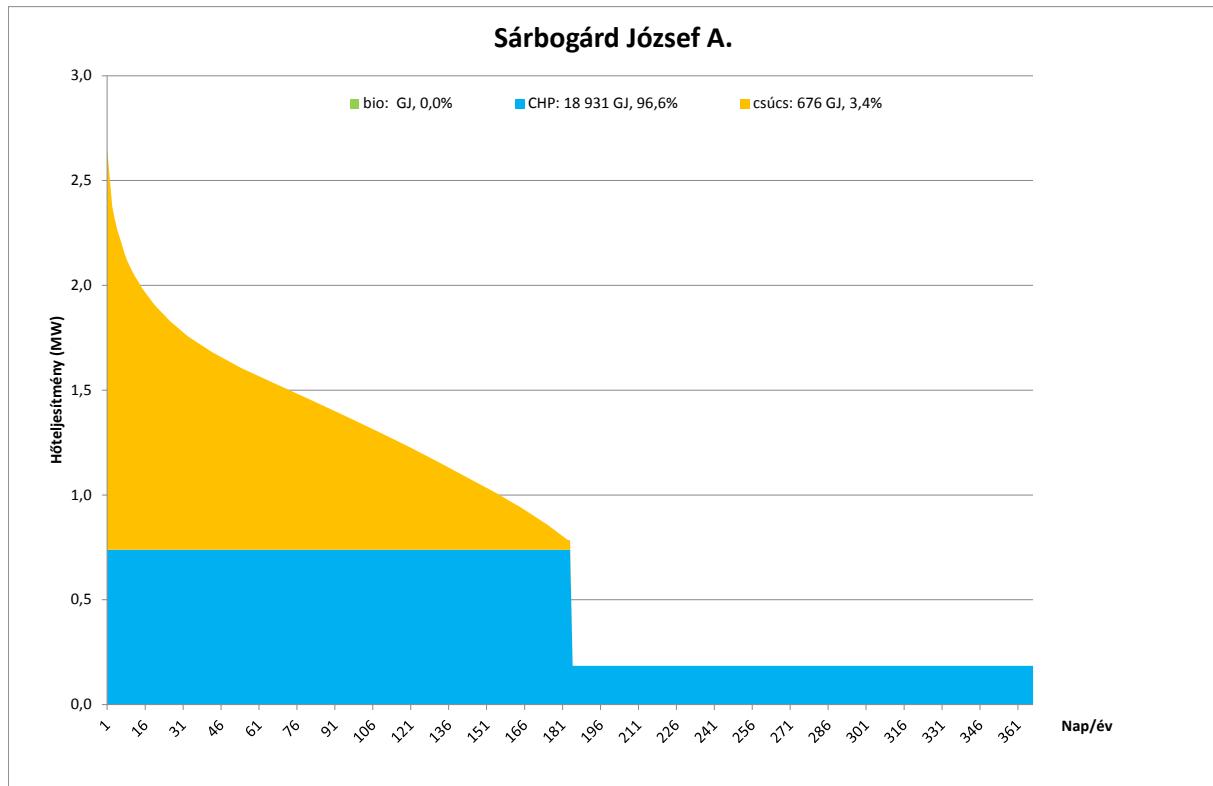
With 8 MW of new biomass-based capacity.



Salgótarján Beszterce	Beszterce, Salgótarján
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

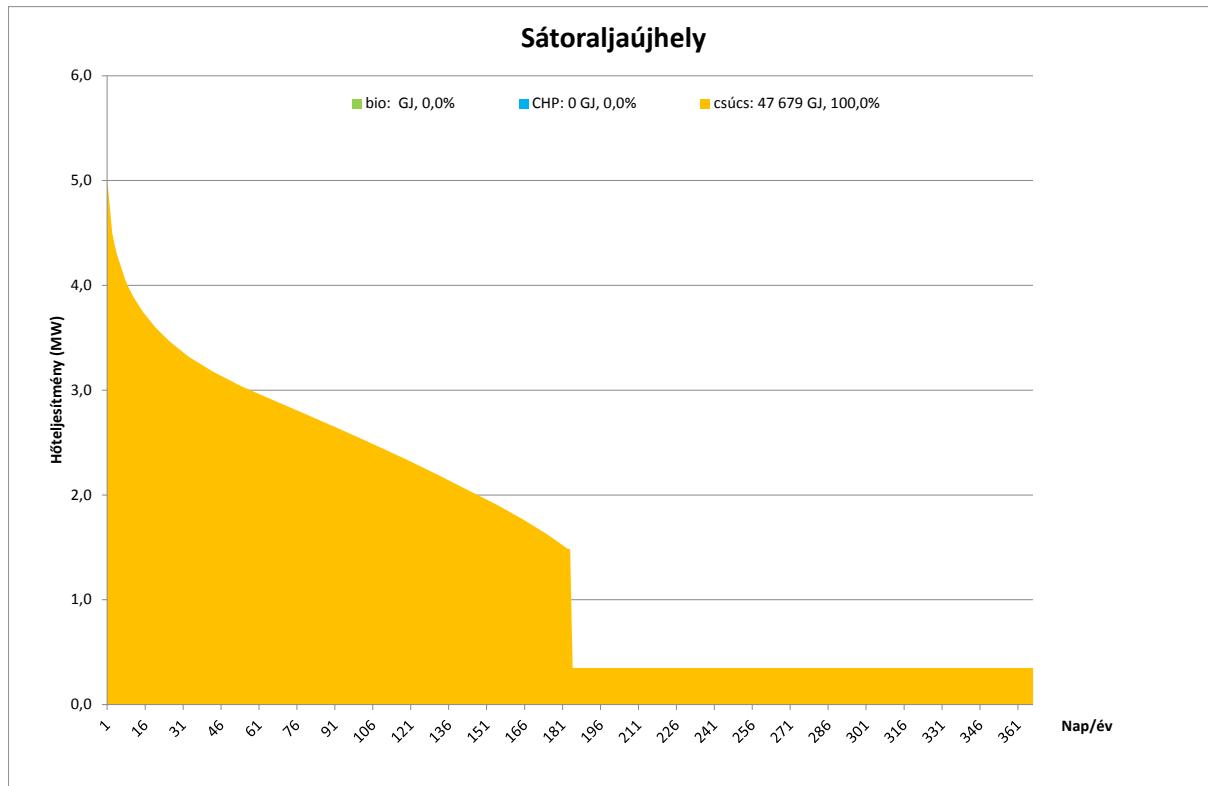
Figure 100 – Beszterce System, Salgótarján

With 700 kW new biomass-based capacity.



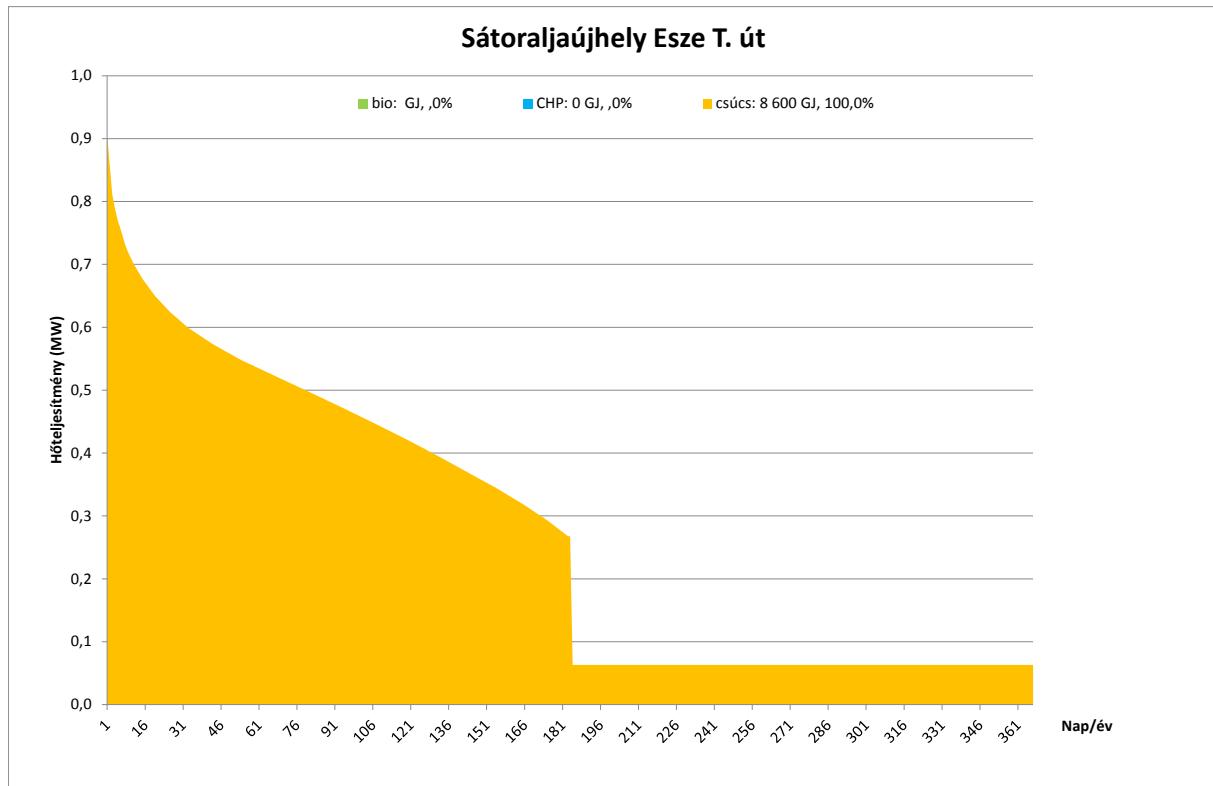
Sárbogárd József A.	József A., Sárbogárd
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 101 – József A. System, Sárbogárd



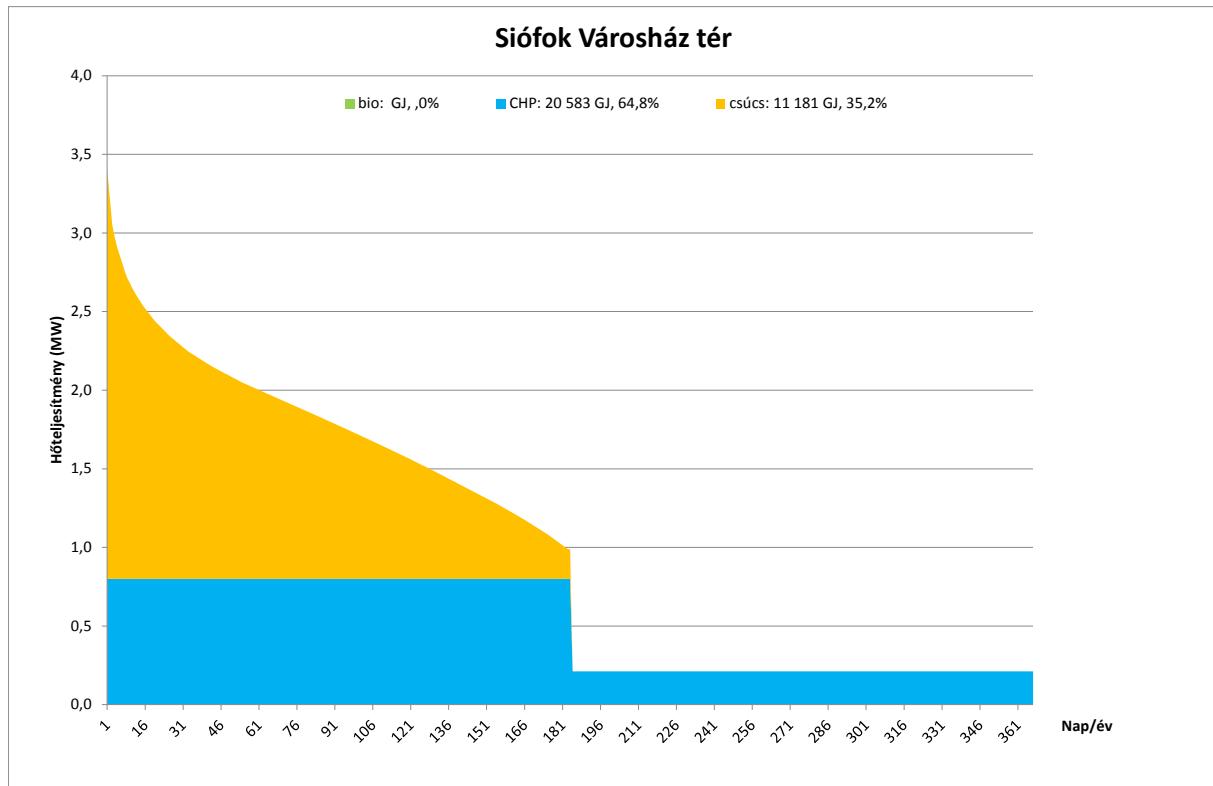
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 102 – Dózsa út System, Sátoraljaújhely



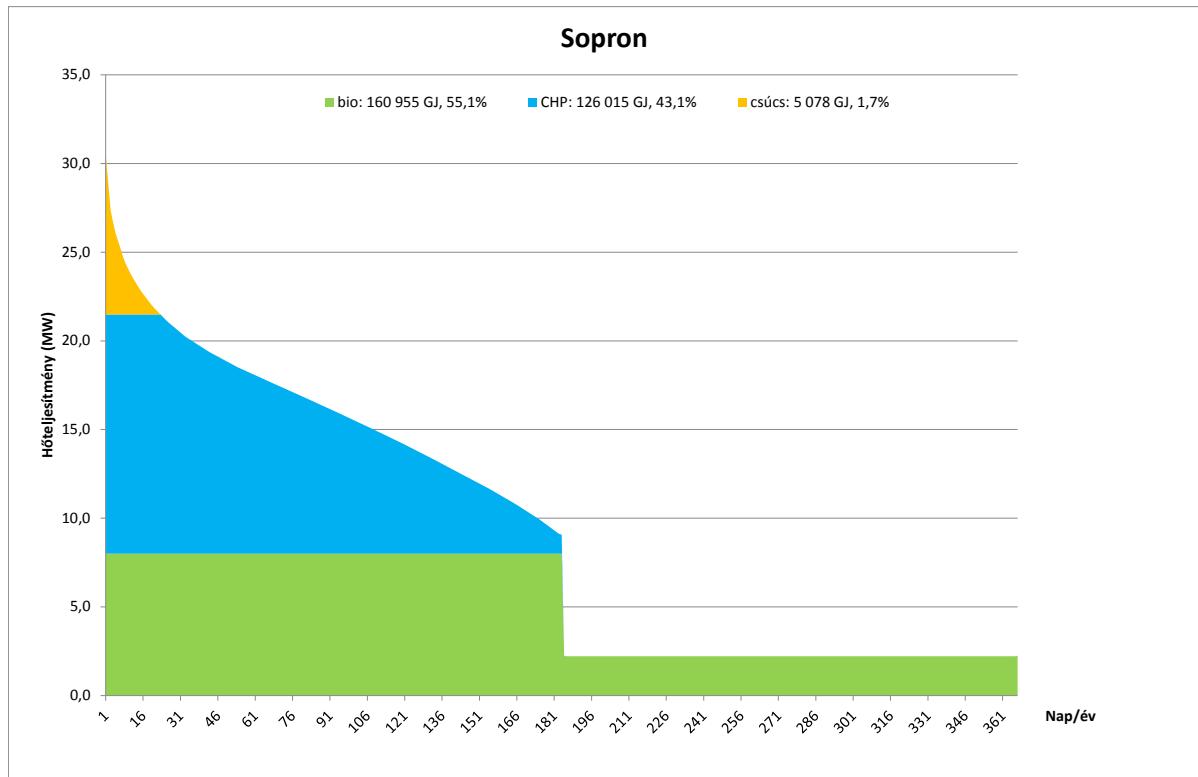
Sátoraljaújhely Esze T. út	Esze T. út, Sátoraljaújhely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 103 – Esze T. System, Sátoraljaújhely



<b>Siófok Városháza tér</b>	<b>Városháza tér, Siófok</b>
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

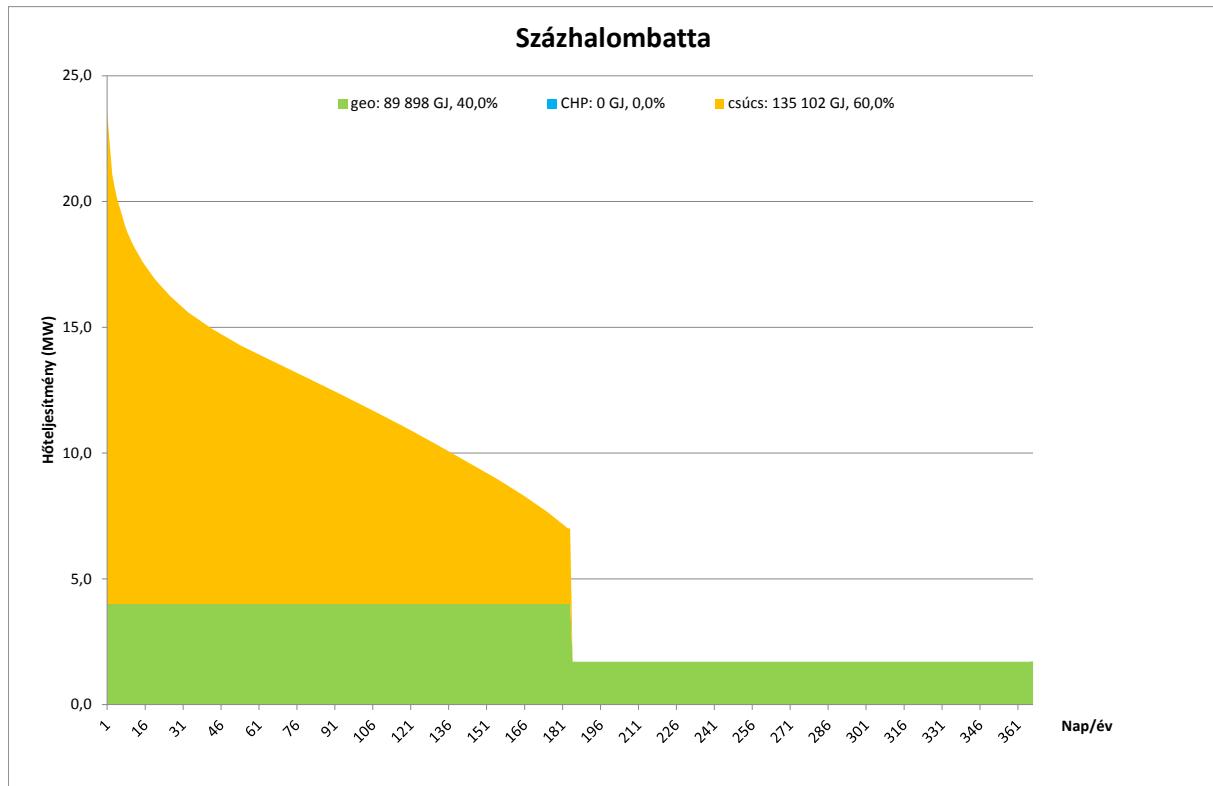
Figure 104 – Városház tér System, Siófok



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 105 – District heating system, Sopron**

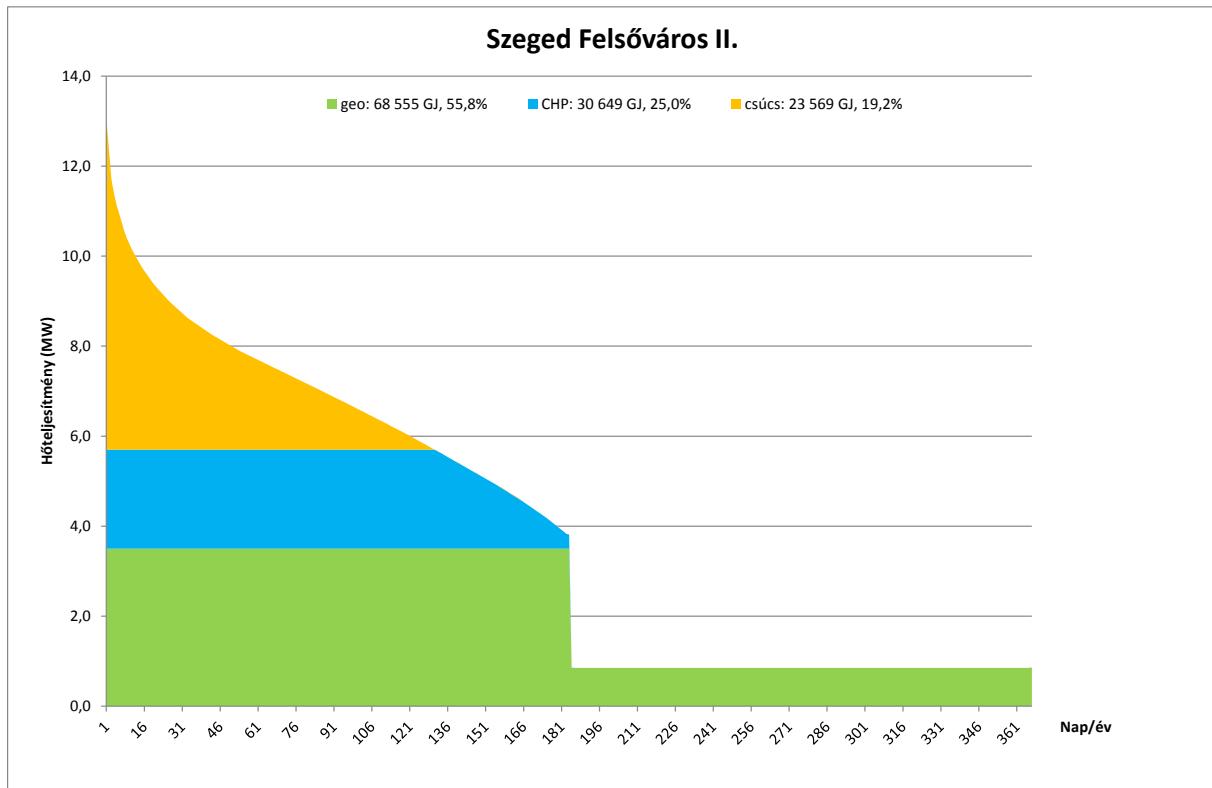
Assuming the establishment of 8 MW of new biomass capacity.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 106 – District heating system, Százhalombatta**

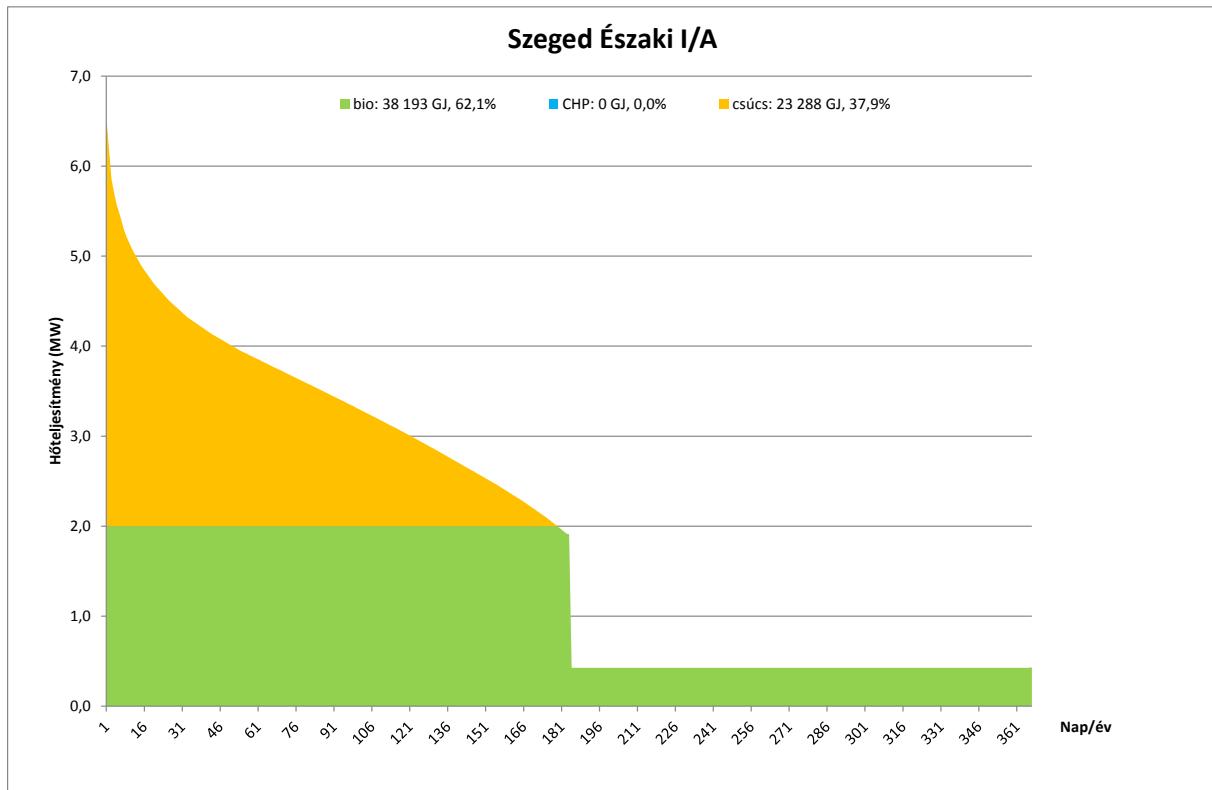
Assuming the connection of 4 MW of new geothermal capacity.



Szeged Felsőváros II.	Felsőváros II, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 107 – Felsőváros II System, Szeged

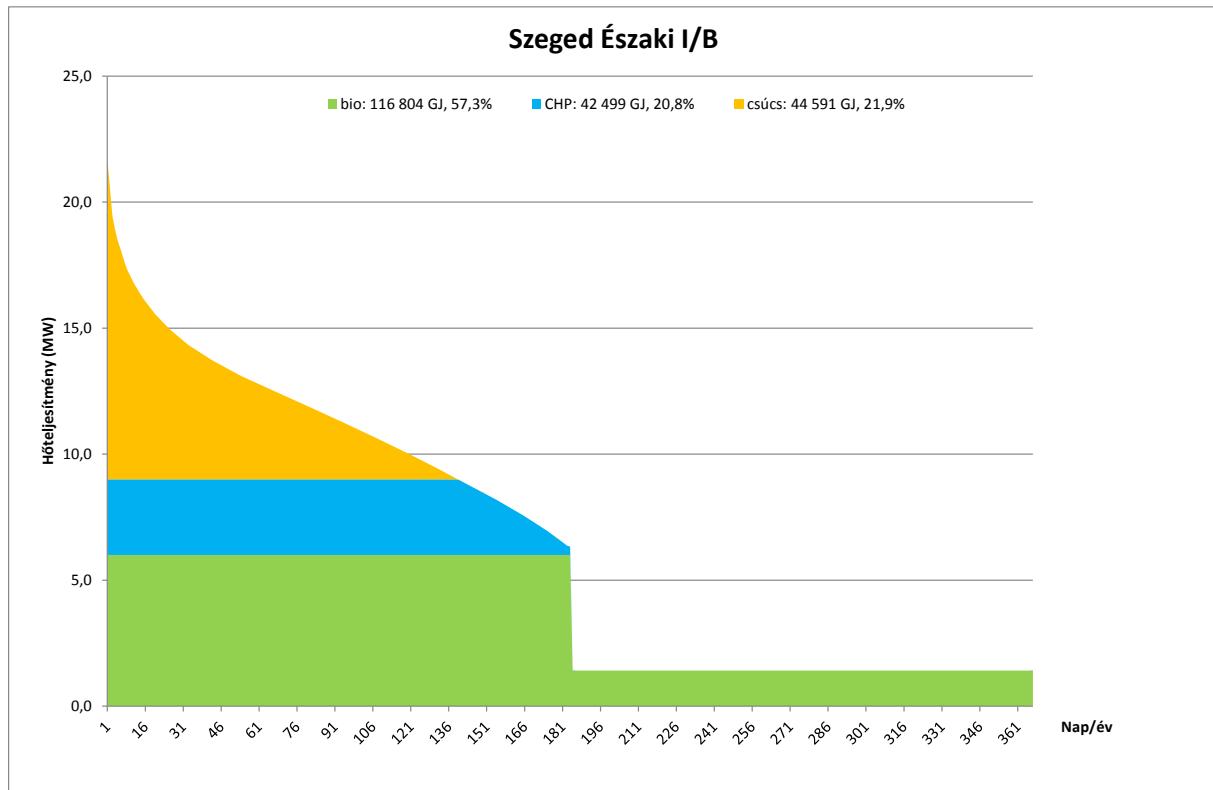
With a newly established 3.5 MW geothermal heat source.



Szeged Északi I/A	North I/A, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 108 – North District System I/a, Szeged

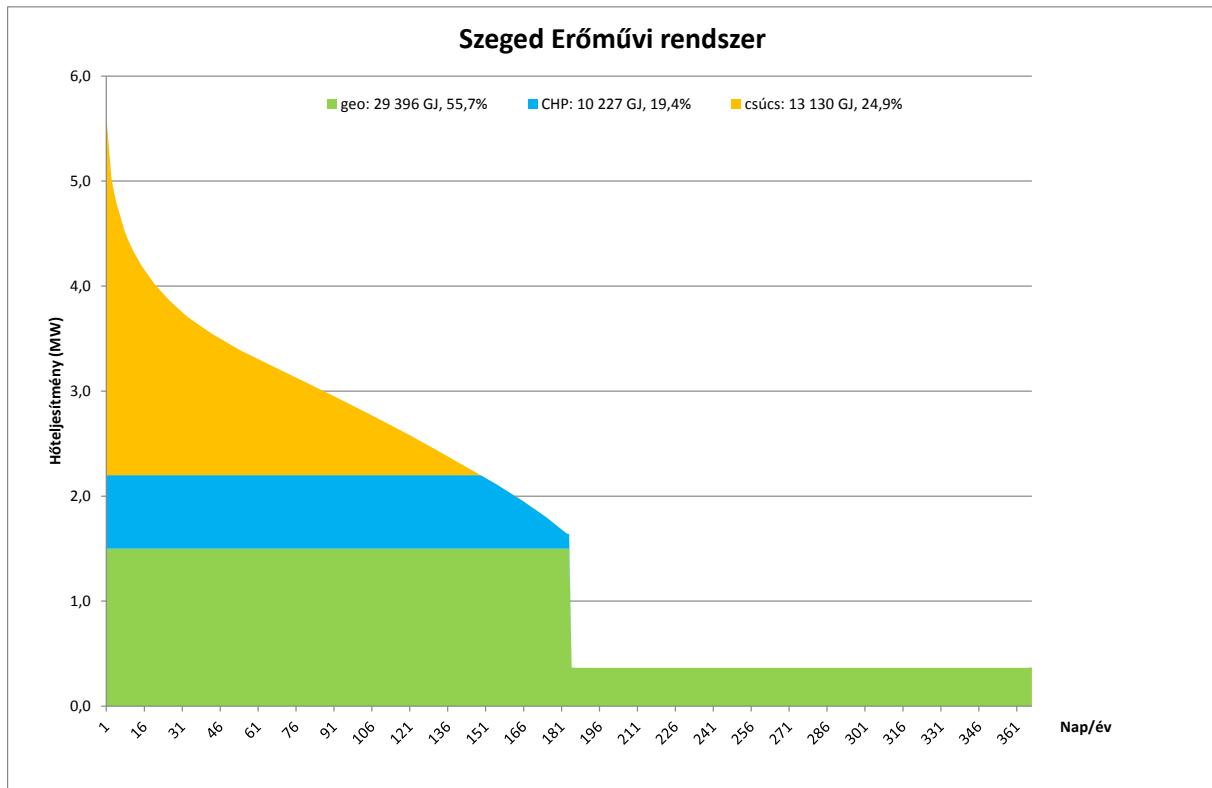
With a newly established 2 MW biomass-based heat source.



Szeged Északi I/B	North I/B, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 109 – North District System I/b, Szeged

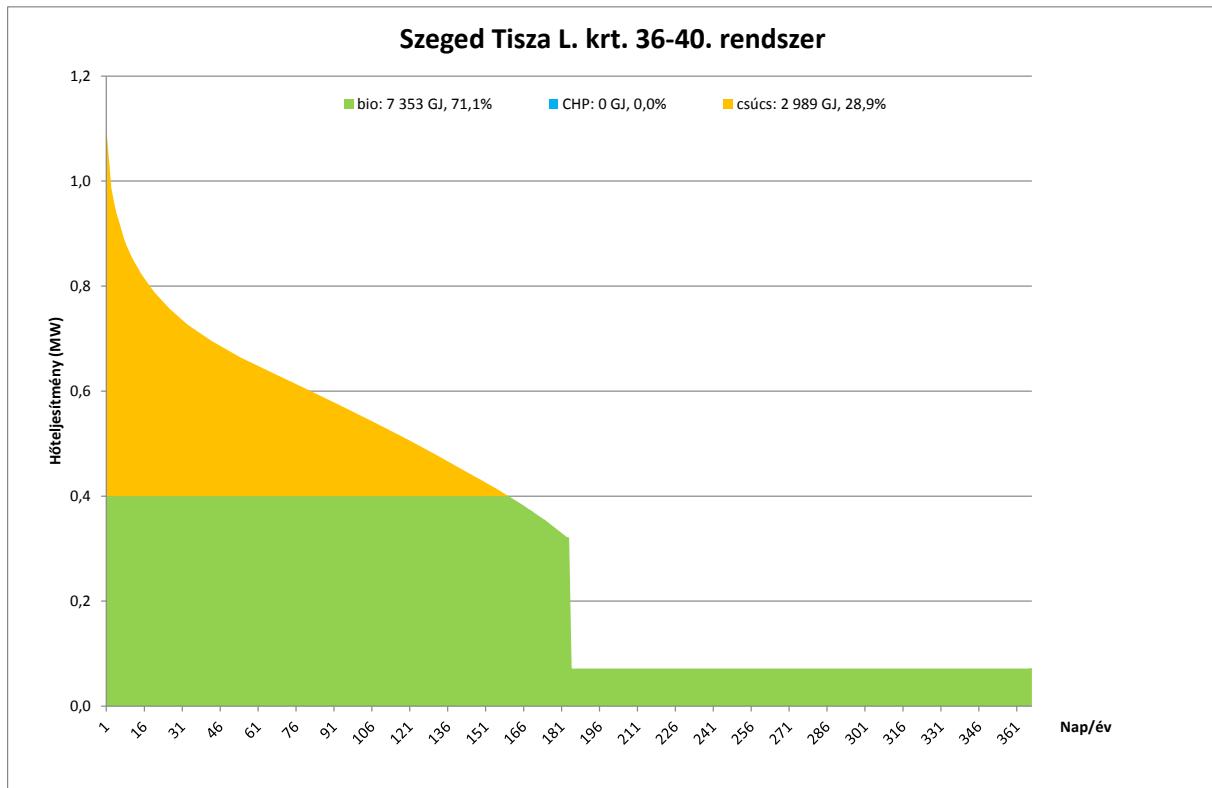
With a newly established 6 MW biomass-based heat source.



Szeged Erőművi rendszer	Power Plant System, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 110 – Power Plant System, Szeged**

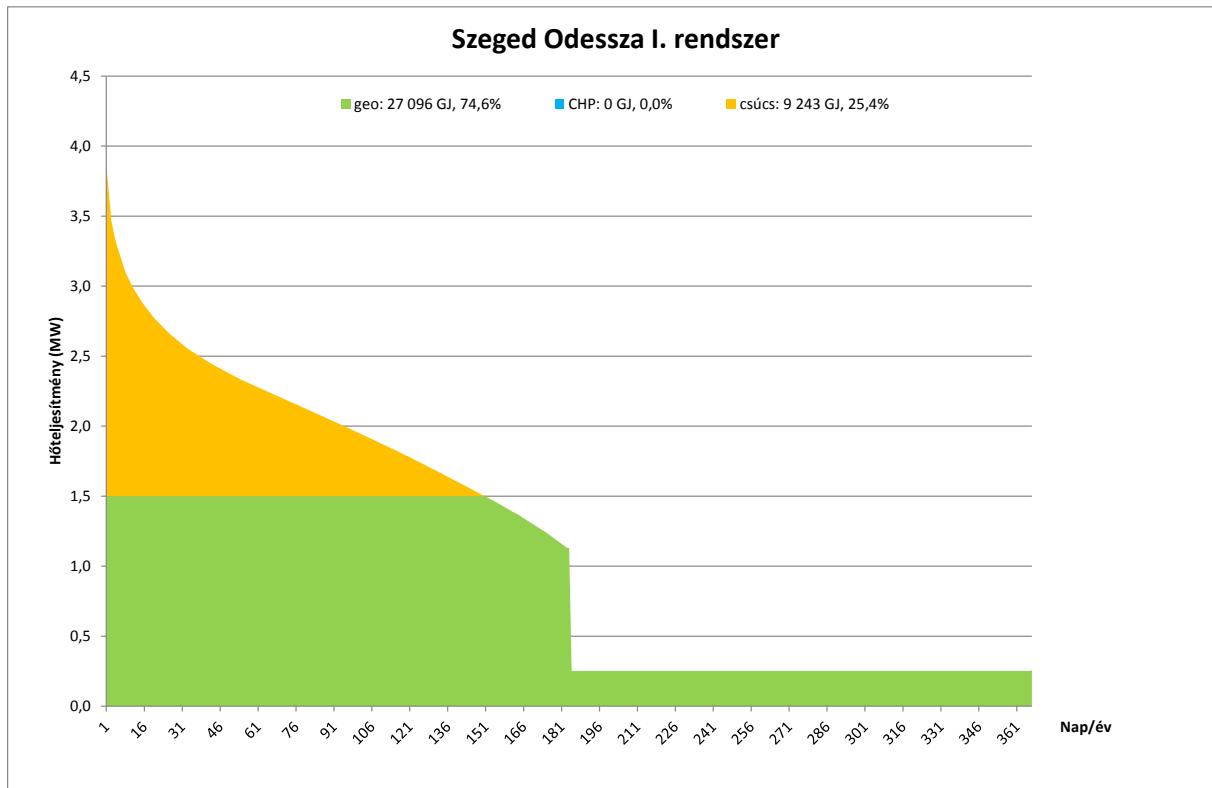
With 1.5 MW of geothermal heat generation capacity to be newly established.



Szeged Tisza L. krt. 36-40. rendszer	Tisza Lajos krt. 36-40. System, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 111 – Tisza Lajos krt. 36-40. System, Szeged

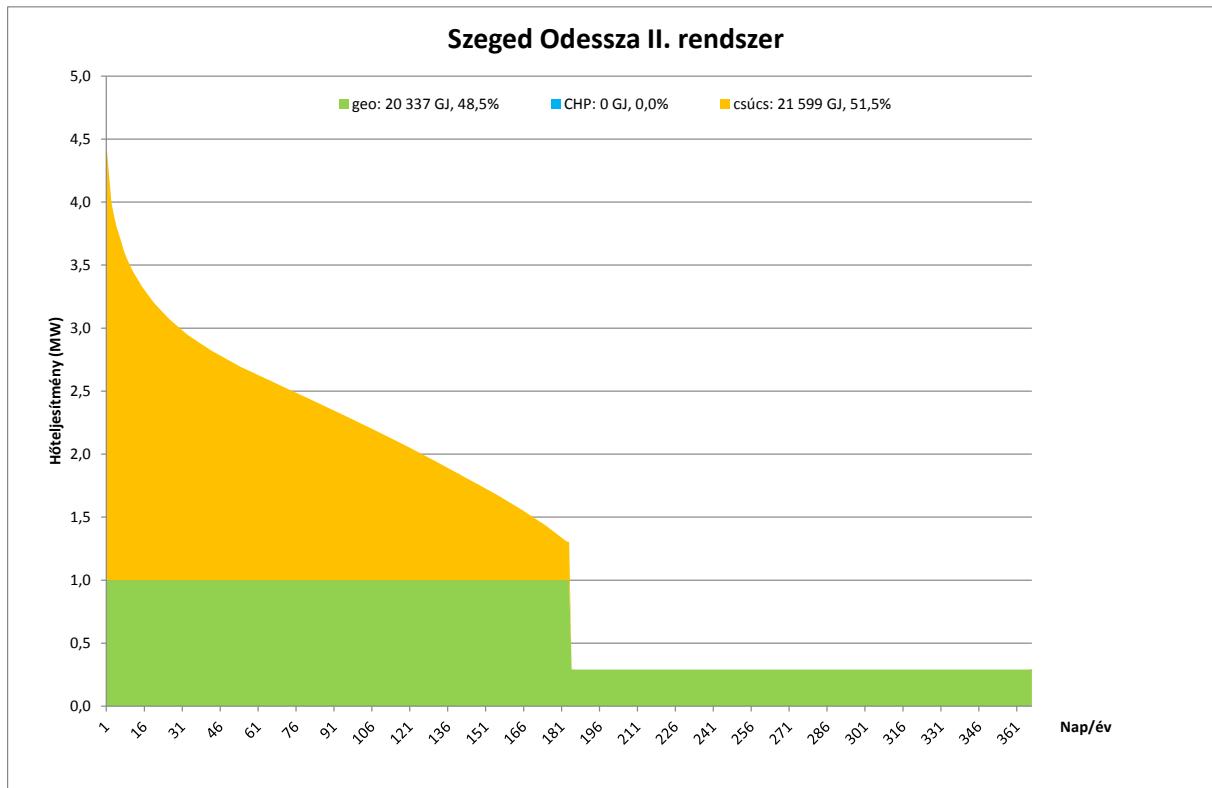
With 400 kW new biomass-based capacity.



Szeged Odessa I. rendszer	Odessa I System, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 112 – Odessa I System, Szeged

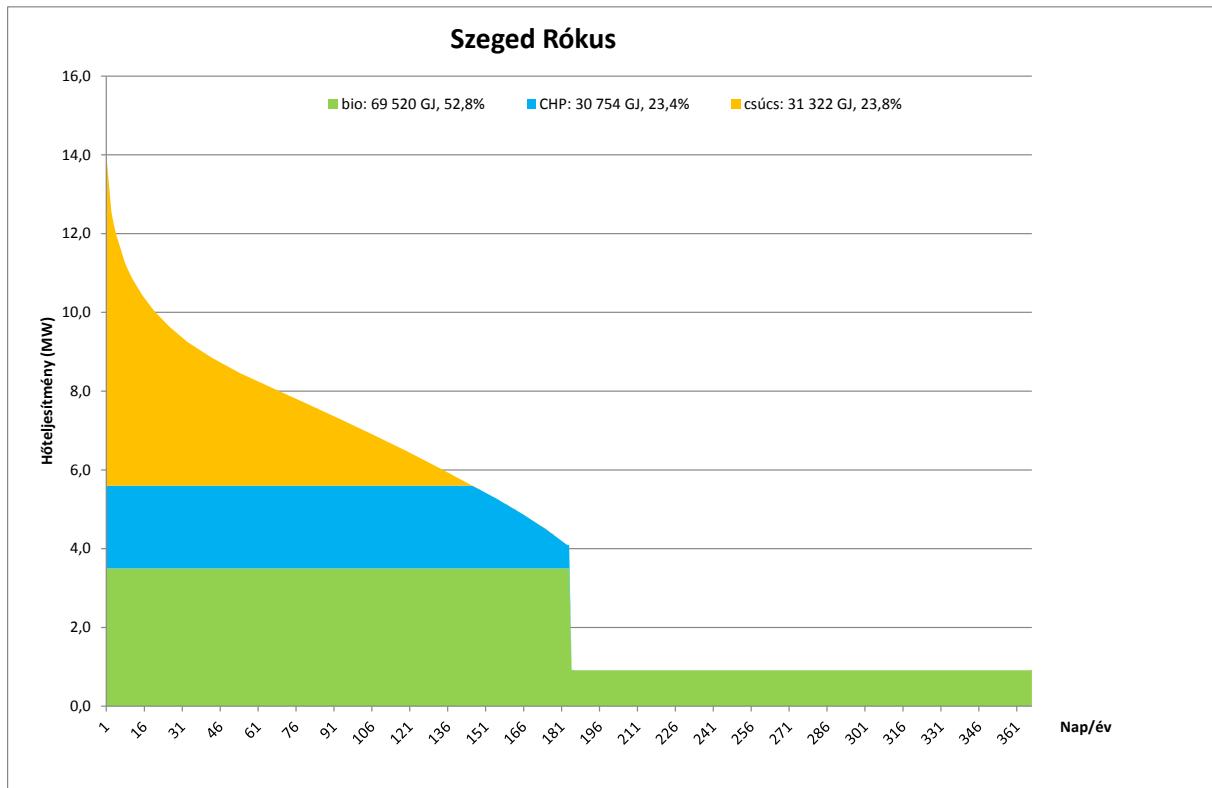
With 1.5 MW of new geothermal-based capacity.



Szeged Odessa II. rendszer	Odessa II System, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 113 – Odessa II System, Szeged

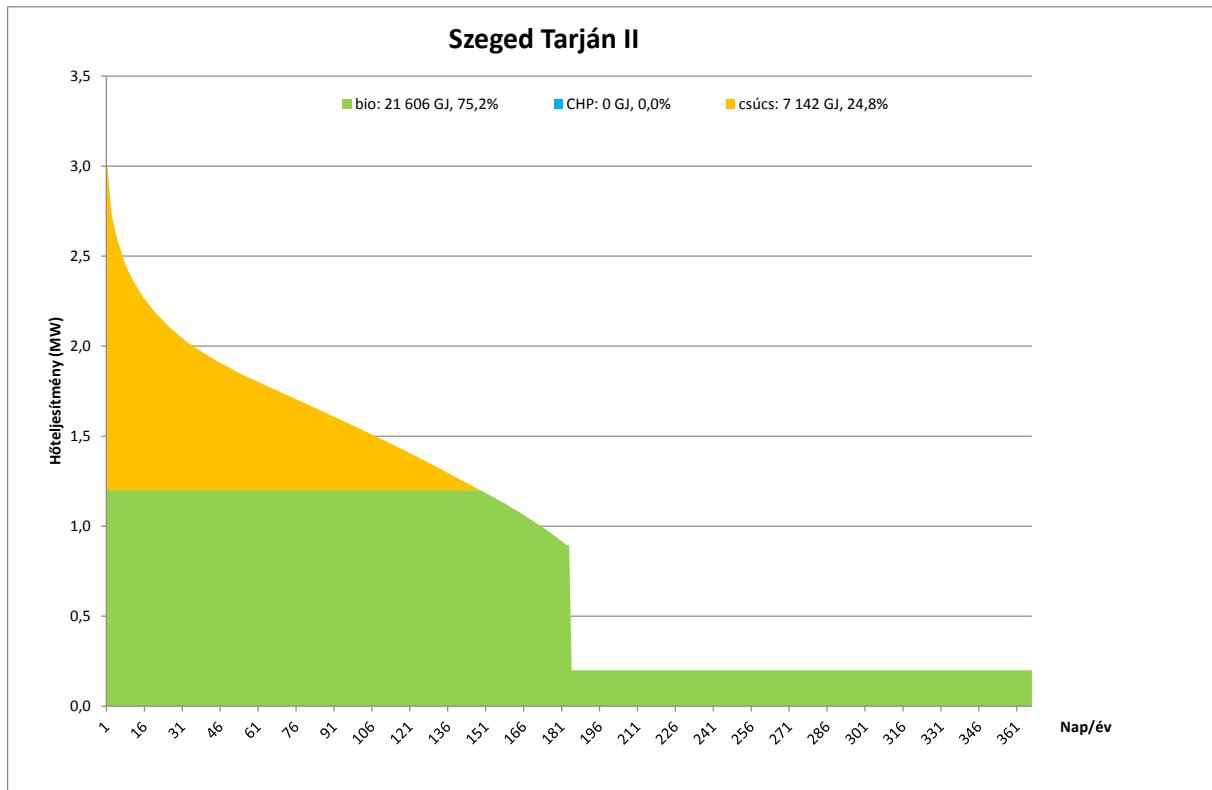
Existing geothermal-based district heating system.



Szeged Rókus	Rókus, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 114 – Rókus System, Szeged

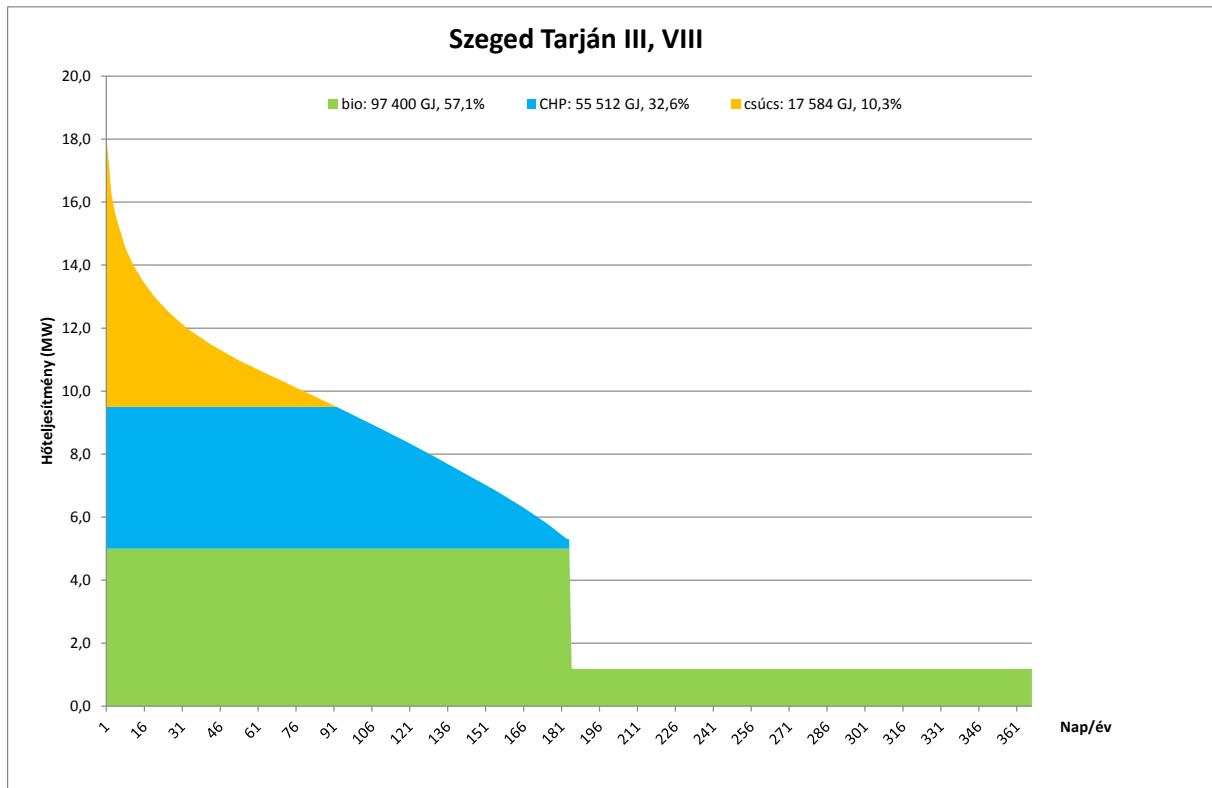
In the event of the establishment of 3.5 MW of new biomass-based heat generation unit.



Szeged Tarján II	Tarján II, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 115 – Tarján II System, Szeged

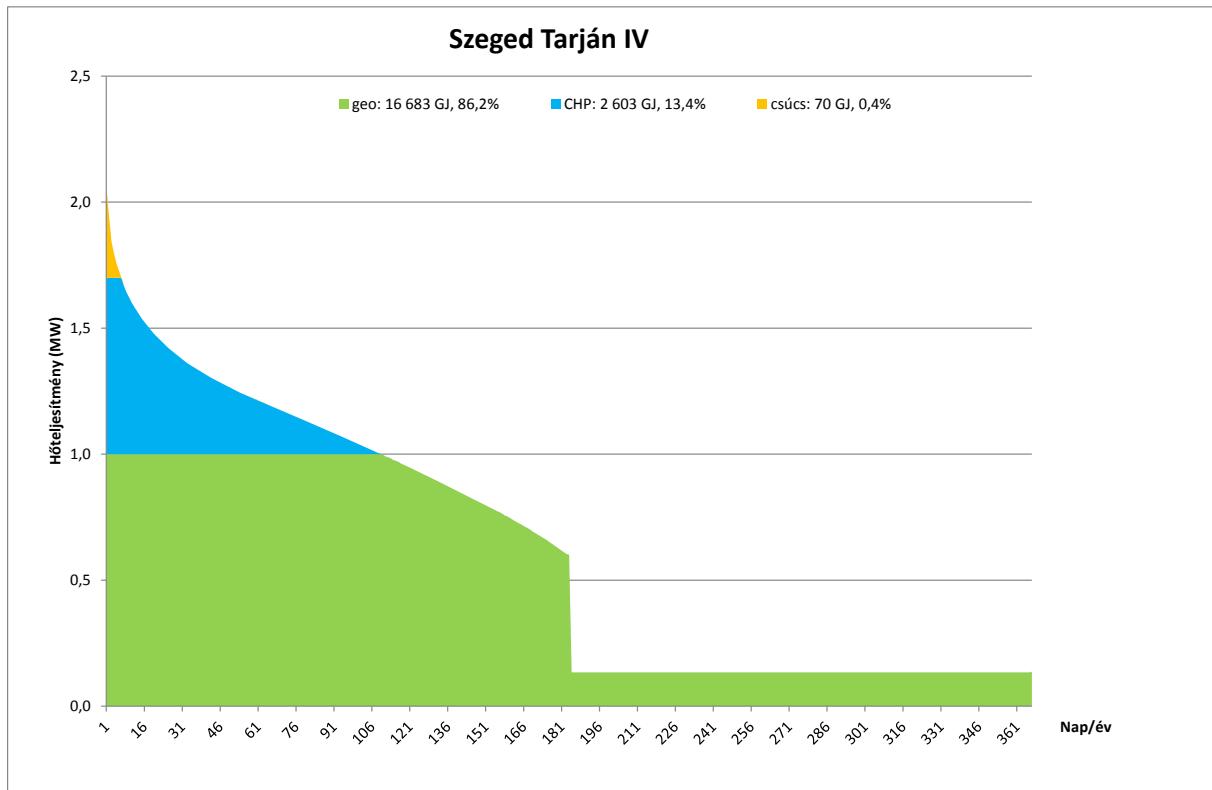
With the establishment of 1.2 MW biomass-based heat generation capacity.



Szeged Tarján III, VIII	Tarján III and VIII, Szeged
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 116 – Tarján III to VIII and Felsőváros 1 Systems, Szeged

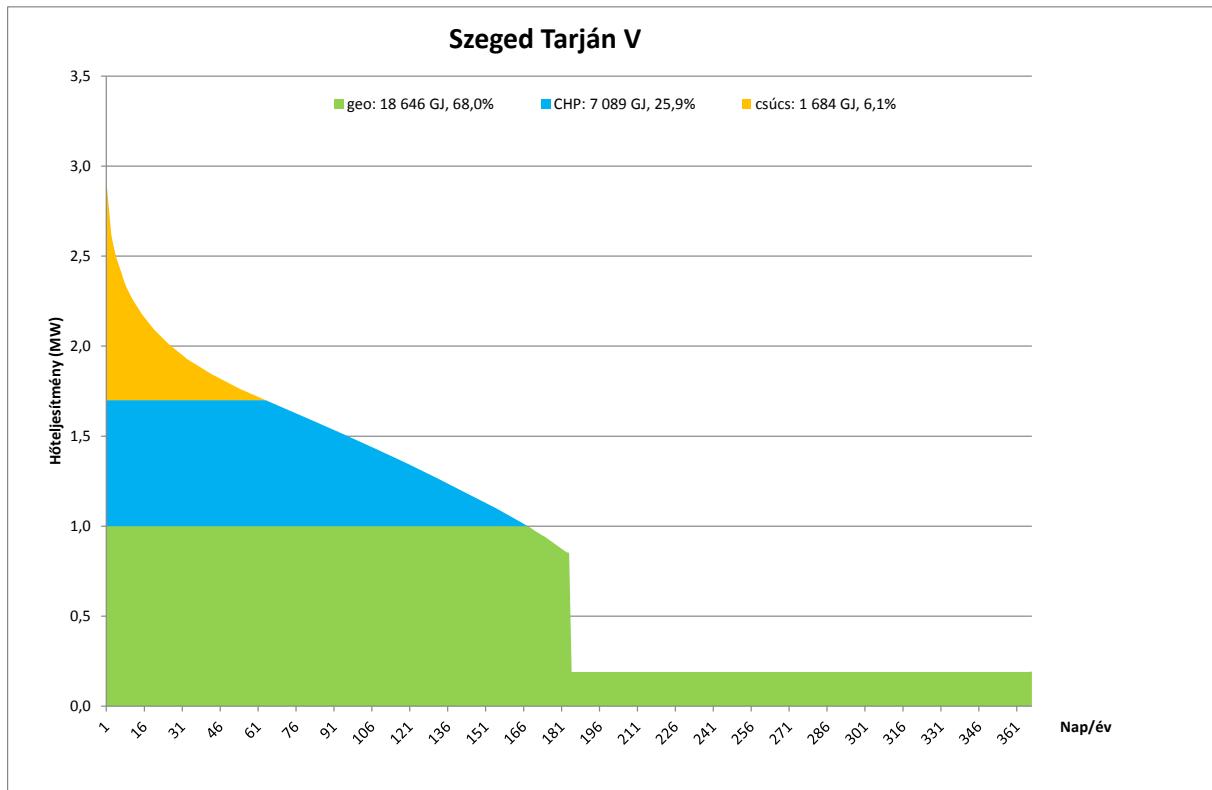
With the establishment of 5 MW new biomass-based heat generation capacity.



Szeged Tarján IV	Tarján IV, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 117 – Tarján IV System, Szeged

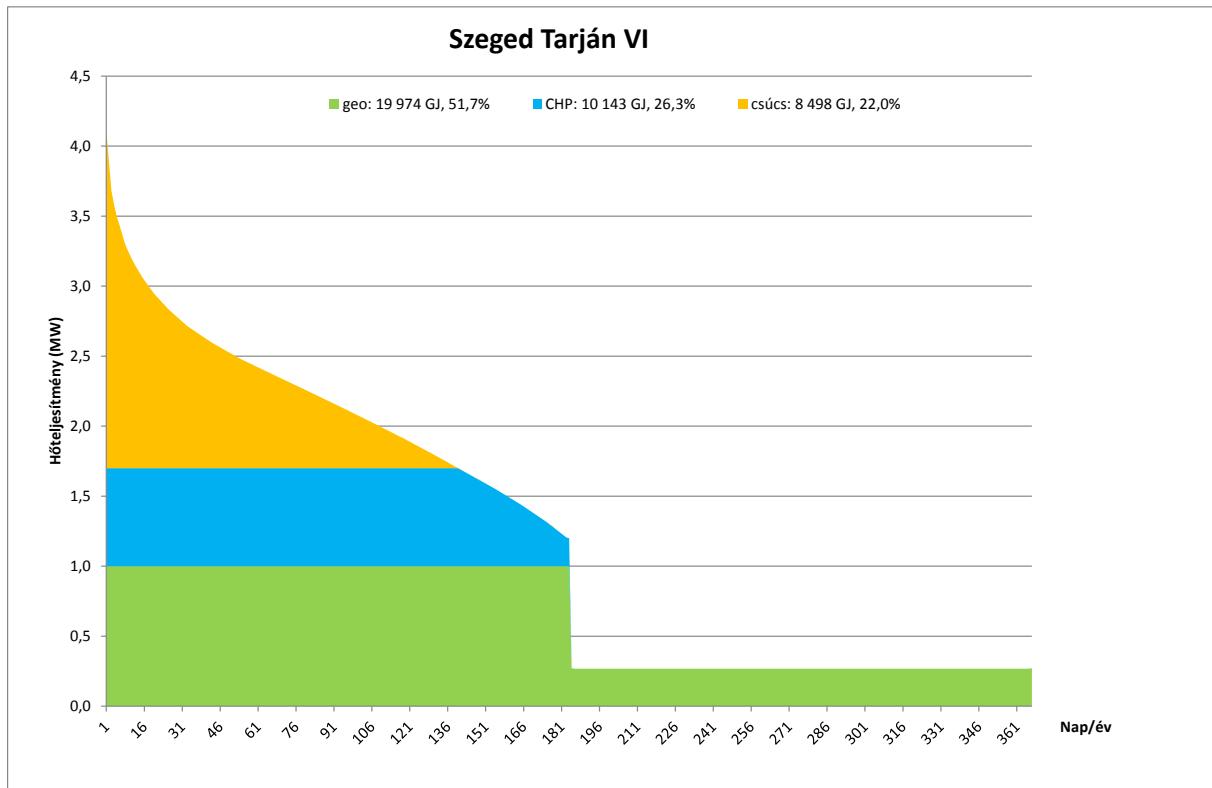
With the establishment of 1 MW of new geothermal heat generation capacity.



Szeged Tarján V	Tarján V, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 118 – Tarján V System, Szeged

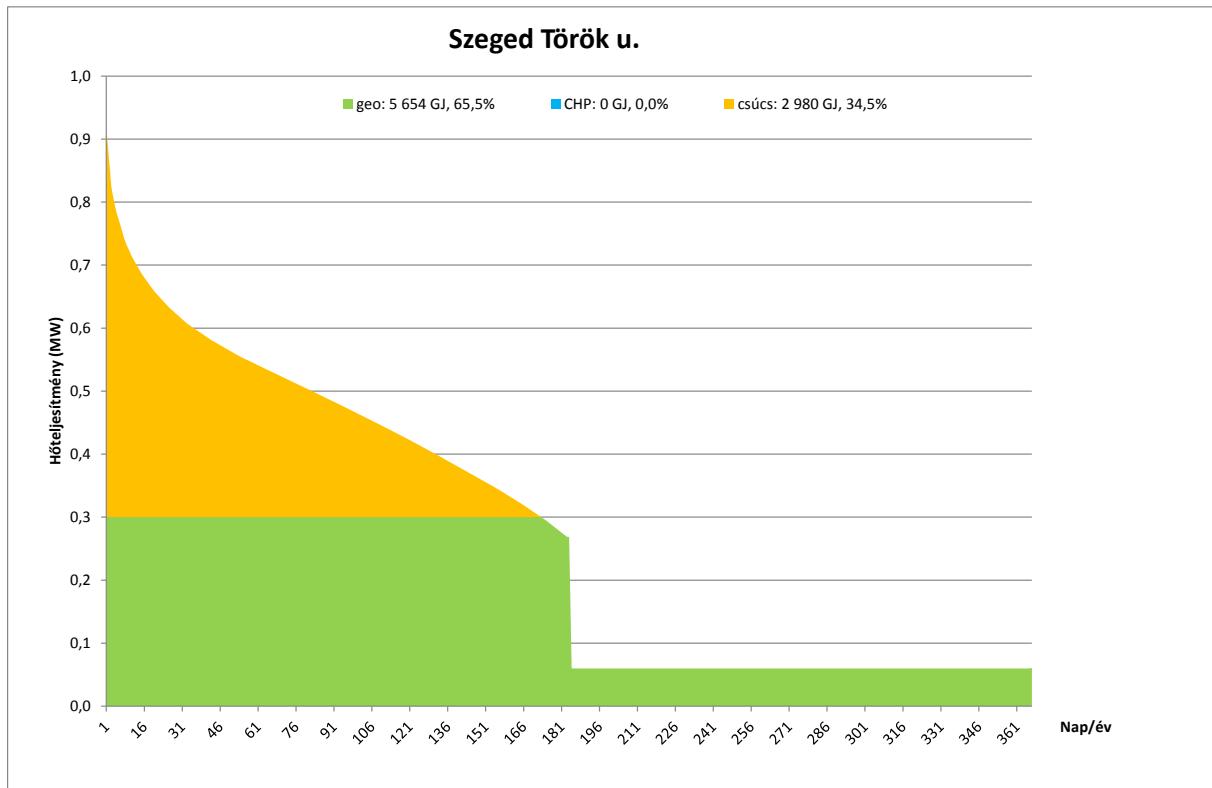
With the establishment of 1 MW of new geothermal heat generation capacity.



Szeged Tarján VI	Tarján VI, Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 119 – Tarján VI System, Szeged

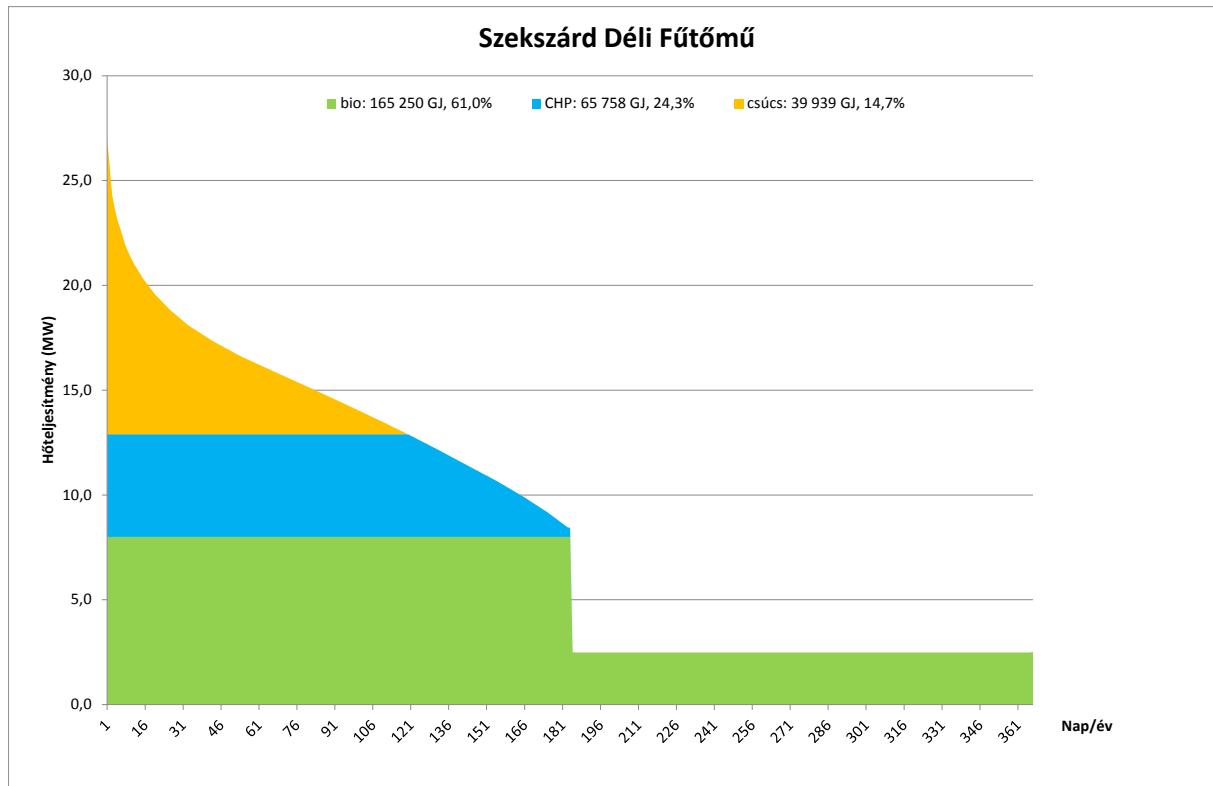
With the establishment of 1 MW of new geothermal heat generation capacity.



Szeged Török u.	Török u., Szeged
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 120 – Török út System, Szeged

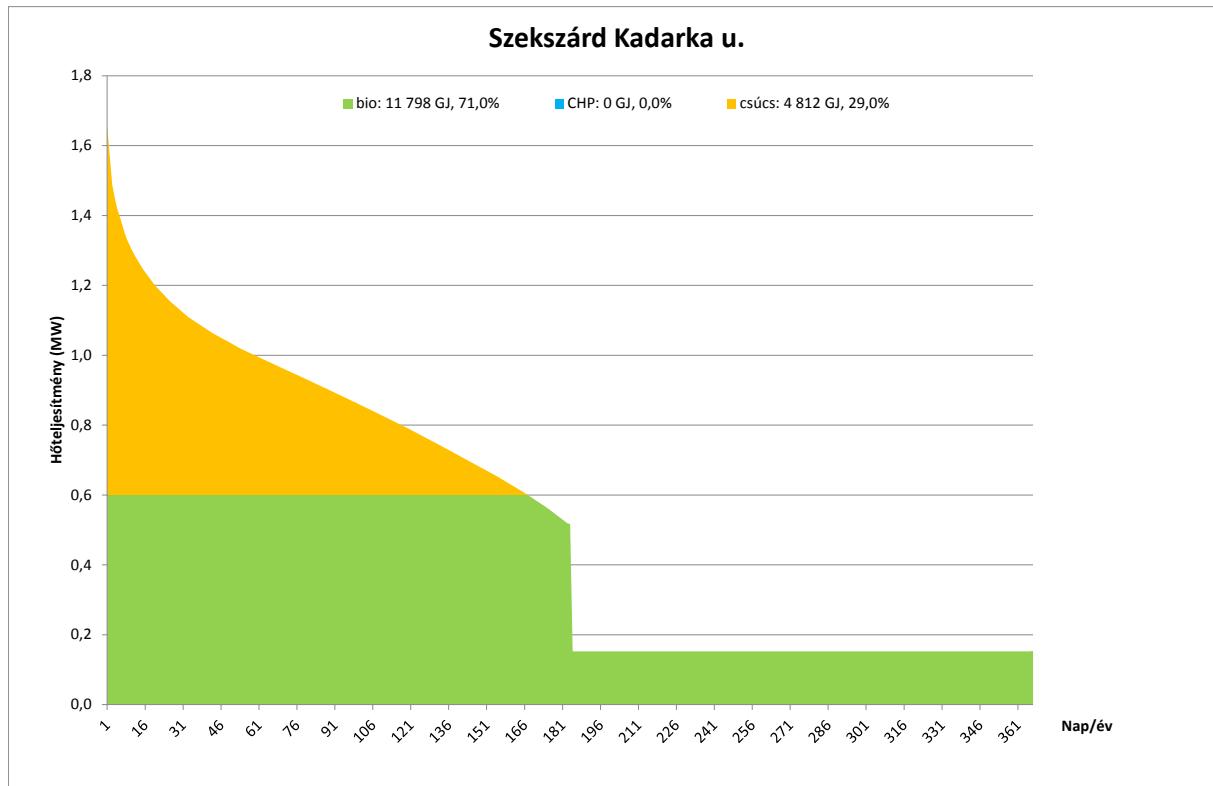
With the installation of 300 kW of new biomass boiler capacity.



Szekszárd Déli Fűtőmű	South Central Heating Plant, Szekszárd
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 121 – District heating system of the South CHP, Szekszárd**

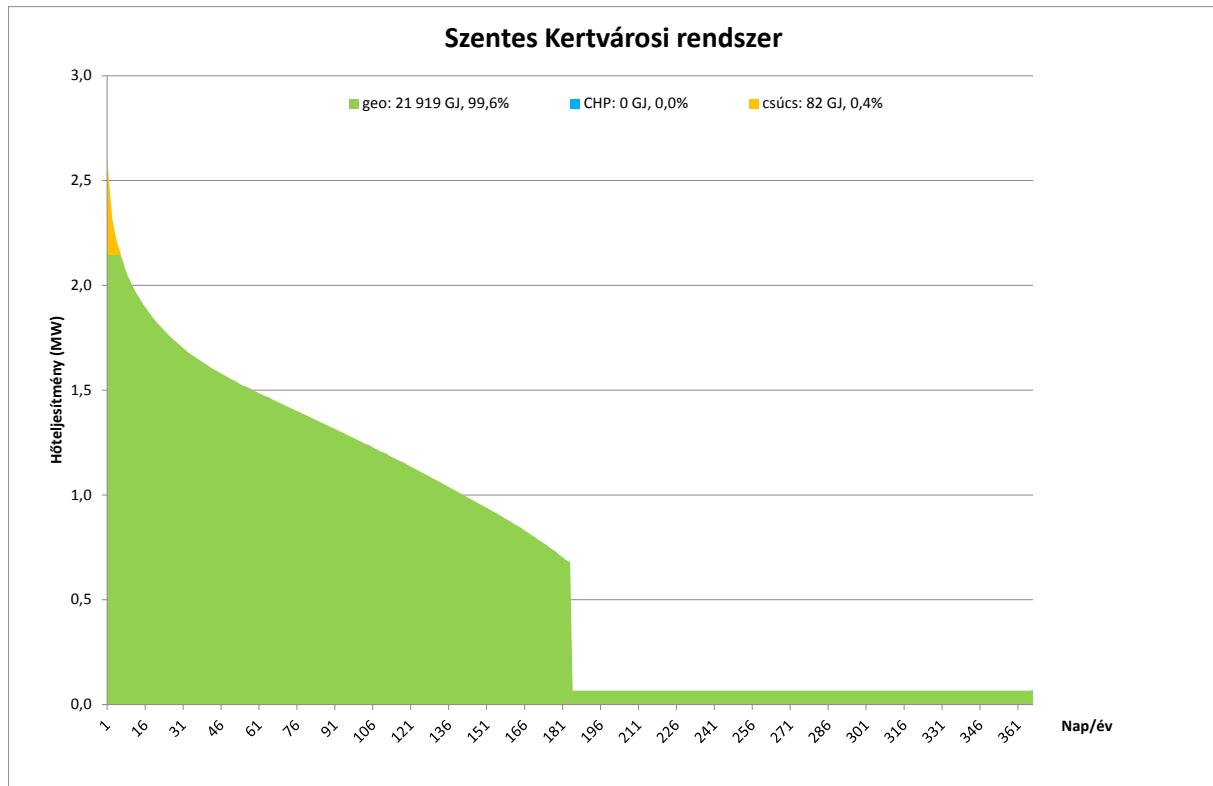
With the installation of 8 MW of new biomass-based boiler capacity.



Szekszárd Kadarka u.	Kadarka u., Szekszárd
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 122 – Kadarka u. District Heating System, Szekszárd**

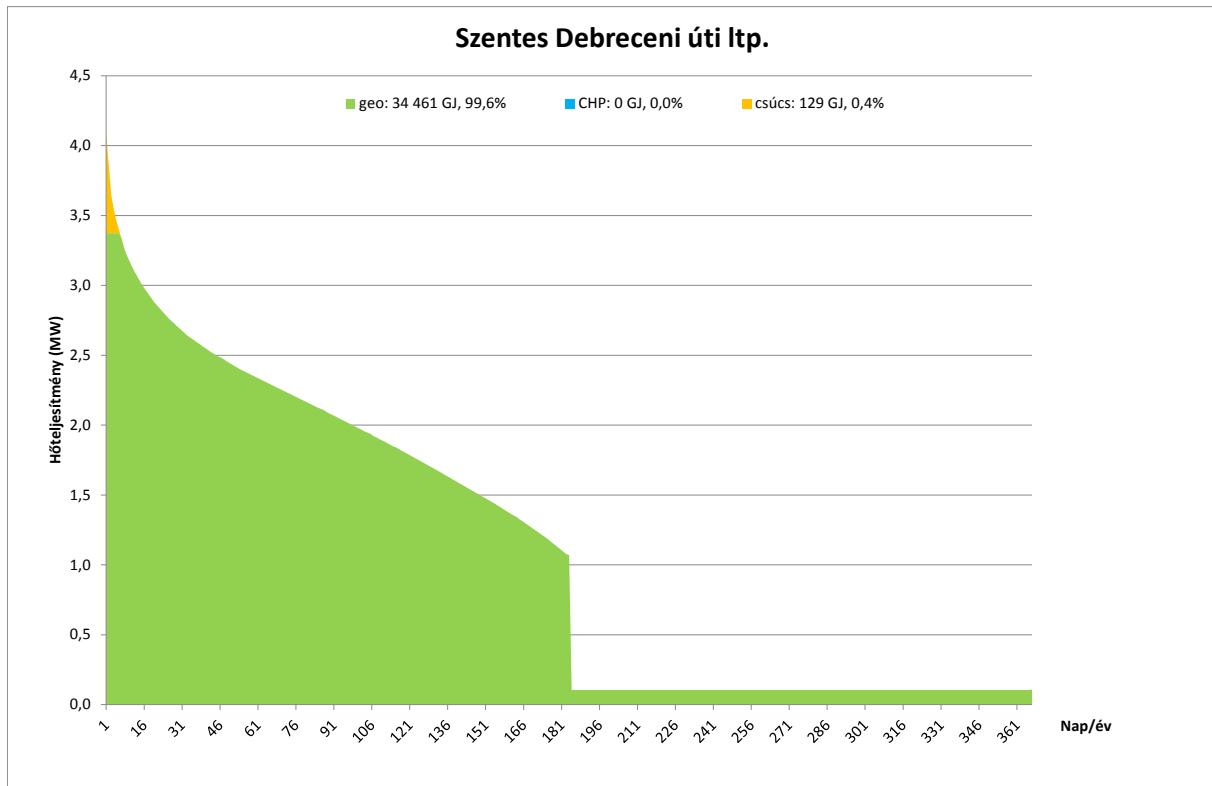
With the installation of 600 kW of new biomass boiler capacity.



Szentes Kertvárosi rendszer	Suburban System, Szentes
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 123 – Suburban System, Szentes

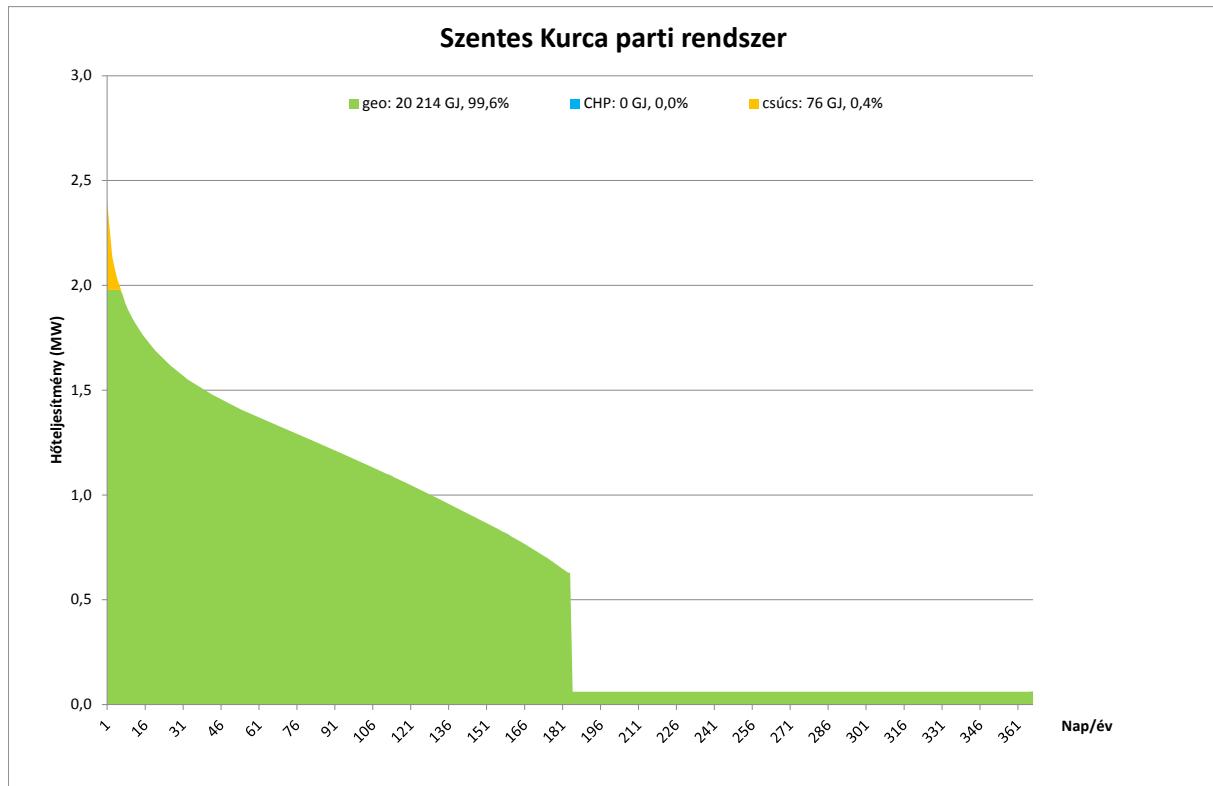
Existing geothermal-based district heat generation.



Szentesz Debreceni úti ltp.	Debrecen út Housing Estate, Szentes
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 124 – Debrecen út Housing Estate System, Szentes

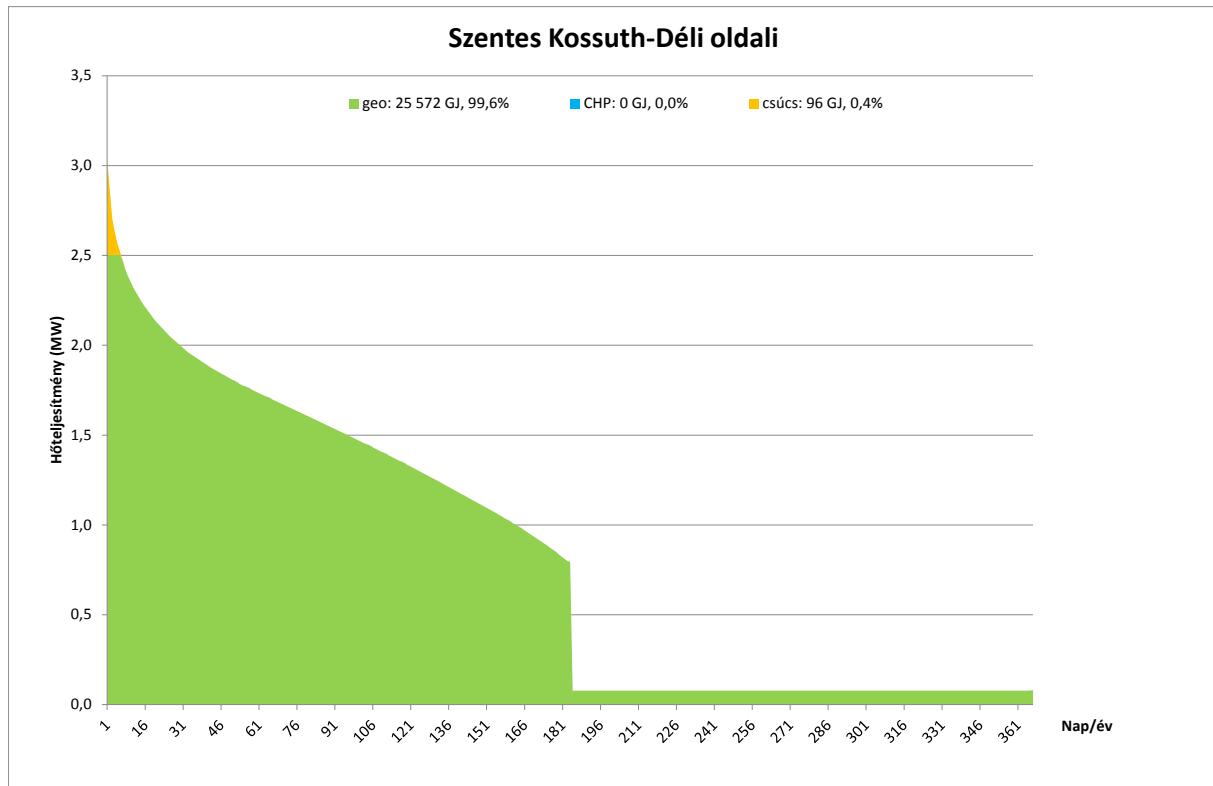
Existing geothermal-based district heat generation.



Szentesz Kurca parti rendszer	Kurca bank System, Szentesz
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 125 – Kurca bank System, Szentesz

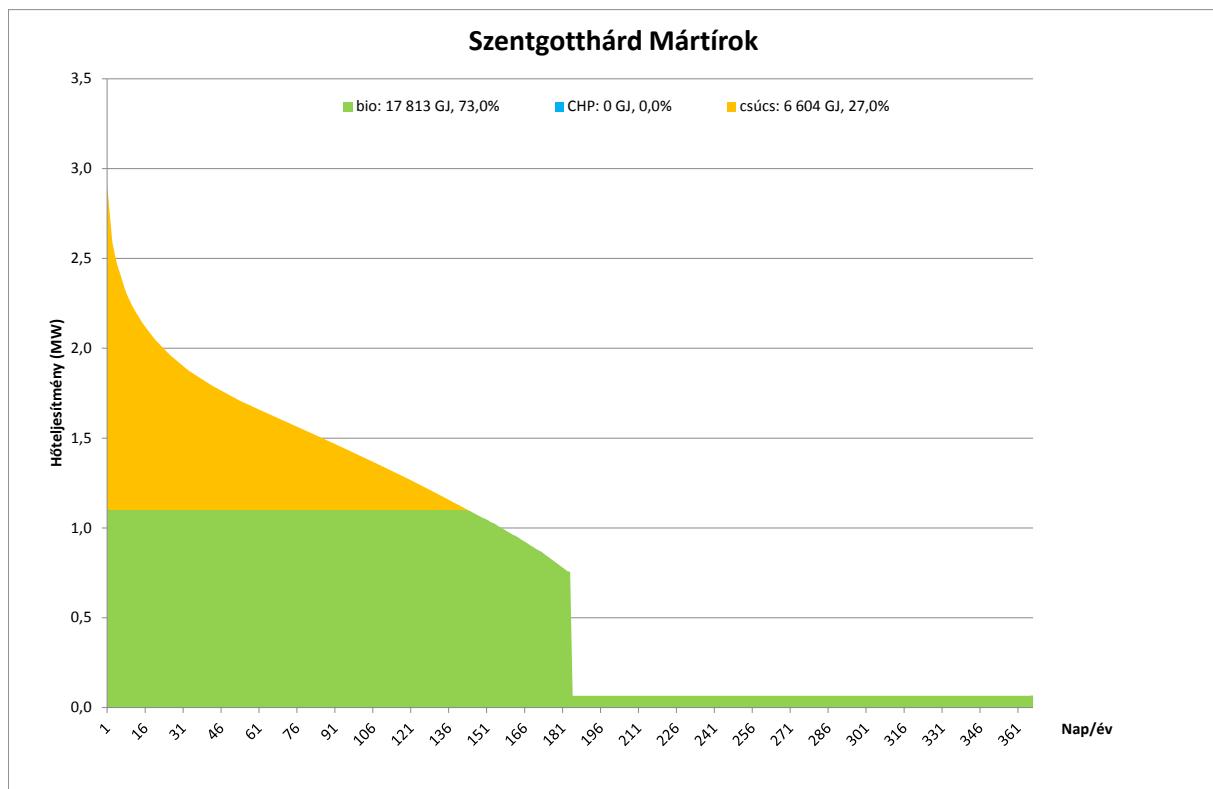
Existing geothermal-based district heat generation.



Szentes Kossuth-Déli oldali	Kossuth South Side, Szentes
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 126 – Kossuth South Side System, Szentes

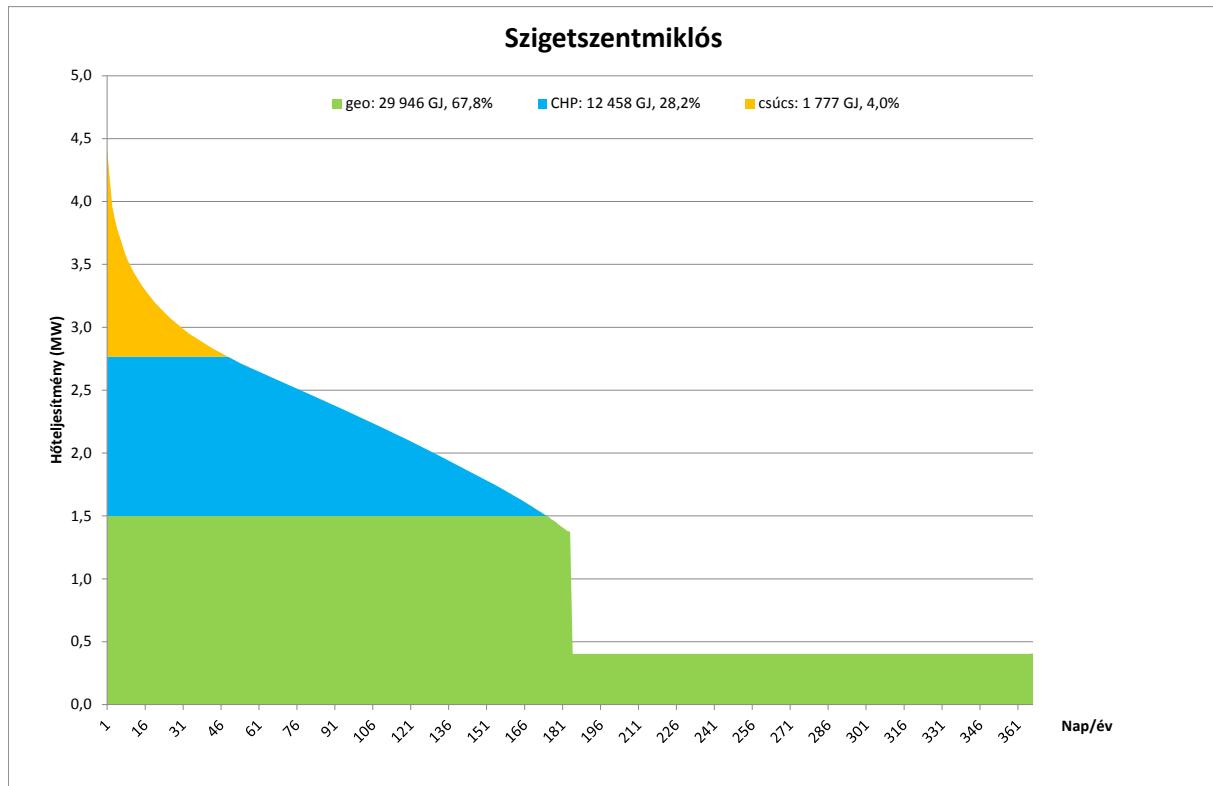
Existing geothermal-based district heat generation.



Szentgotthárd Mártyrok	Mártyrok, Szentgotthárd
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 127 – Mártyrok út System, Szentgotthárd

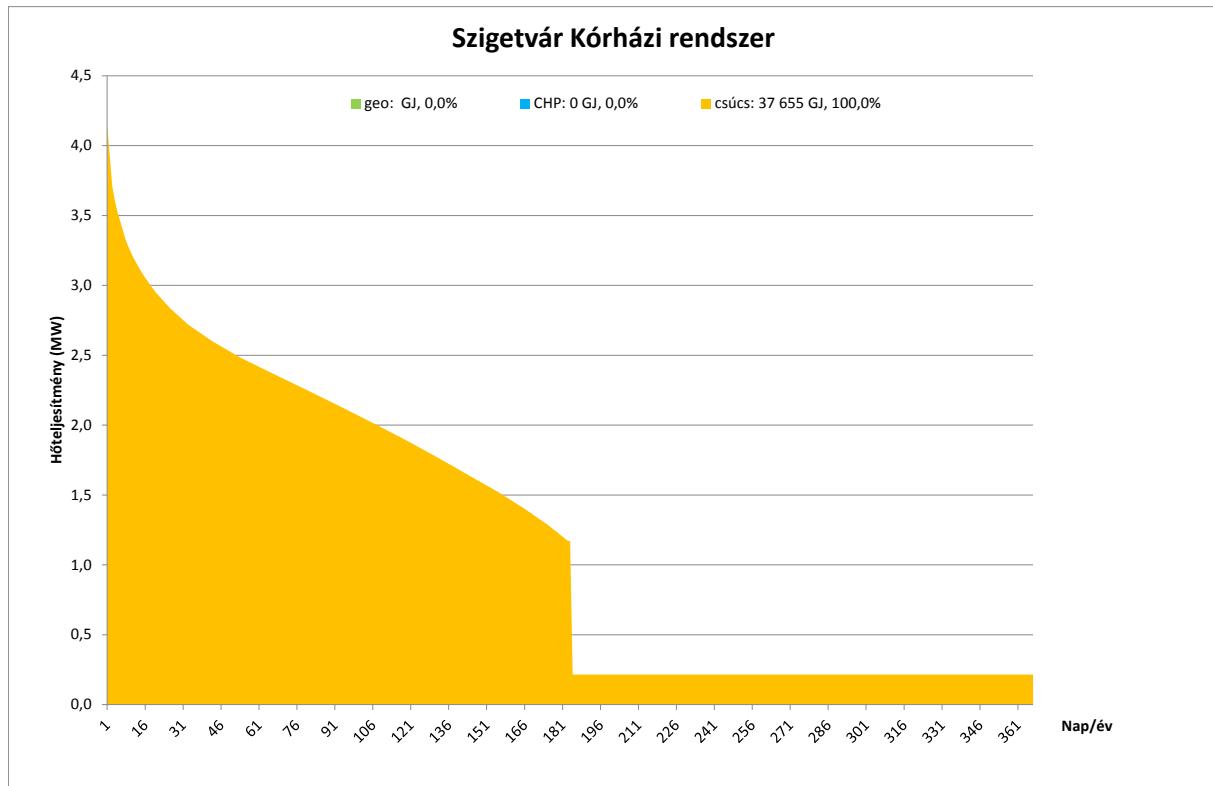
In the event of the establishment of 1.1 MW of new biomass-based capacity.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

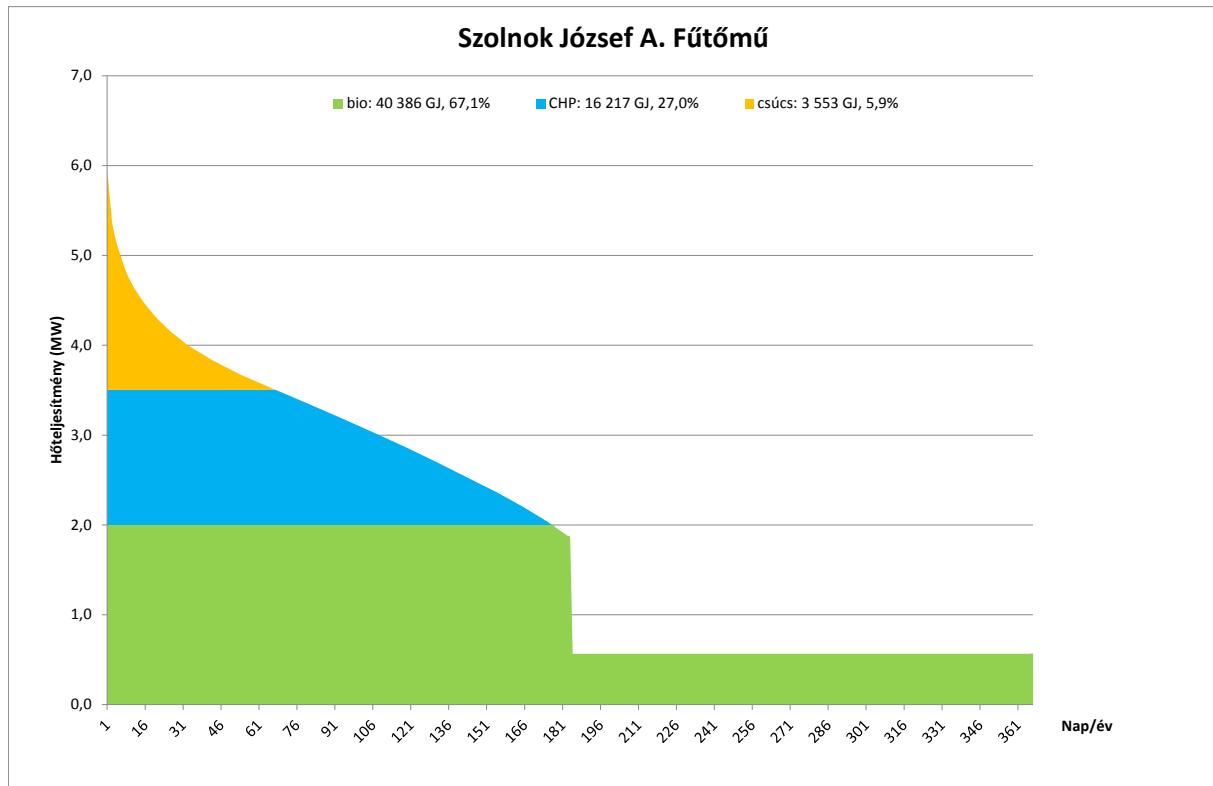
**Figure 128 – District heating system, Szigetszentmiklós**

In the event of the establishment of 1.5 MW of new biomass-based capacity.



Szigetvár Kórházi rendszer	Hospital System, Szigetvár
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

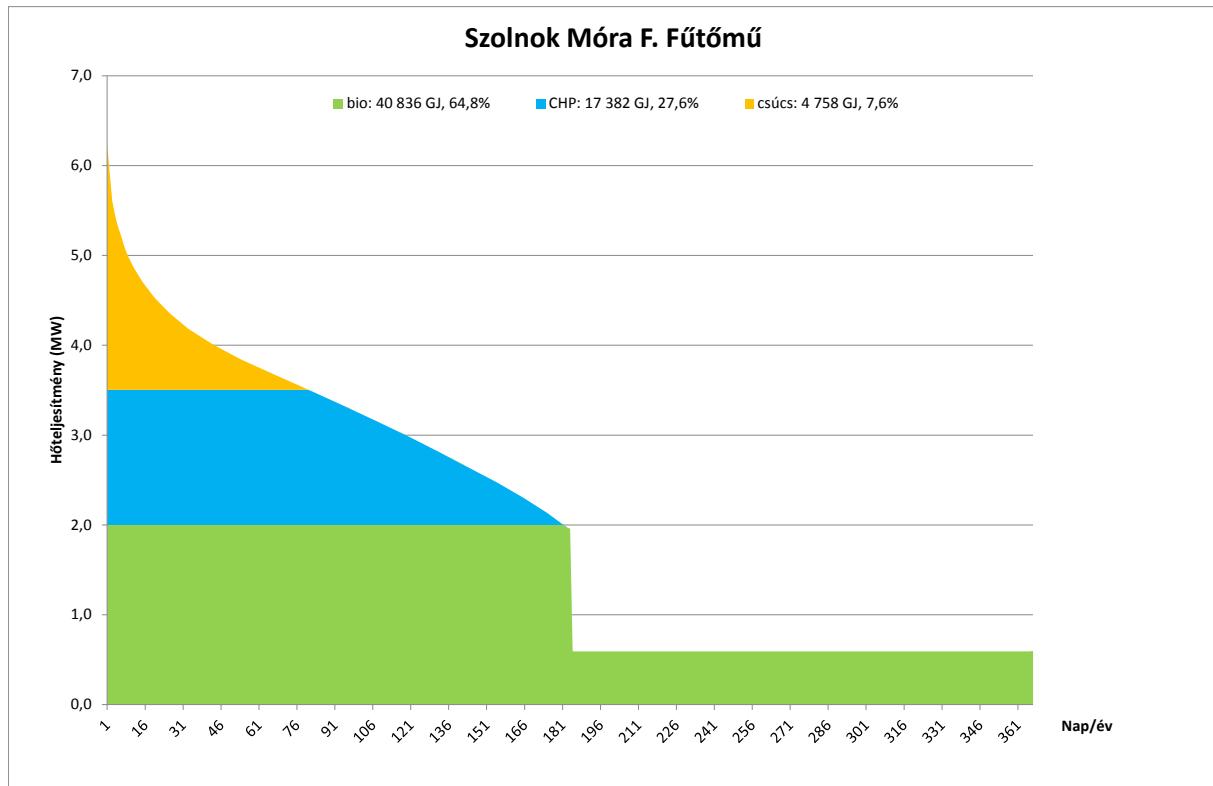
Figure 129 – Hospital System, Szigetvár



Szolnok József A. Fűtőmű	József A. Heating Plant, Szolnok
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 130 – József A. Housing Estate System, Szolnok**

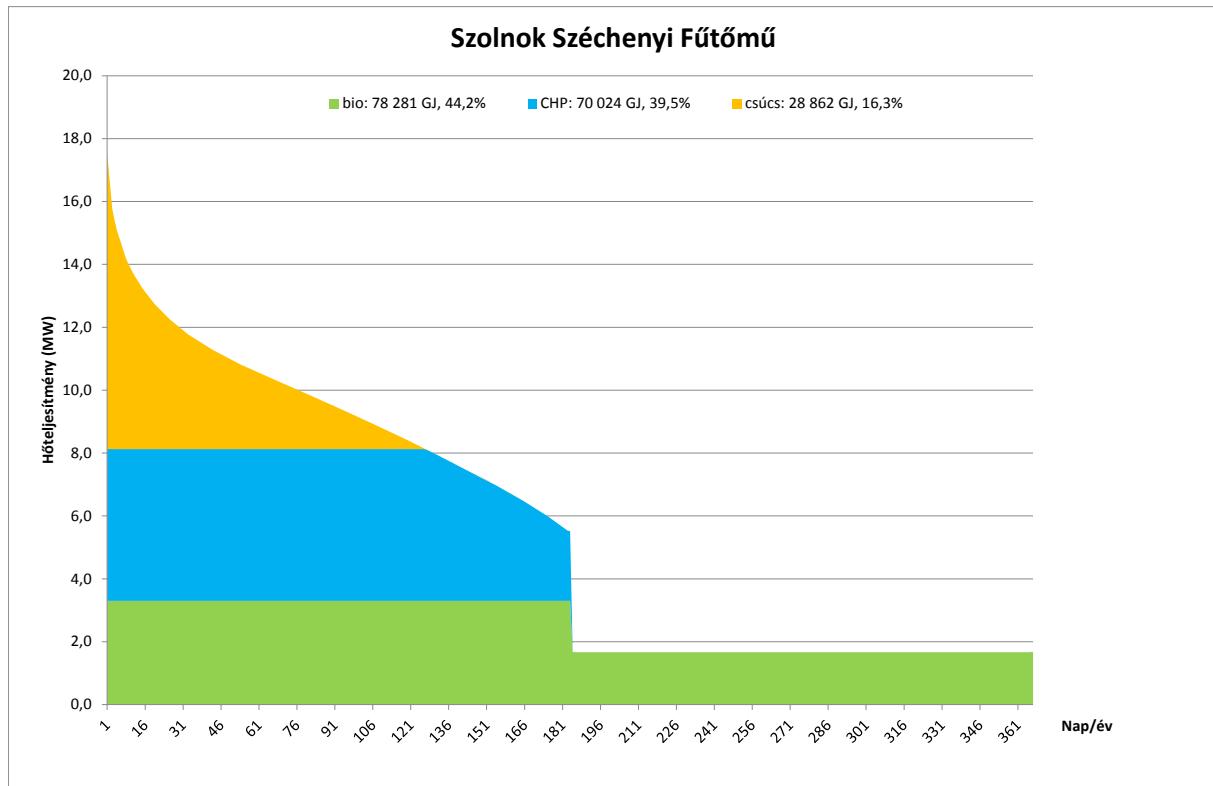
In the event of the establishment of 2 MW of new biomass-based capacity.



Szolnok Móra F. Fűtőmű	Móra F. Central Heating Plant, Szolnok
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 131 – Móra F. Central Heating Plant System, Szolnok

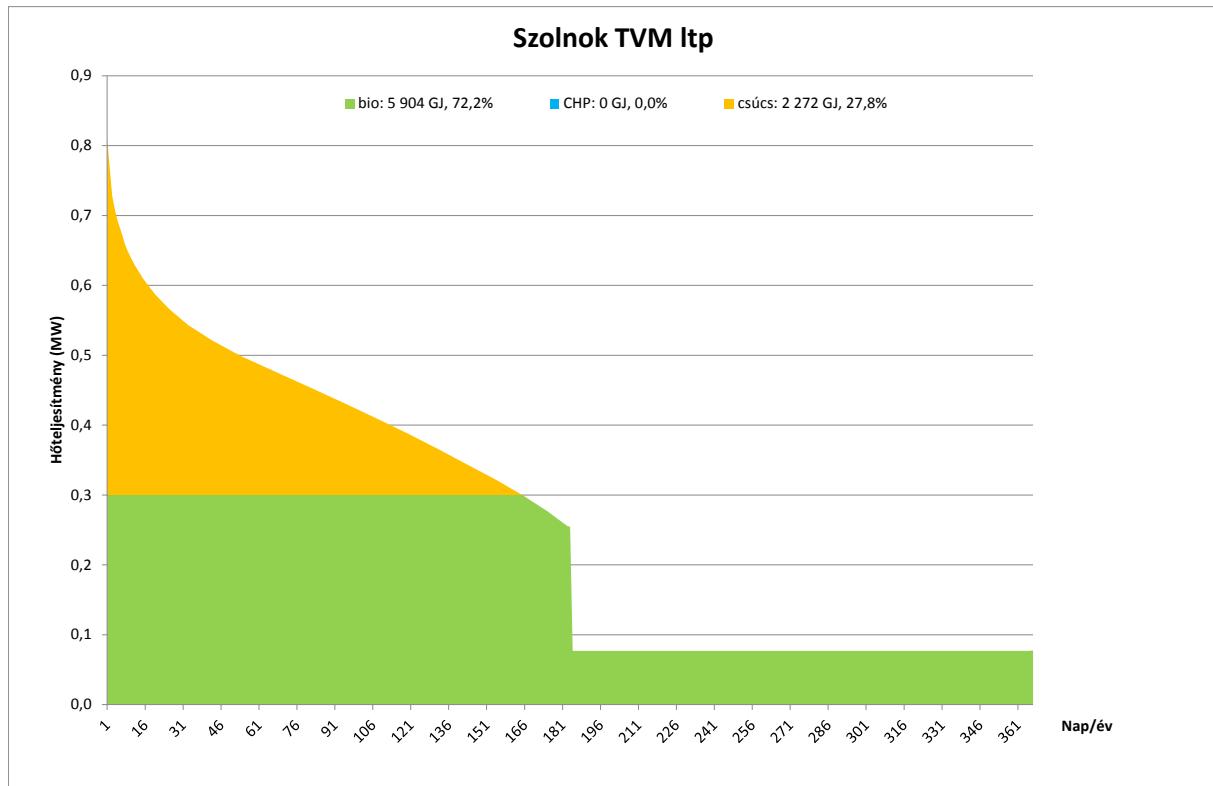
In the event of the establishment of 2 MW of new biomass-based capacity.



Szolnok Széchenyi Fűtőmű	Széchenyi Central Heating Plant, Szolnok
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 132 – Széchenyi A. Housing Estate System, Szolnok**

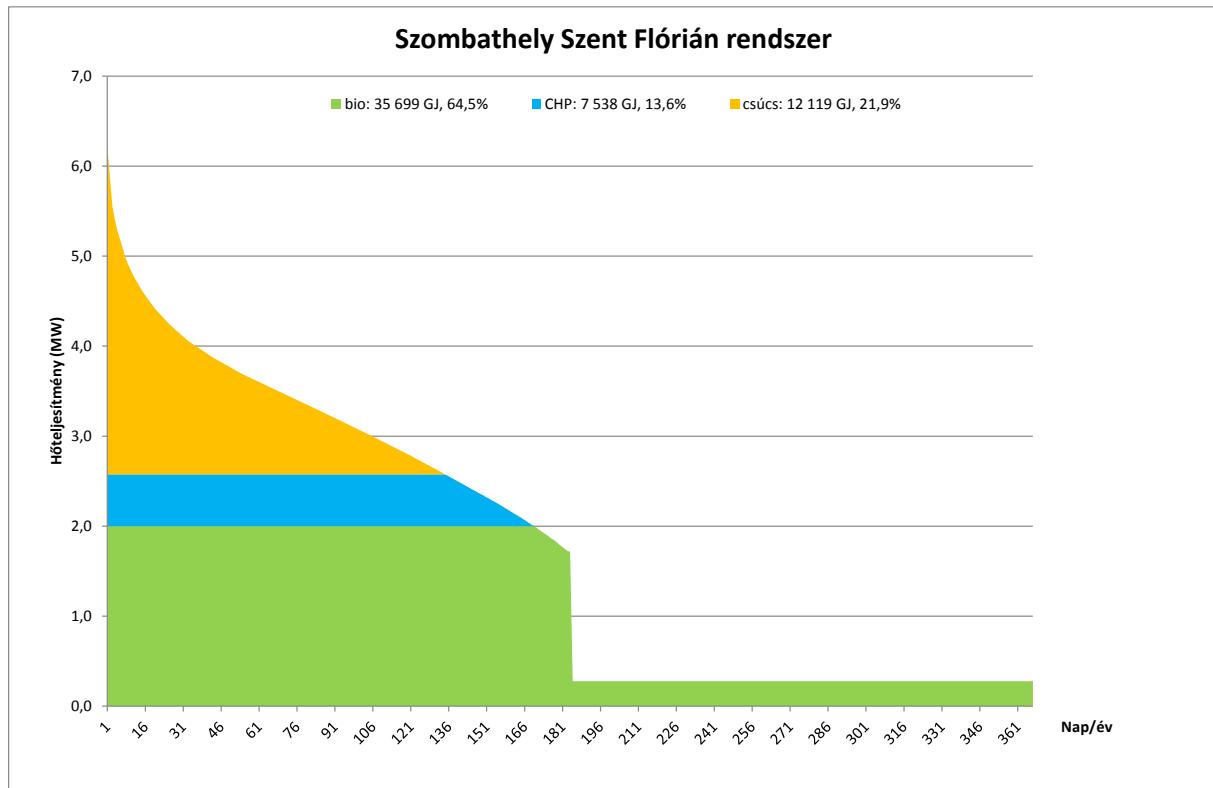
With existing biomass boiler.



Szolnok TVM Itp	TVM Housing Estate, Szolnok
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 133 – TVM System, Szolnok

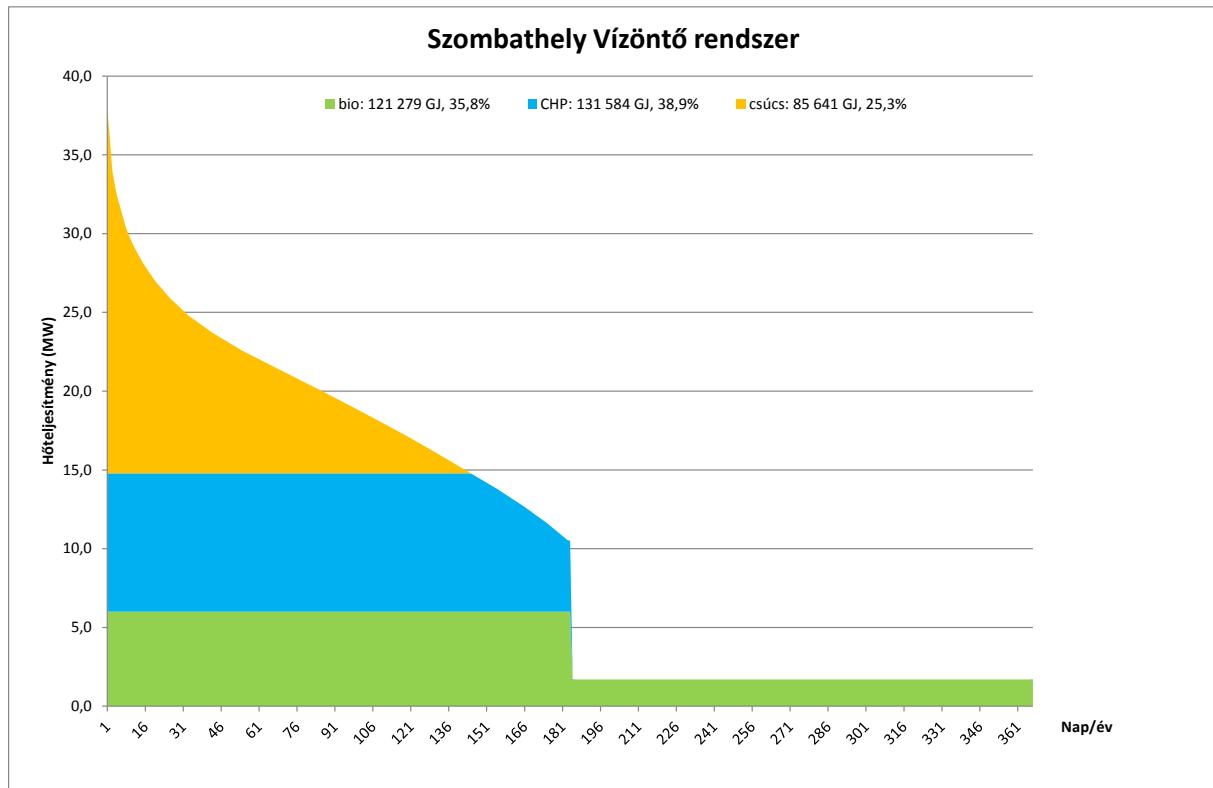
With a 300 kW biomass-based heat generation unit to be newly established.



Szombathely Szent Flórián rendszer	Szent Flórián System, Szombathely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 134 – Szent Flórián System, Szombathely

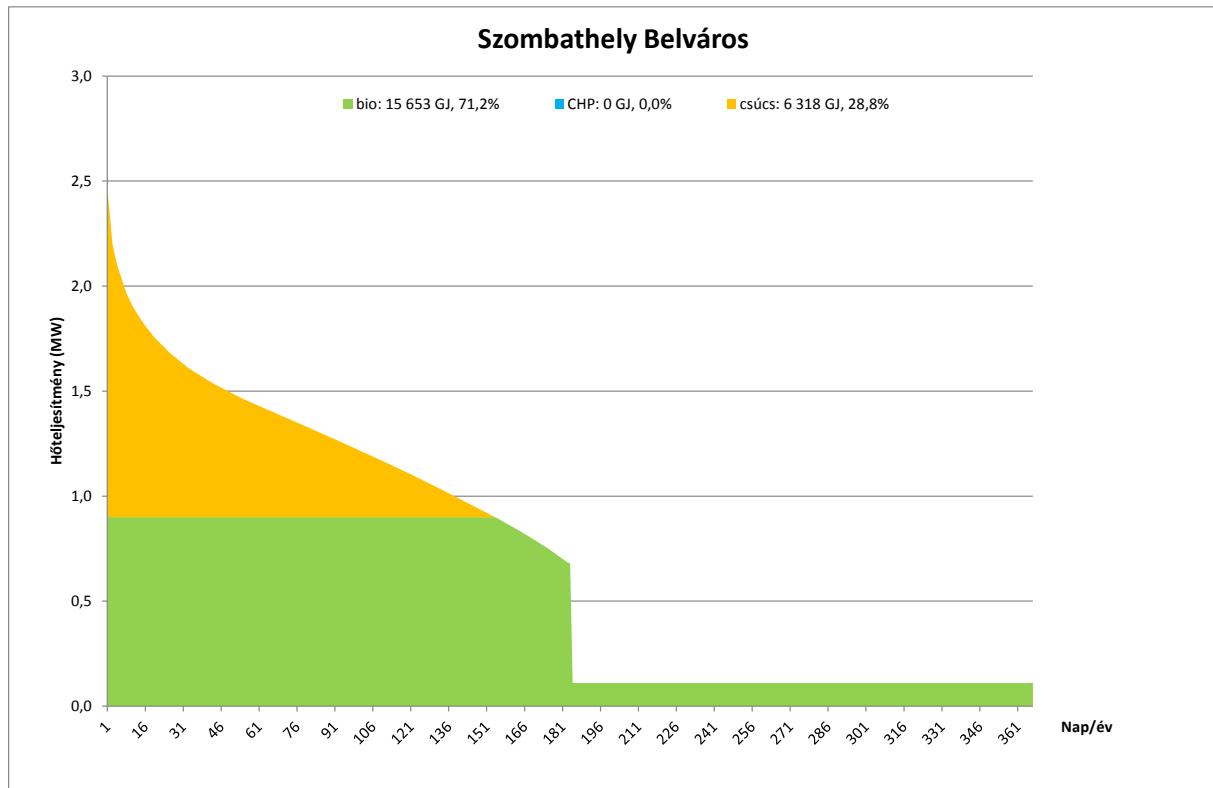
With a 2 MW biomass-based heat generation unit to be newly established.



Szombathely Vízöntő rendszer	Vízöntő System, Szombathely
bio	Bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 135 – Vízöntő System, Szombathely**

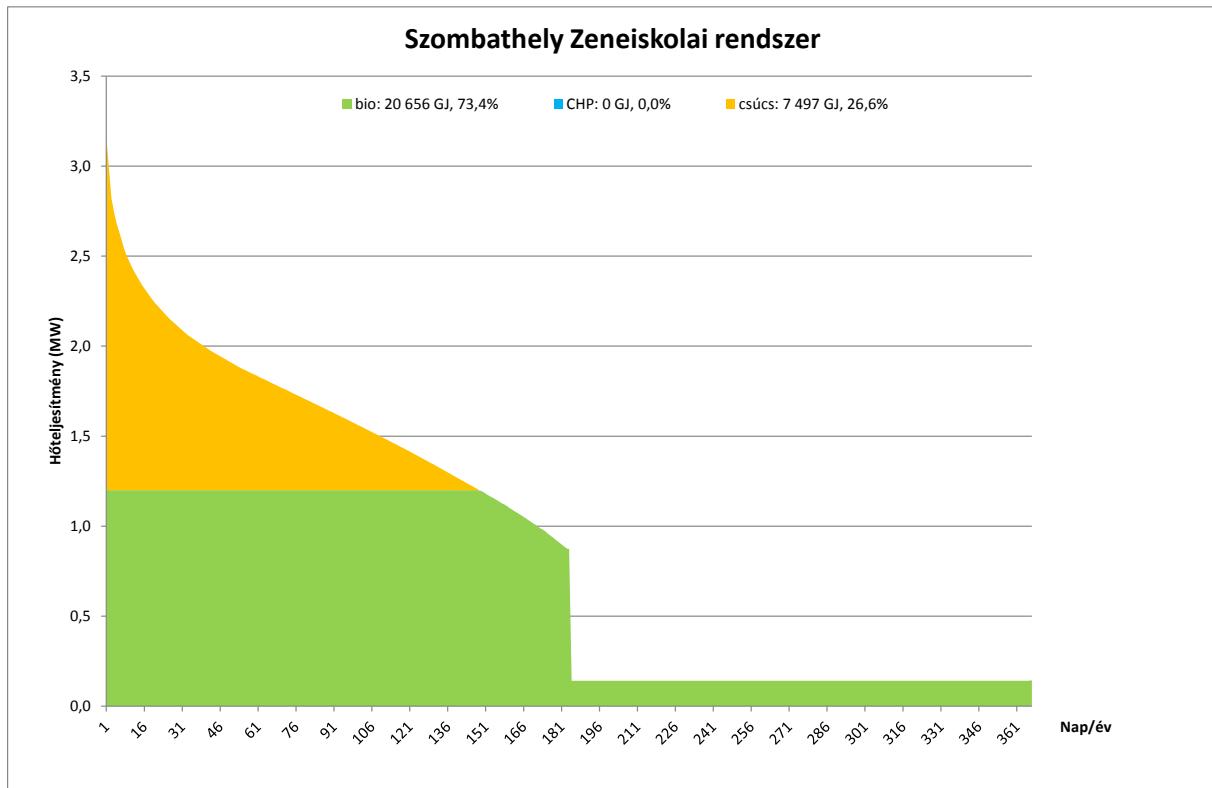
With a 6 MW biomass-based heat generation unit to be newly established.



Szombathely Belváros	City Centre, Szombathely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 136 – City Centre System, Szombathely

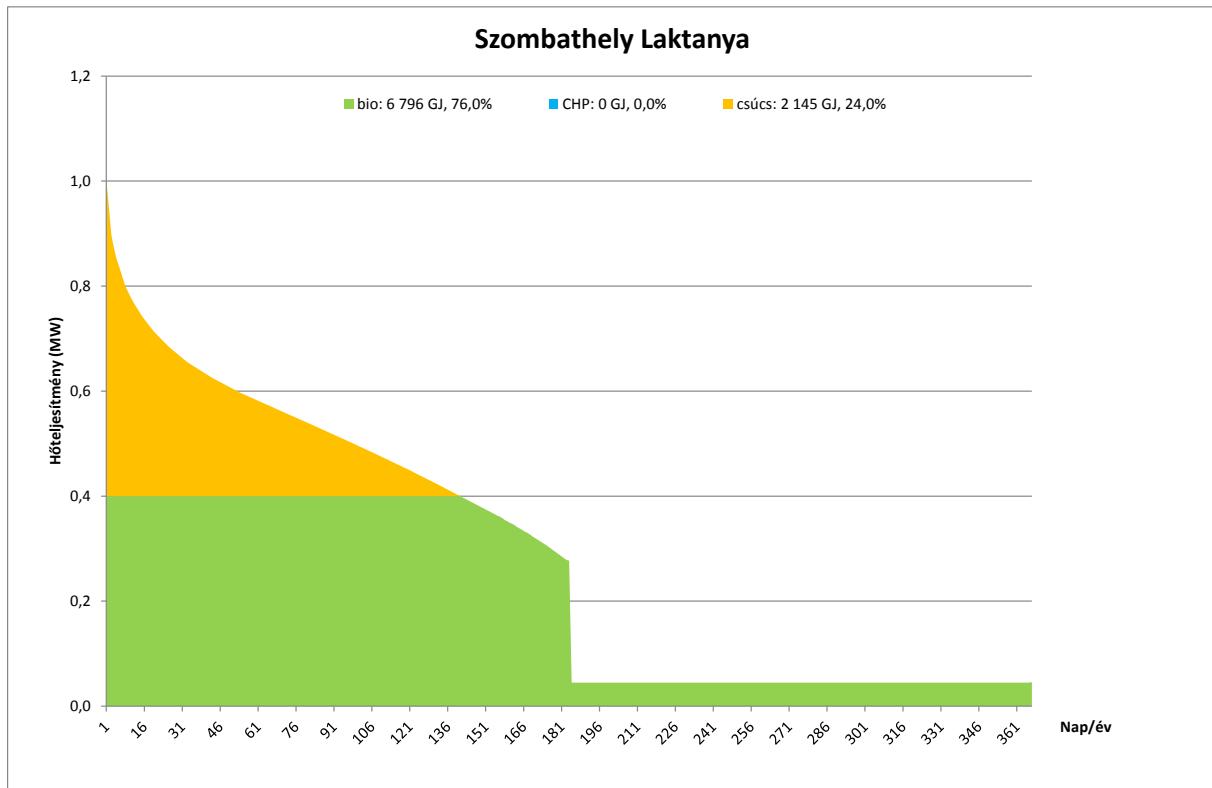
With a 900 kW biomass-based heat generation unit to be newly established.



Szombathely Zeneiskola rendszer	Music School System, Szombathely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 137 – Music School System, Szombathely

With a 1.2 MW biomass-based heat generation unit to be newly established.



Szombathely Laktanya	Barracks, Szombathely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 138 – Boiler Building System of the Barracks, Szombathely**

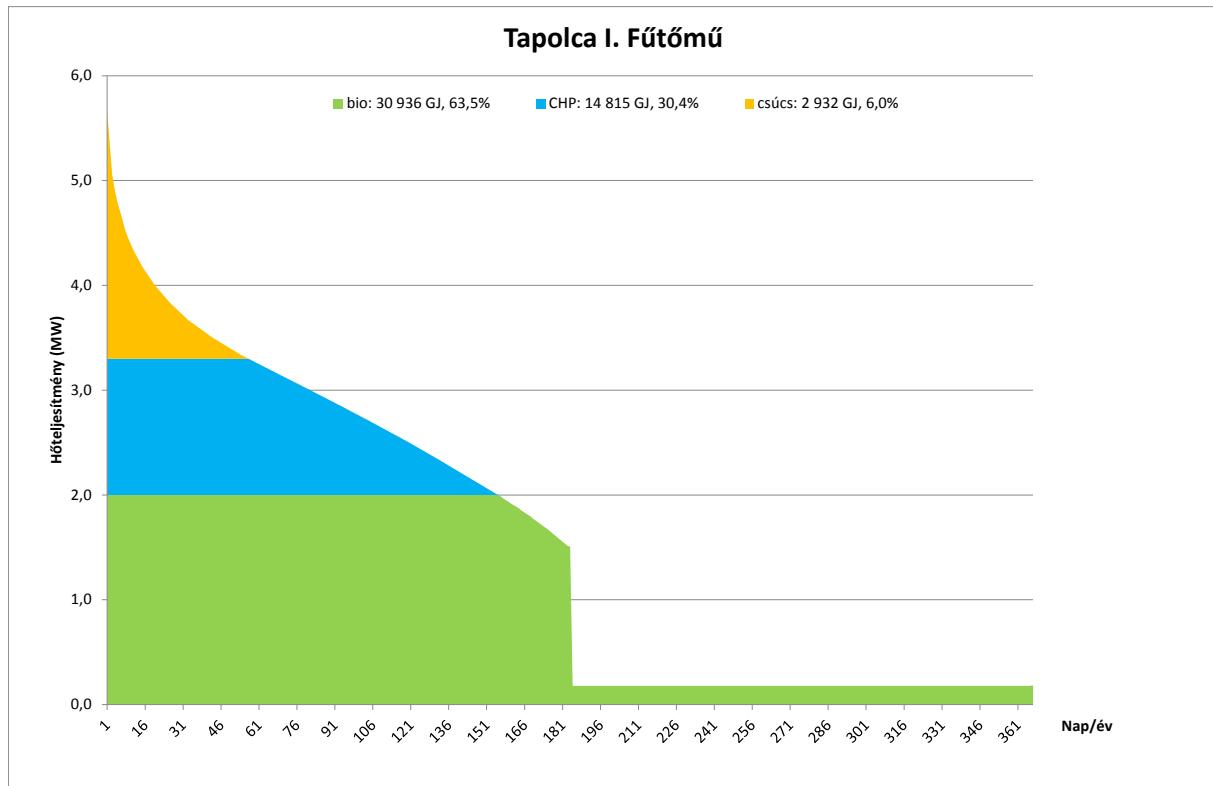
With a 400 kW biomass-based heat generation unit to be newly established.



Szombathely Mikes úti rendszer	Mikes út System, Szombathely
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 139 – Mikes út System, Szombathely**

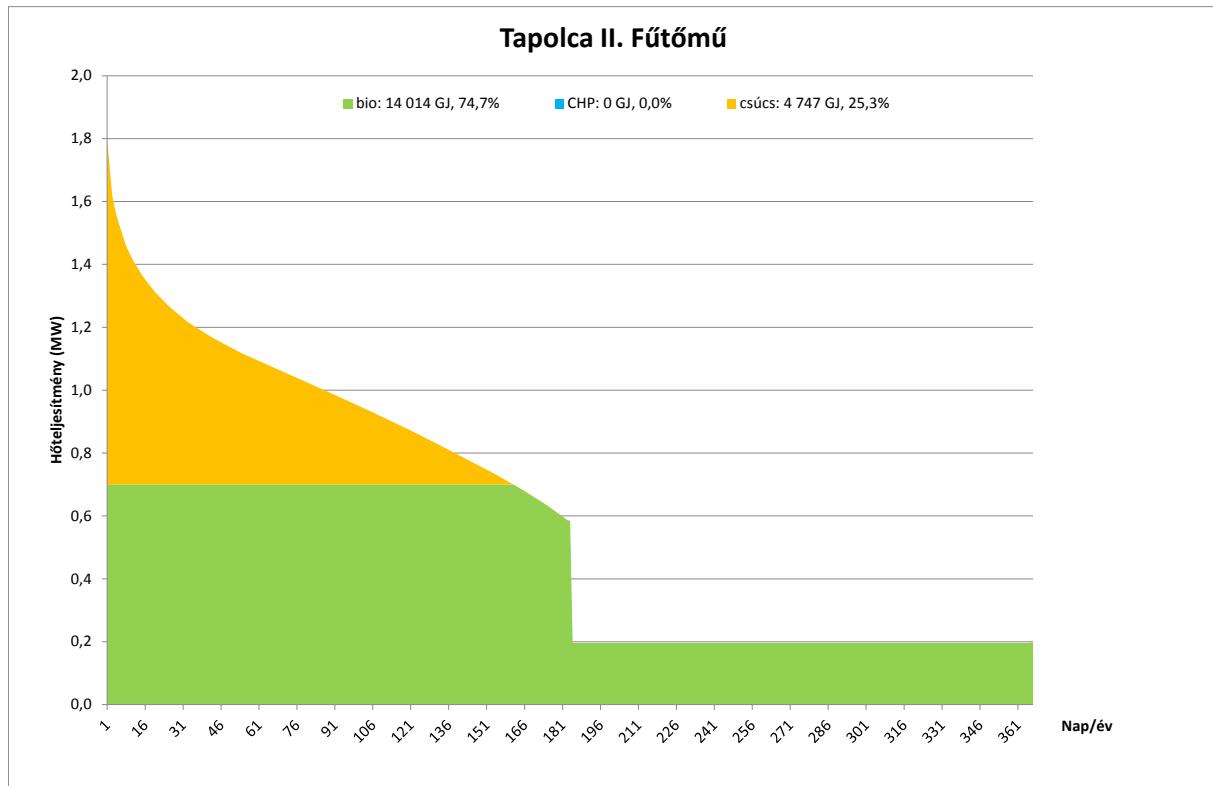
With existing wood chips-fired boiler.



Tapolca I. Fűtőmű	Central Heating Plant I, Tapolca
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 140 – Central Heating Plant I System, Tapolca**

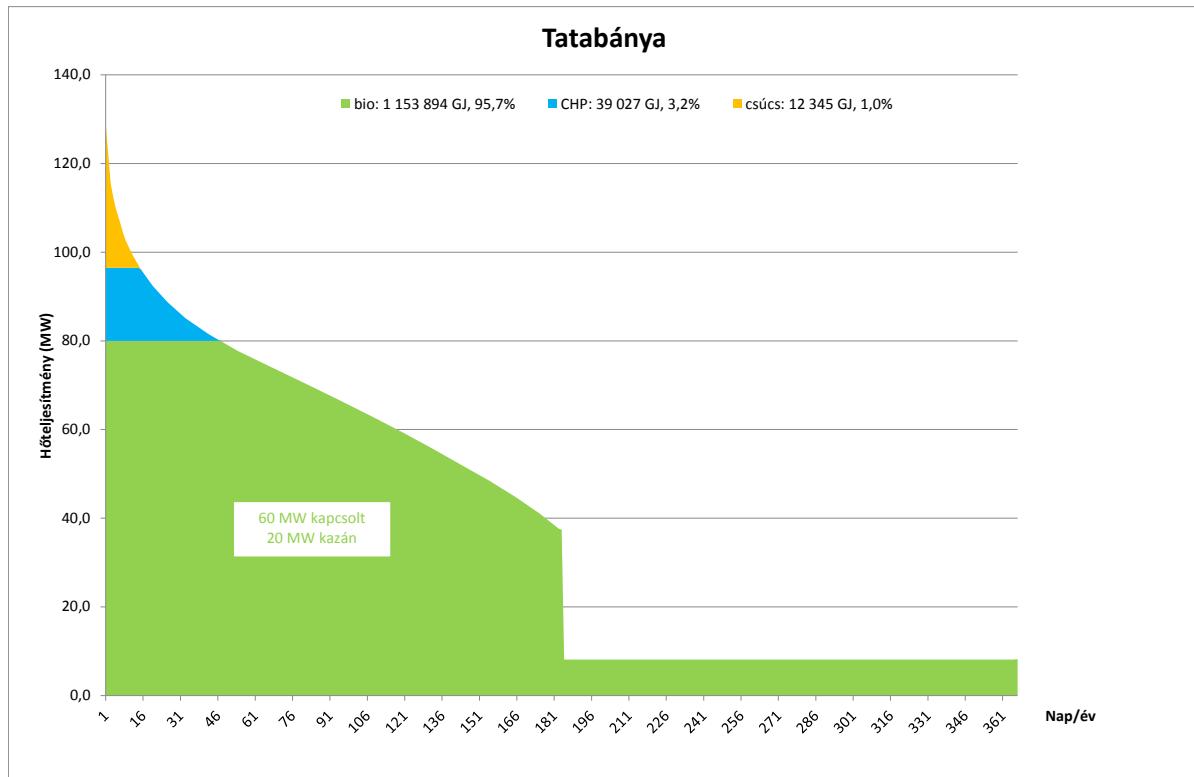
With a 2 MW biomass-based heat generation unit to be newly established.



Tapolca II. Fűtőmű	Central Heating Plant II, Tapolca
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 141 – Central Heating Plant II, Tapolca**

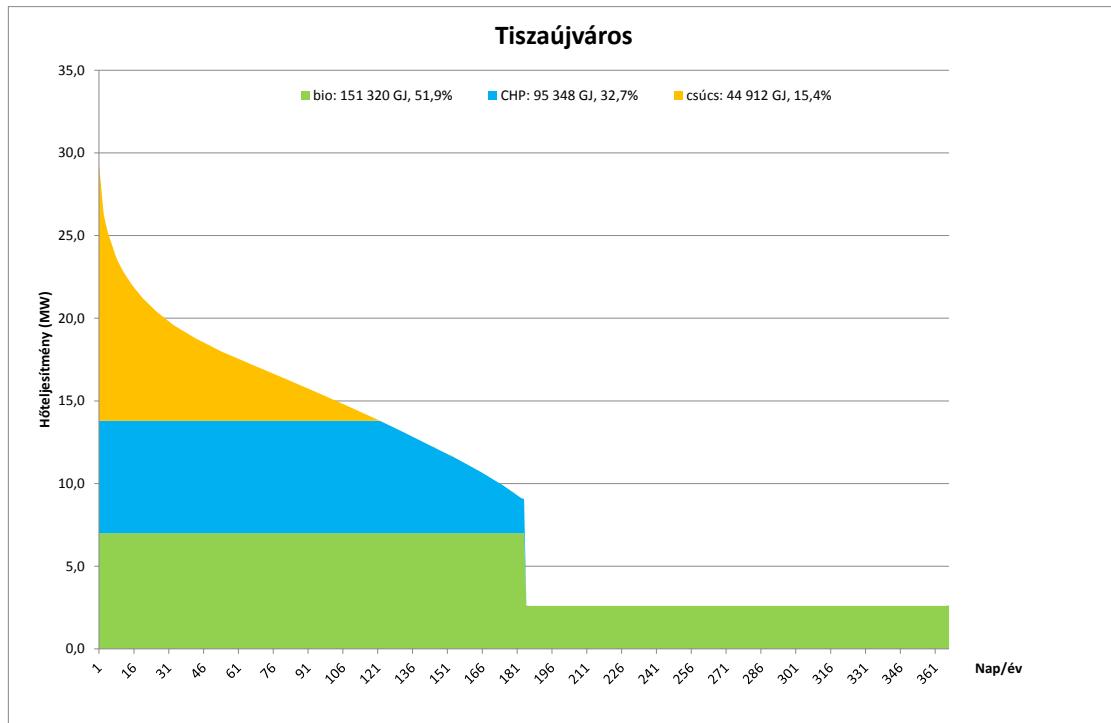
With a 900 kW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
60 MW kapcsolt	60 MW cogeneration
20 MW kazán	20 MW boiler
Nap/év	Days/year

**Figure 142 – District heating system, Tatabánya**

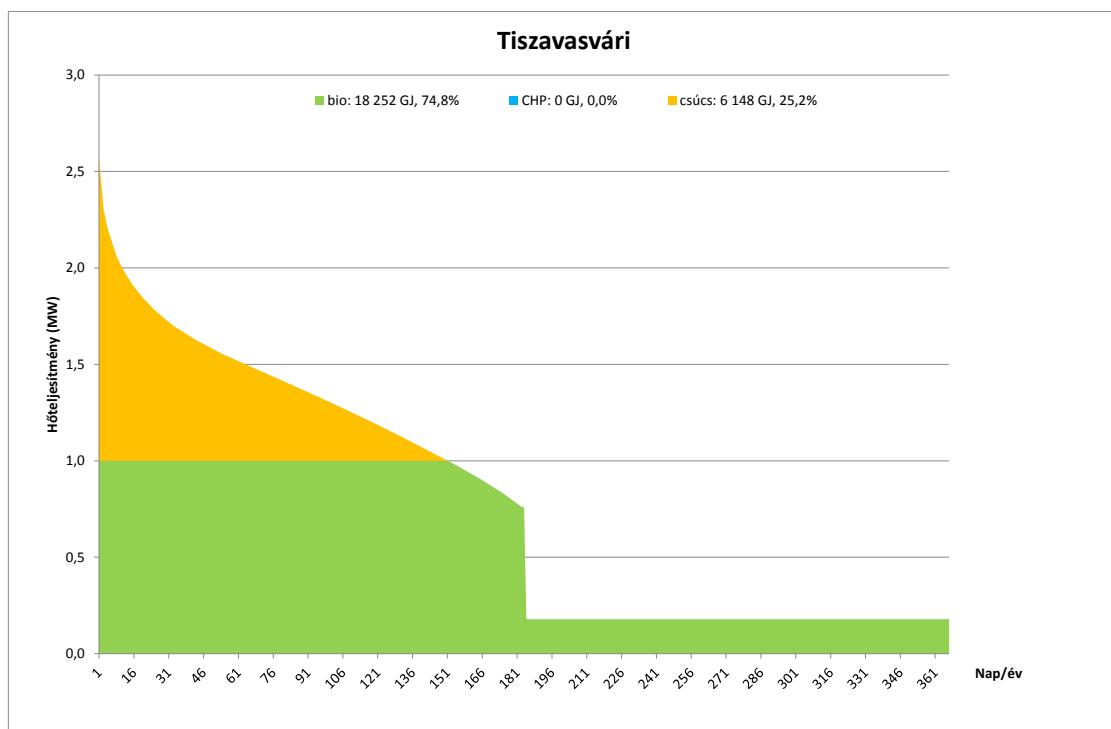
20 MW wood chips-fired boiler and 60 MW<sub>th</sub> of traditional (heating turbine) wood chips-based heat generation capacity.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 143 – District heating system, Tiszaújváros**

With a 6 MW biomass-based heat generation unit to be newly established.

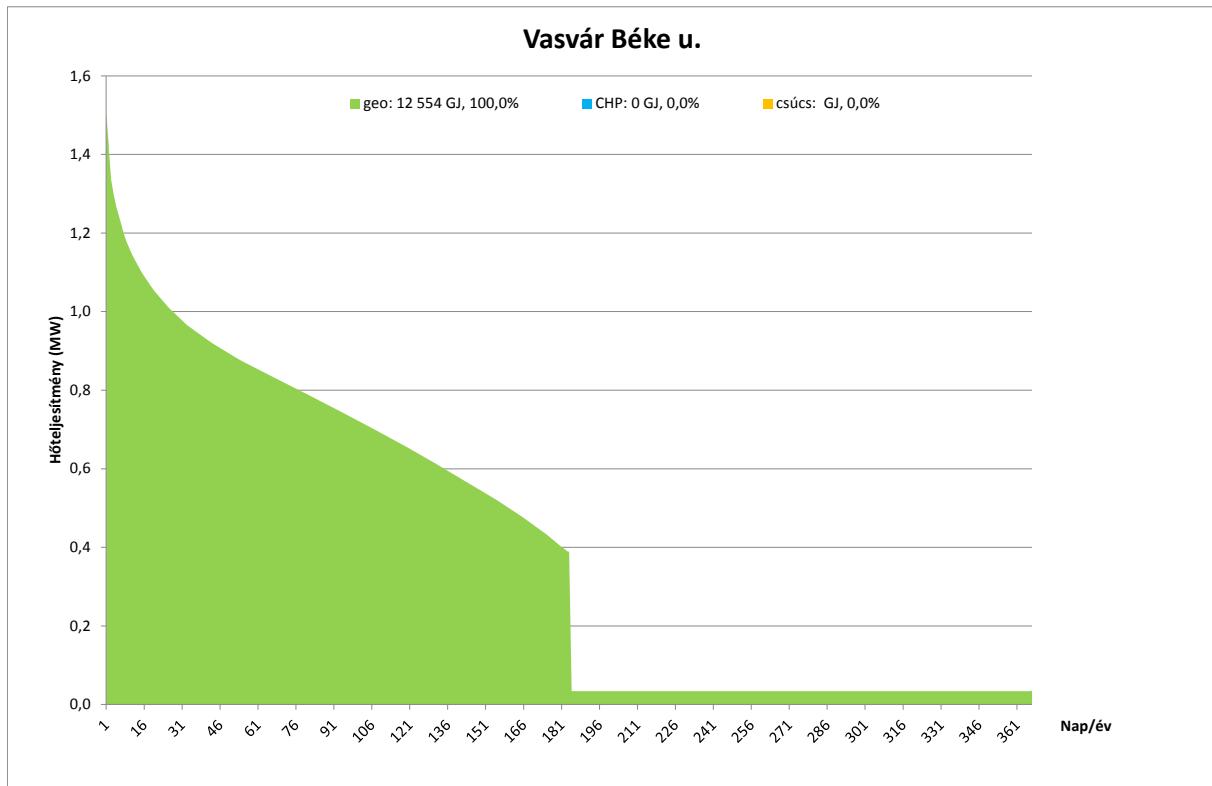


bio	bio
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CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 144 – District heating system, Tiszavasvár**

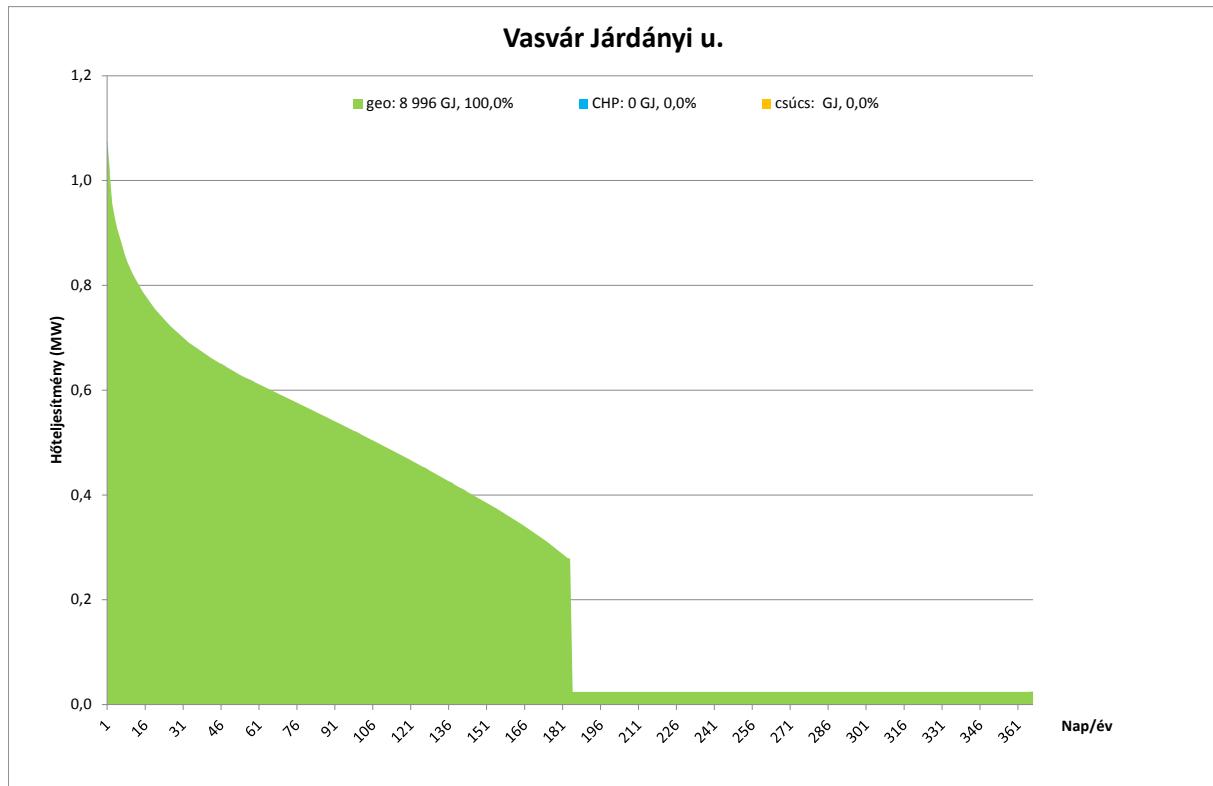
With a 1 MW biomass-based heat generation unit to be newly established.



geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 145 – Béke út System, Vasvár**

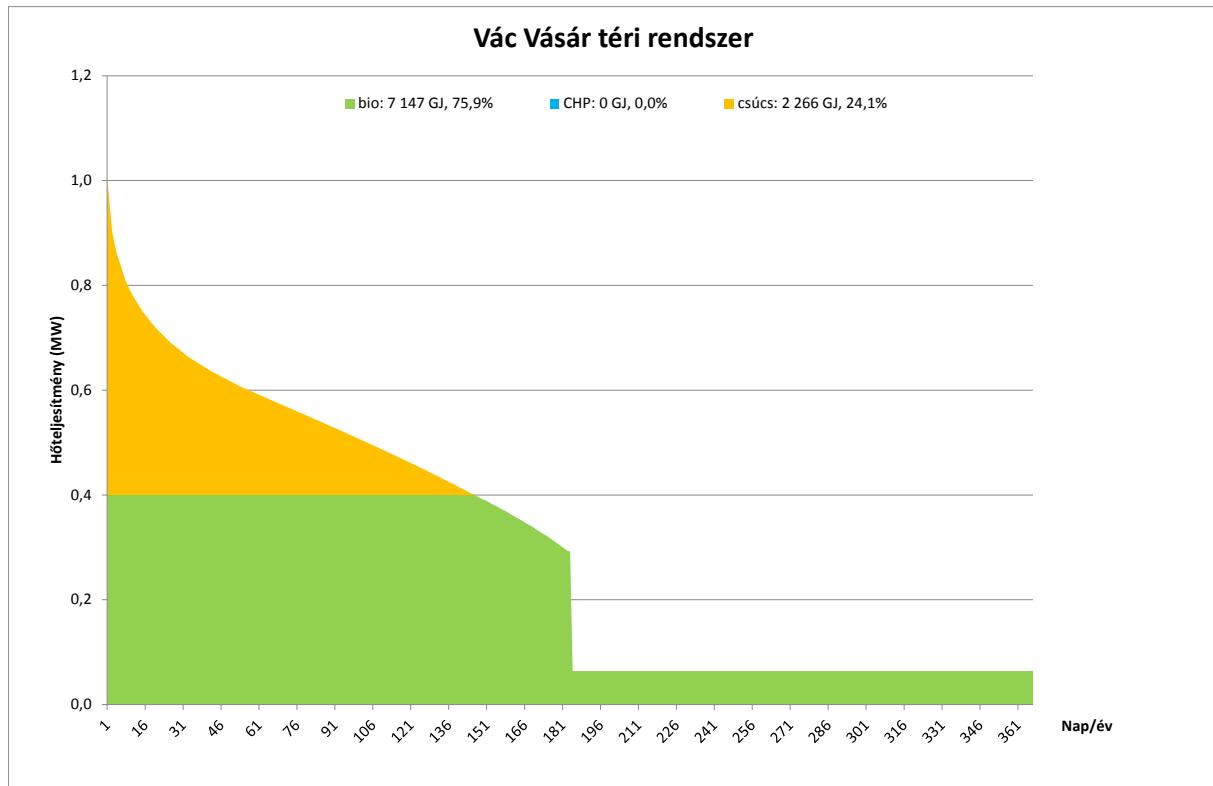
Existing geothermal-based heat generation.



Vasvár Járdányi u.	Járdányi u., Vasvár
geo	geo
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

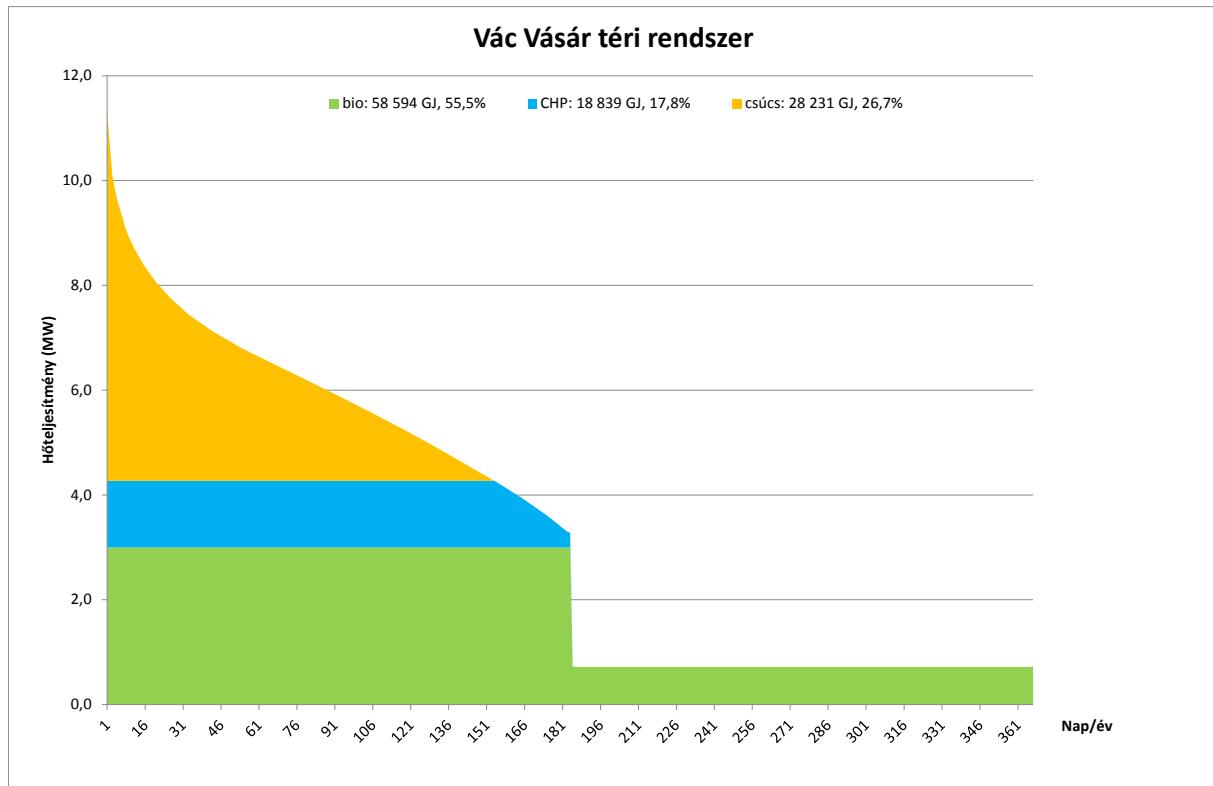
**Figure 146 – Járdányi út System, Vasvár**

Existing geothermal-based heat generation.



**Figure 147 – Deákvar System, Vác**

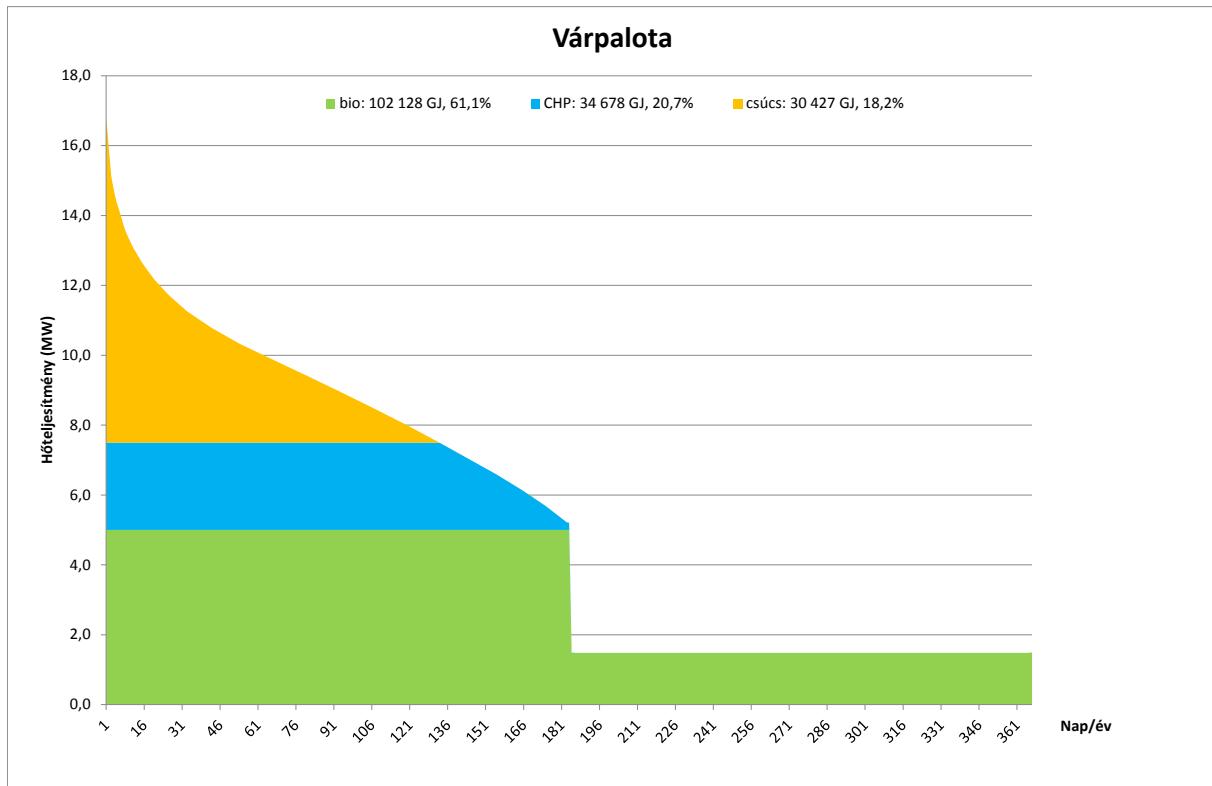
With a 400 kW biomass-based heat generation unit to be newly established.



Vác Vásár téri rendszer	Vásár tér System, Vác
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 148 – Vásár tér System, Vác

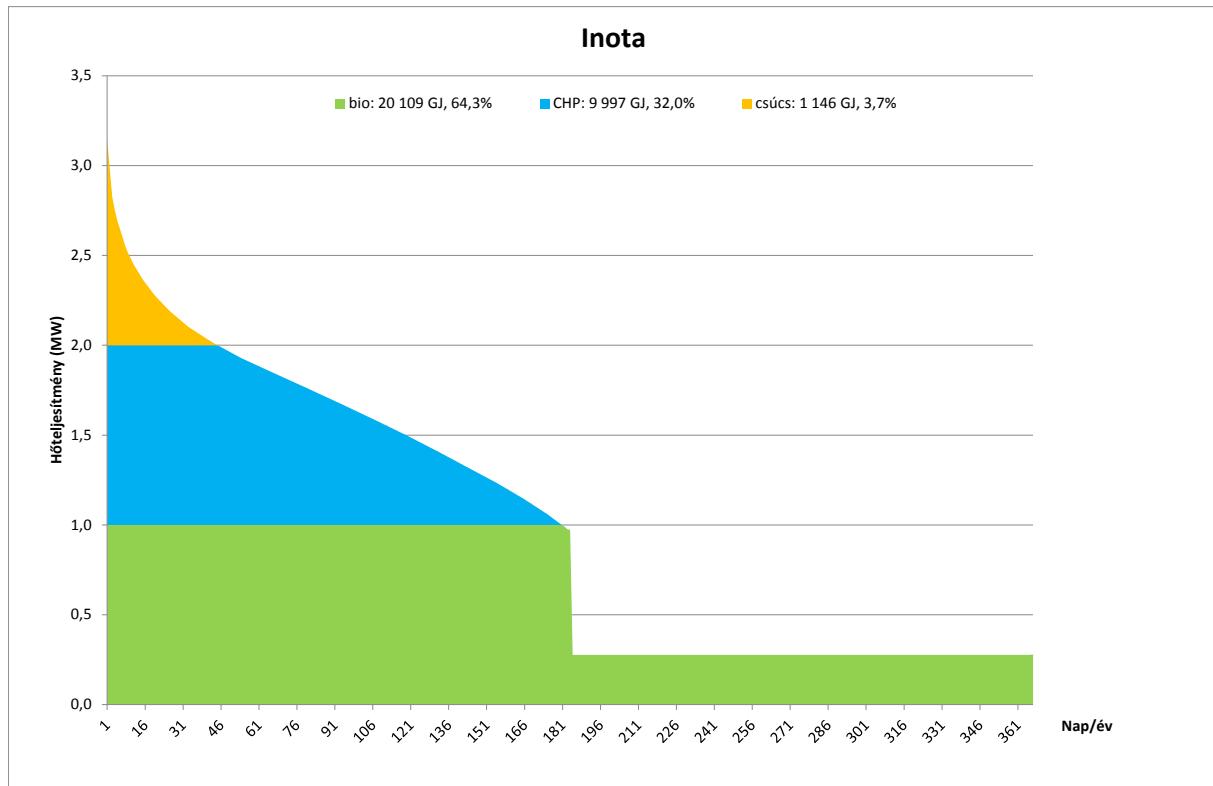
With a 2.5 MW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 149 – District heating system, Várpalota**

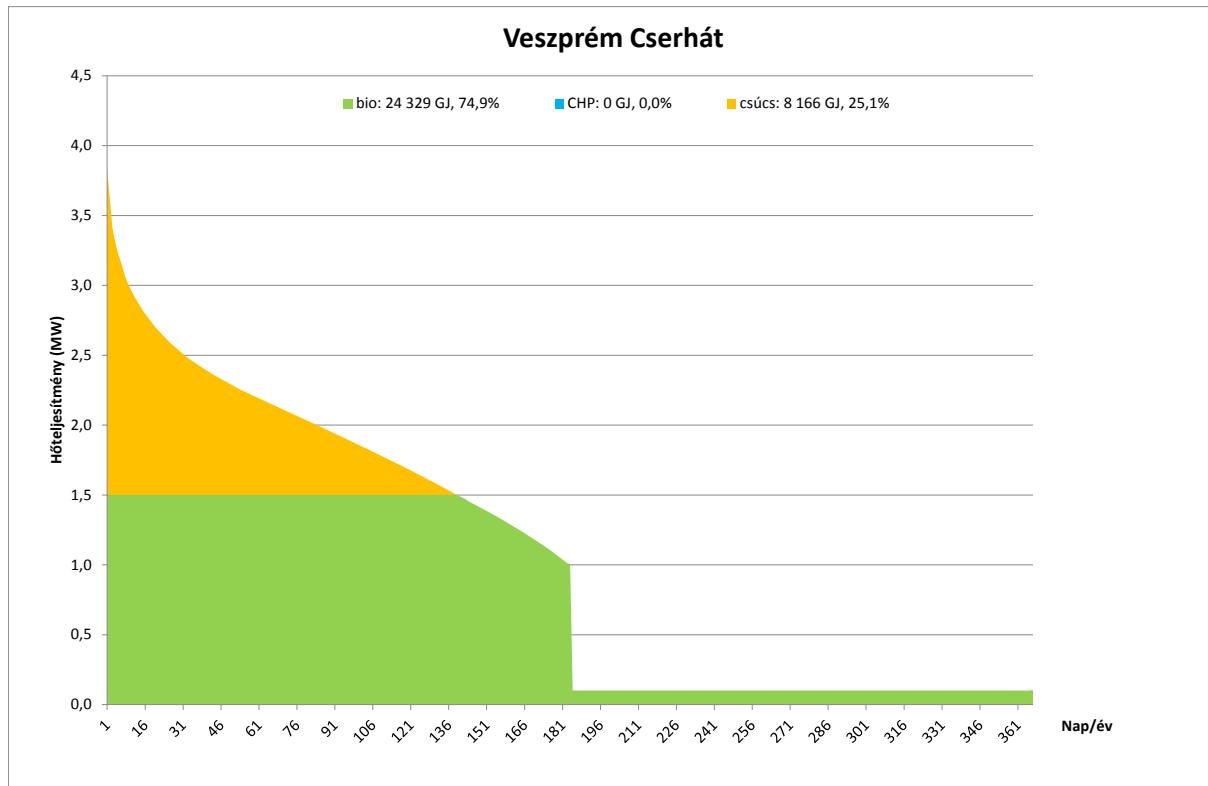
With a 5 MW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 150 – District heating system, Inota**

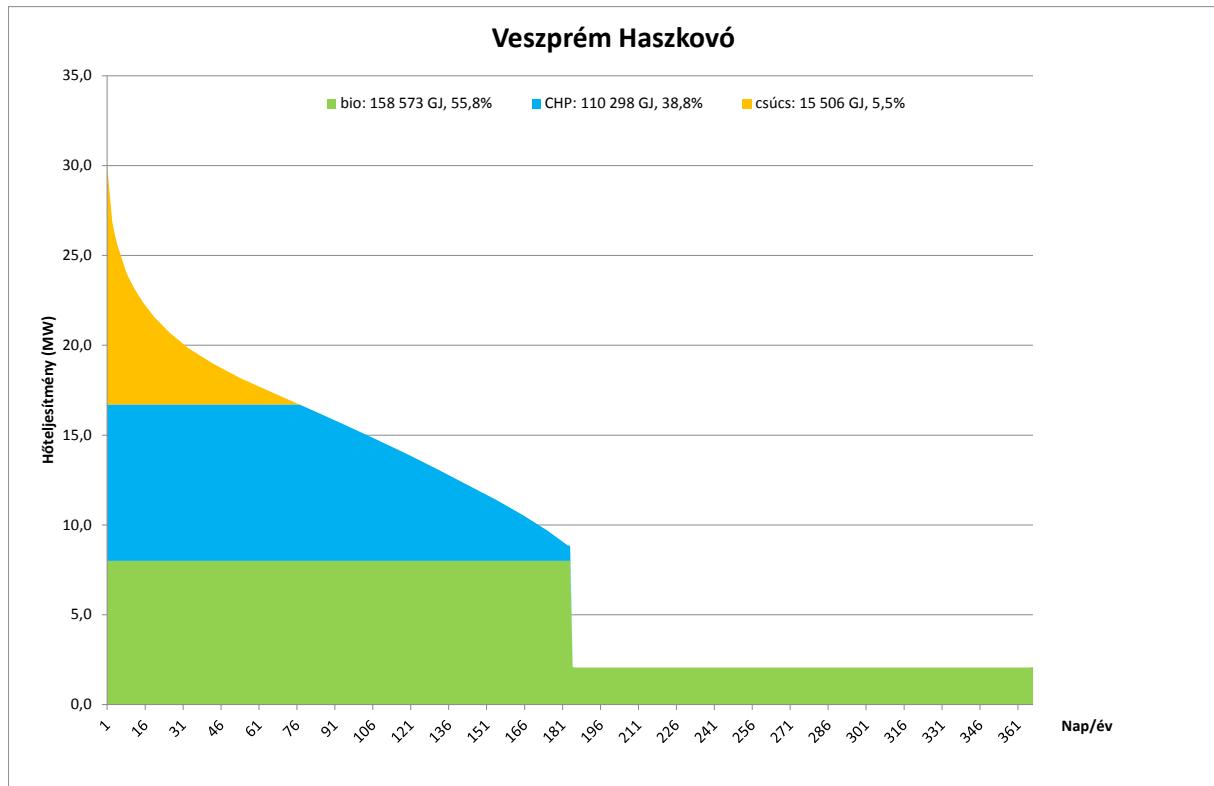
With a 1 MW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 151 – Cserhát Housing Estate System, Veszprém

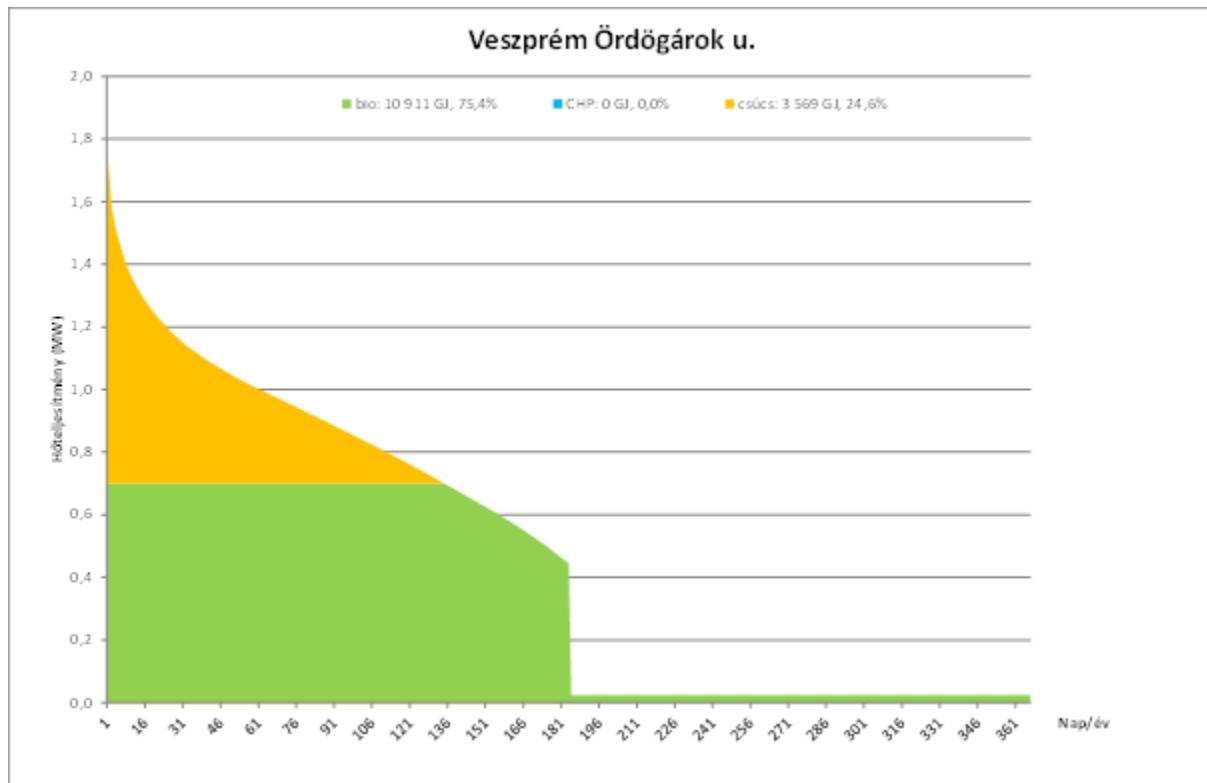
With a 1.5 MW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 152 – Haszkovó System, Veszprém**

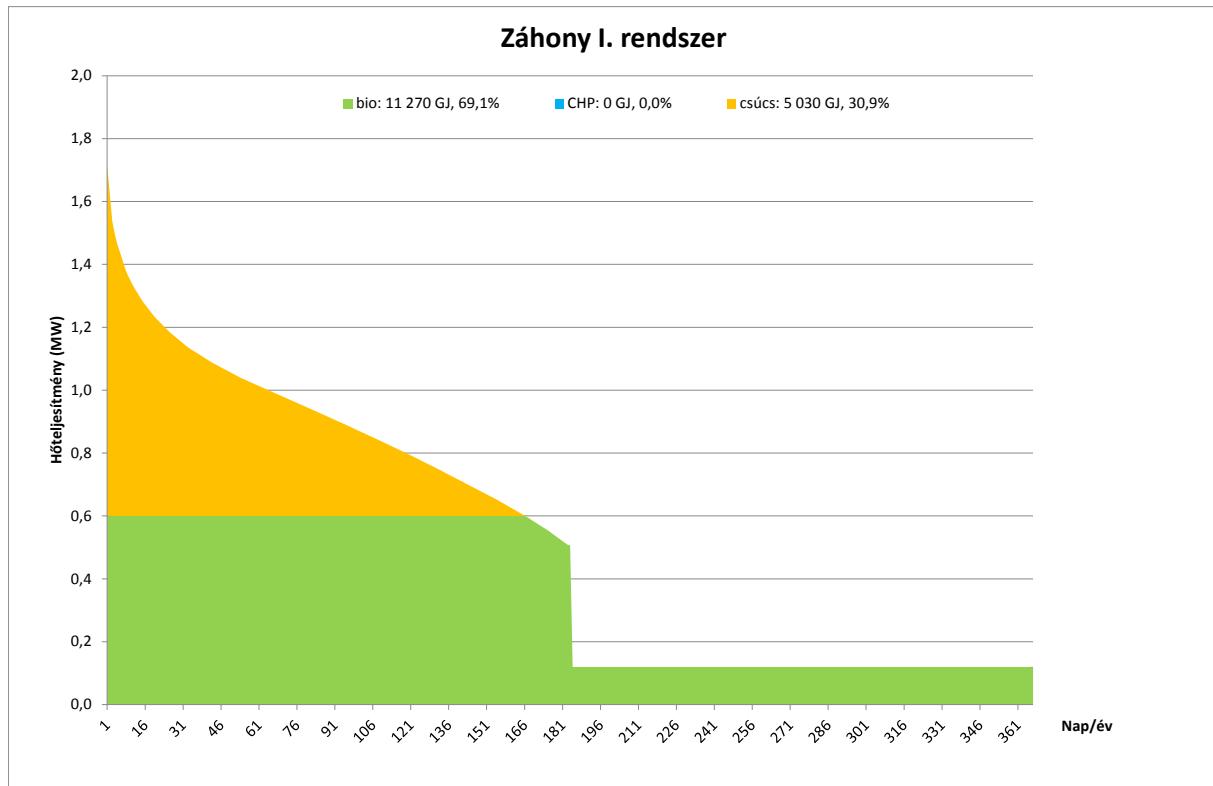
With a 8 MW biomass-based heat generation unit to be newly established.



Veszprém Ördögárok u.	Ördögárok u., Veszprém
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

**Figure 153 – Ördögárok út System, Veszprém**

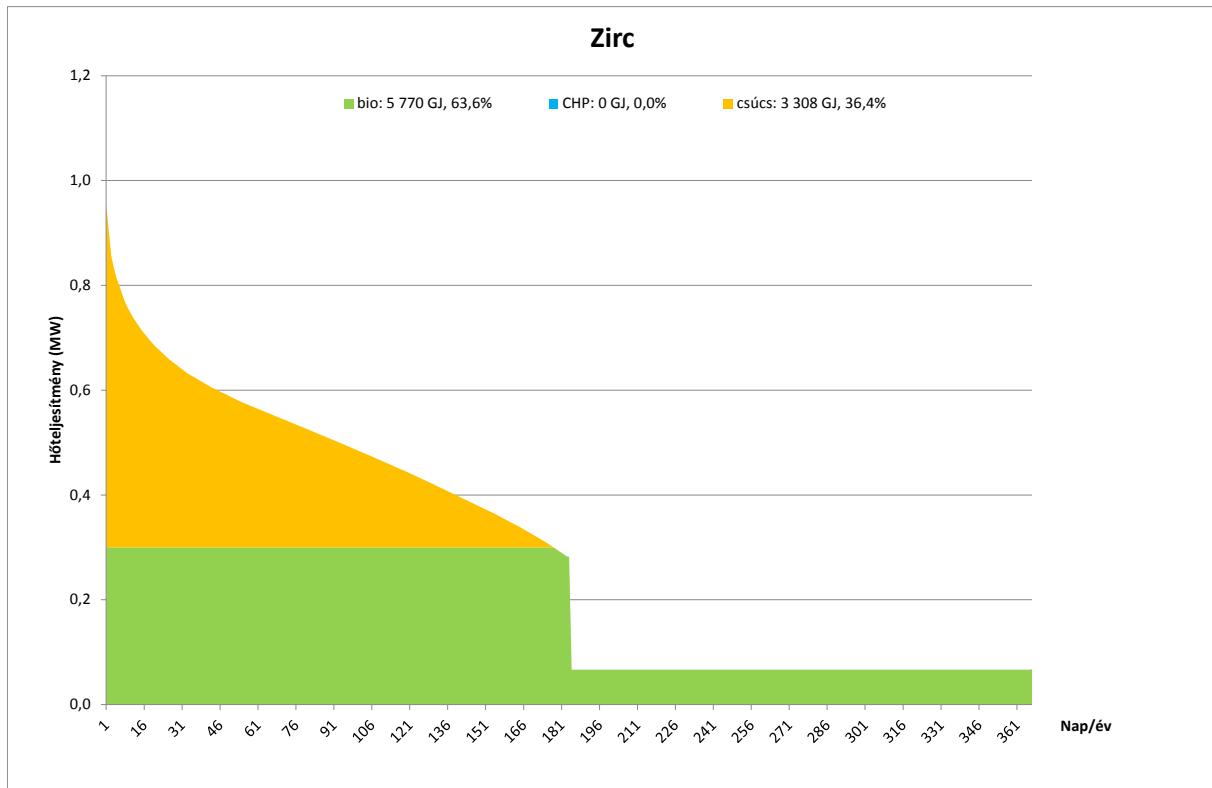
With a 700 kW biomass-based heat generation unit to be newly established.



Záhony I. rendszer	System I, Záhony
bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 154 – System I, Záhony

With a 600 kW biomass-based heat generation unit to be newly established.



bio	bio
CHP	CHP
csúcs	peak
Hőteljesítmény (MW)	Heat output (MW)
Nap/év	Days/year

Figure 155 – District heating system, Zirc

With a 600 kW biomass-based heat generation unit to be newly established.