20403(05/07/10/13)

Thermoelectric power generator with integrated heat sink

Thermagy™ power panel (200W)

Product Overview

The 20403(05/07/10/13) Thermagy™ power panel is a plug and play thermoelectric power generator that can convert waste heat of 700-1200°C into electricity and usable heat.

Features

- Integrated heat exchanger
- For generation of electricity and heat
- Suitable for thermal radiating heat sources (700°C - 1200˚C)
- Suitable for operation with different coolants (water, oil) and a wide range of cooling temperatures
- Simple installation
- Operates under atmospheric conditions
- No mechanical pressure mount needed
- Maintenance free
- Robust thermal design
- Use of proven silicide materials
- Can be connected with commercially available inverters

Performance overview

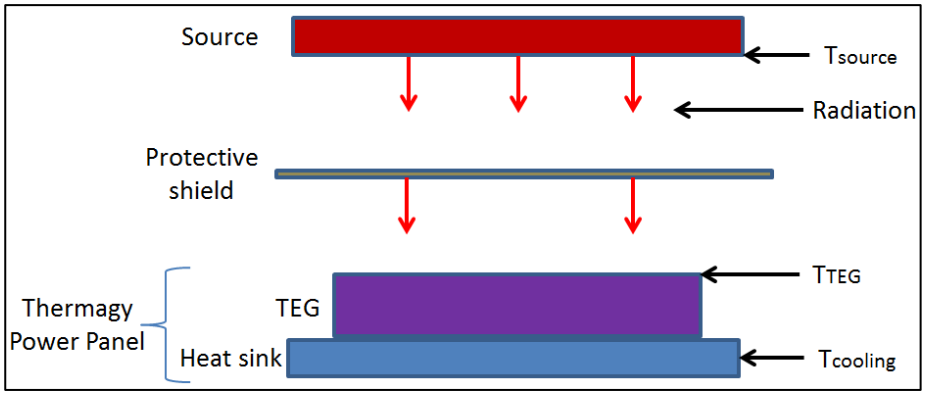
Thermagy™ power panel is available for the following heat flows: 100kW/m^2 – 65kW/m^2 – 50kW/m^2 – 35kW/m^2. These heat flows corresponds to different Thermagy models 20403(05/07/10/13). The performance of these Power panels depends on the temperature of the heat sink. In the table below are 30°C and 60°C displayed, this are typical sink temperatures depending on the available cooling system or to make use of the captured heat.
For industrial situations it might be necessary to use a protective shield due to external influences (corrosive media, mechanical impact). The purpose of a protective shield is to protect the thermal electric power panel. Such protective shield will lower the heat flux through the Thermagy panel and should be taken into account when choosing the most suitable Thermagy model.

Typical data	2040305 (100kW)		2040307 (65kW)		2040310 (basic) (50kW)		2040313 (35kW)	
T_{sink} [°C]	30	60	30	60	30	60	30	60
Heat flow [kW/m^2]	91	86	67	64	48	46	38	36
Indicative T_{source} no shield [°C]	960	950	900	890	845	840	815	805
Indicative T_{source} with shield [°C]*	1140	1125	1054	1045	980	965	925	915
$P_{electric}$ [W]	221	204	194	178	161	148	136	126

**A shield of 2mm steel under ideal circumstances*

Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl

Technical specifications



The next specifications are the maximum operating specifications for the complete range of Thermagy™ power panels.

Cooling	2040305	2040307	2040310 (basic)	2040313
Minimum temperature in	10°C			
Maximum temperature in	140 °C			
Maximum temperature out	150 °C*			
Minimum pressure in	2 bar			
Maximum pressure in	6 bar*			

**This is the maximum load case to operate safely*

Thermal	2040305	2040307	2040310 (basic)	2040313
Maximum T_{TEG}	650 °C*			

**The view factor of TEG to heat source has a big influence at amount of captured heat flow and TEG temperature*

Electrical	2040305	2040307	2040310 (basic)	2040313
Circuit	DC (Direct Current)			
Short circuit current	13,9 A	11,8 A	9,6 A	8 A*
Maximum power point	4 – 4,6 Ω	4,8 – 5,5 Ω	5,7 – 6,9 Ω	7,3 – 8,4 Ω*
Open circuit voltage	64 V	65 V	67 V	68 V*
Internal resistance	~4 Ω	~5 Ω	~6 Ω	~8 Ω*
Max power output	220 W	195 W	160 W	135 W*

**Depending upon heat flux through panel*

Interfaces	2040305	2040307	2040310 (basic)	2040313
Water connections	Thread G1/4			
Electrical connections	Ceramic connector			
Mounting point	12x M6 Welded Aluminum threat			

Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl

Typical operating specifications

The next specifications are typical for a model 2040313 Thermagy™ power panel.

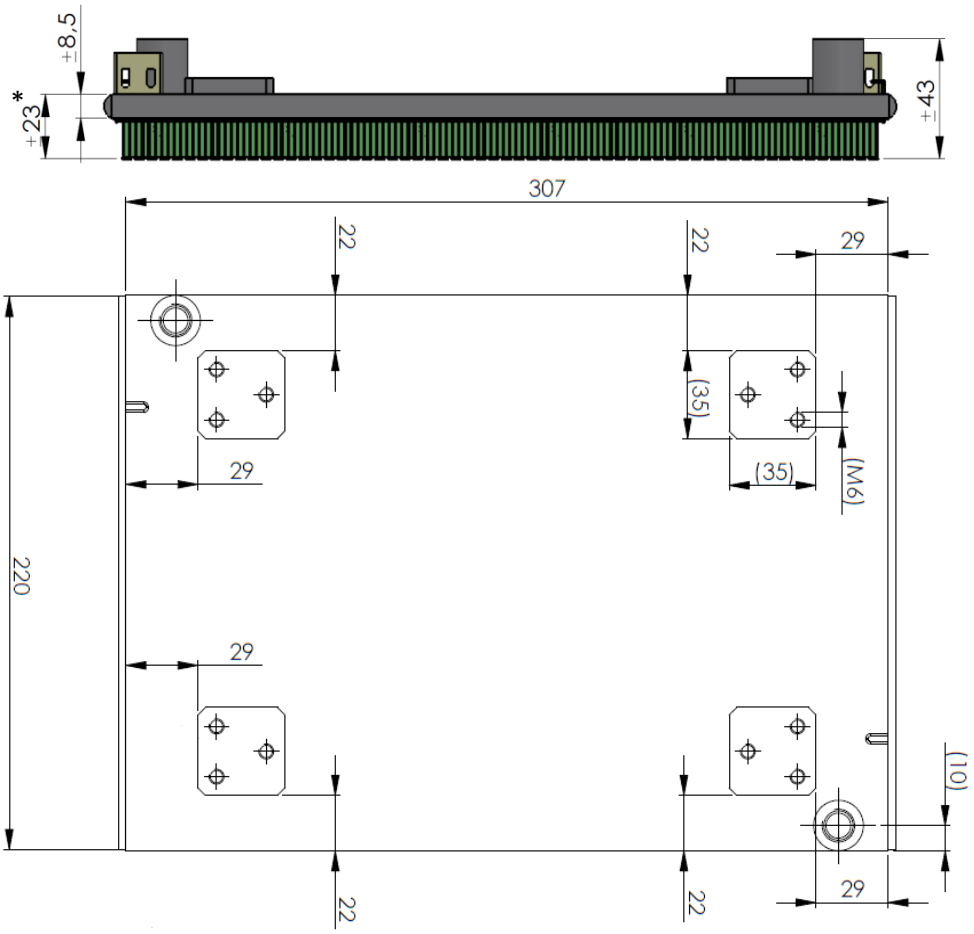
Typical cooling	2040313
Temperature in	20 °C
Temperature out	27 °C
Pressure in	4 bar
Water flow	280 L/h*

**A pressure drop of 1.7 bar over the power panel*

Typical thermal specifications	2040313
T_{TEG}	600 °C
T_{source}	800 °C
Heat flow TEG	~40 kW/m^2

Electrical	2040313
Circuit	DC (Direct Current)
Short circuit current	~ 4 A
Maximum power point	~ 8 Ω
Open circuit voltage	~ 64 V
Power output	~ 120 W

Thermagy™ dimensions (in mm)

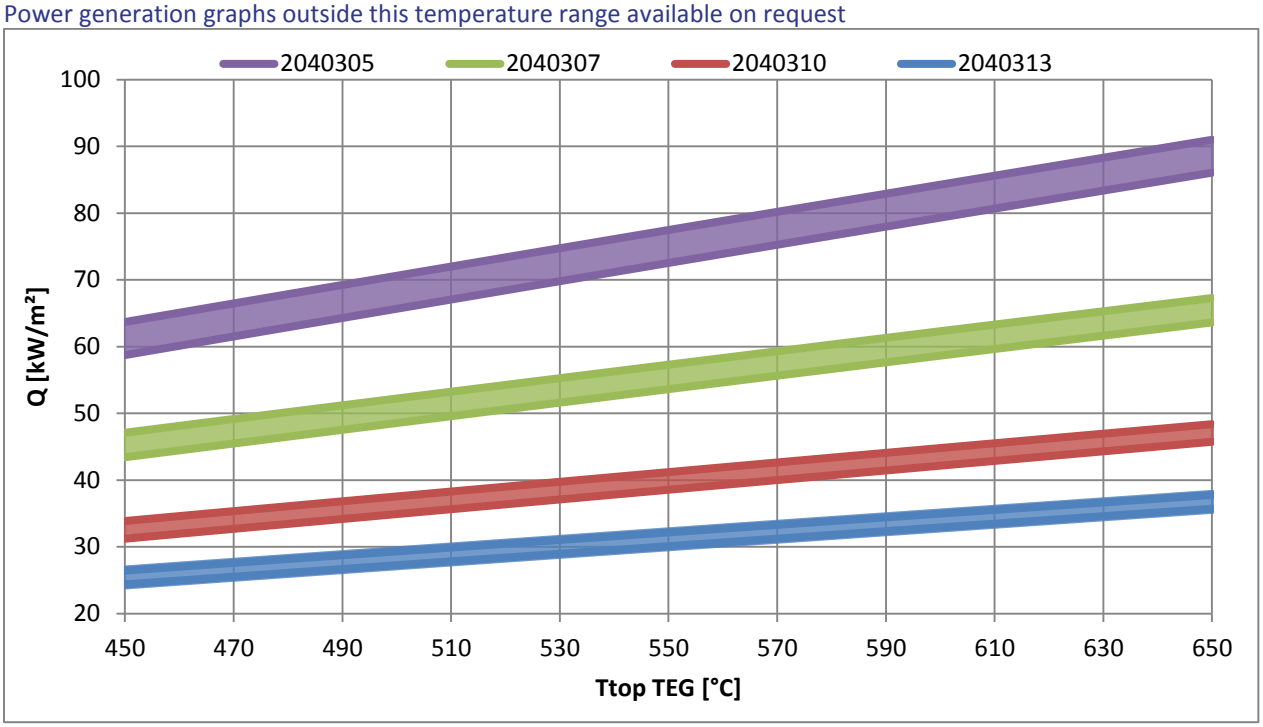


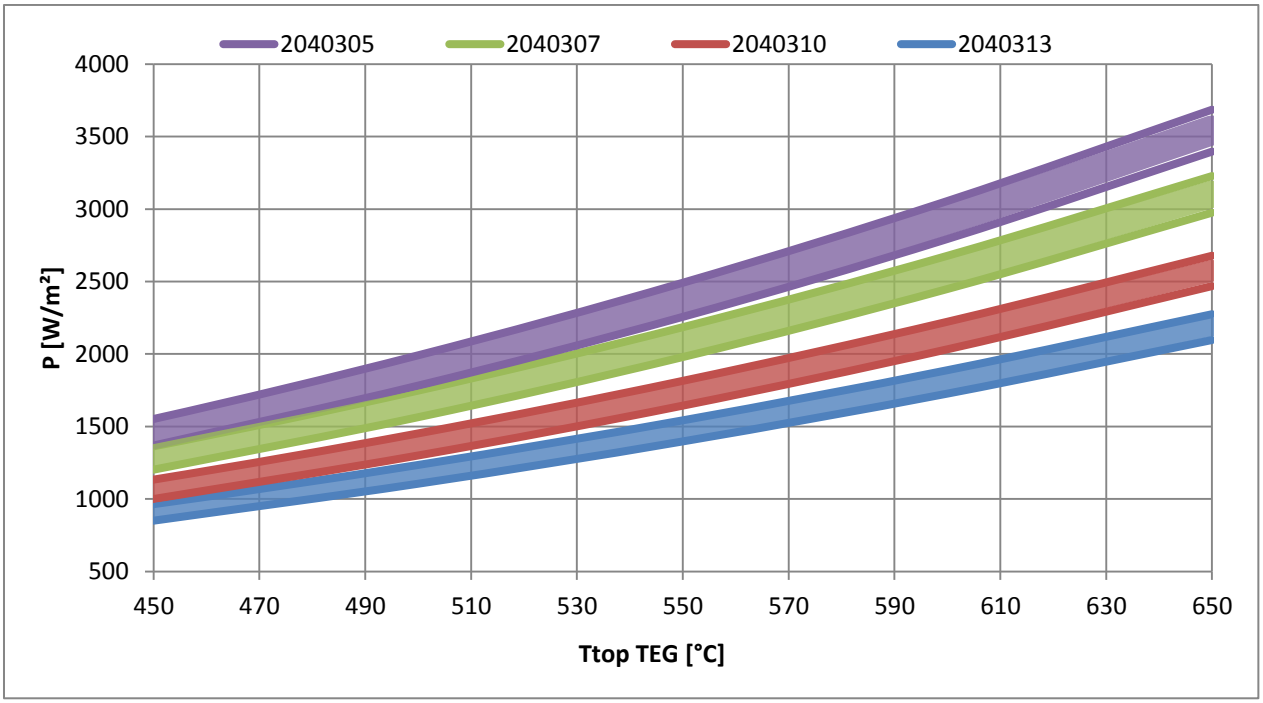
**Height can vary to 15/17/20/23mm depending on model type.*

Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl

Power generation graphs for 30°C to 60°C cooling water

Power generation graphs outside this temperature range available on request

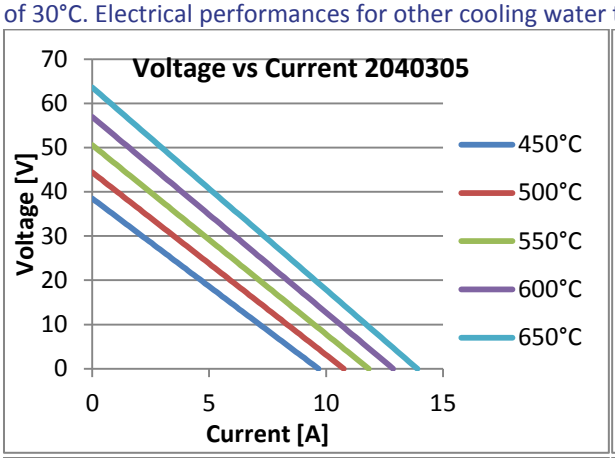


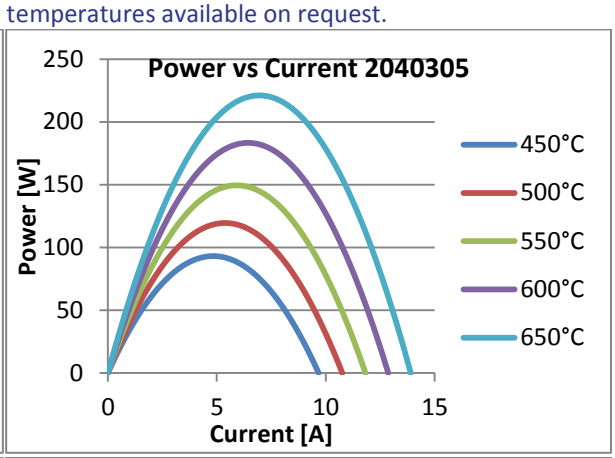


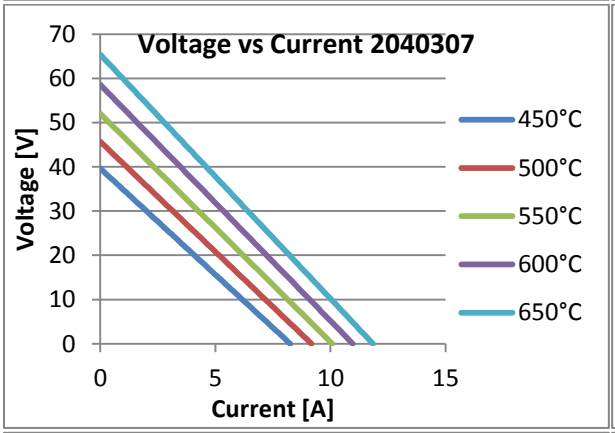
Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl

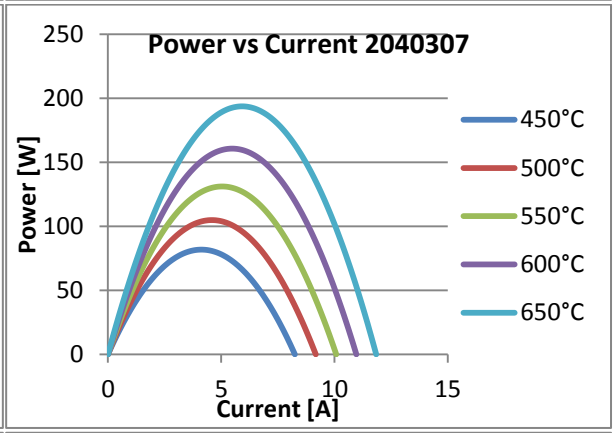
Electrical performance

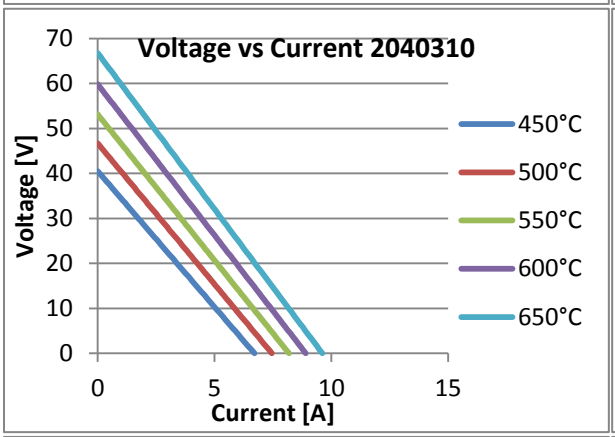
The following graphs show the voltage and power output for different TEG temperatures and a water temperature of 30°C. Electrical performances for other cooling water temperatures available on request.

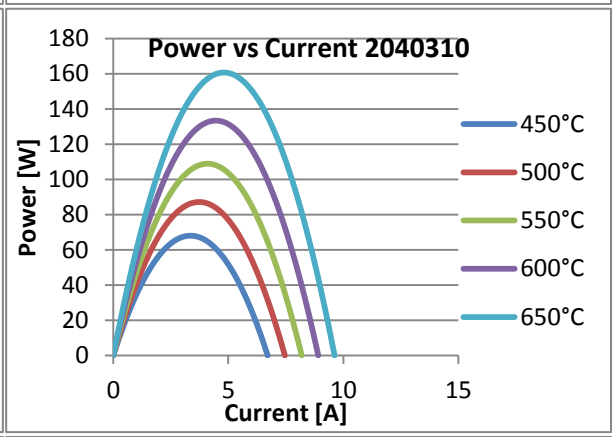


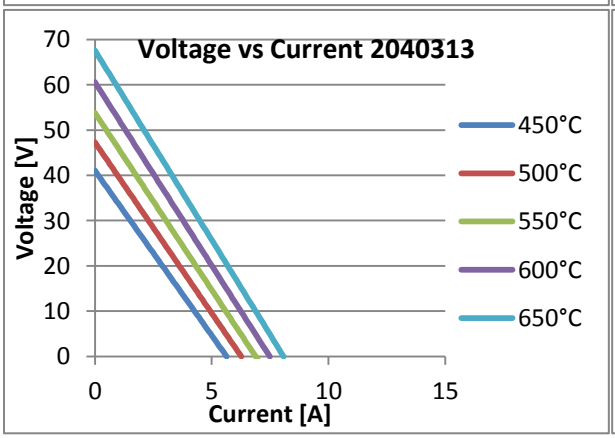


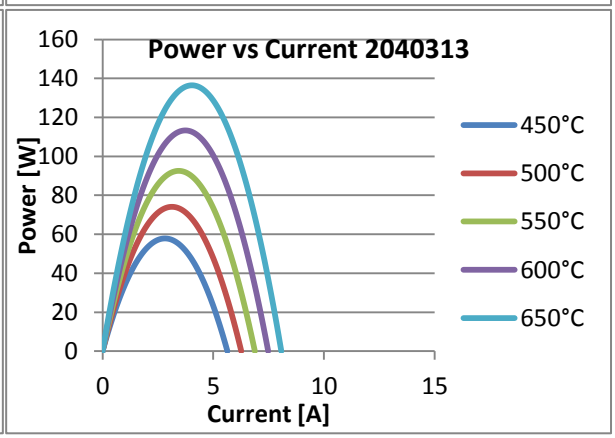












Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl

System application design guidelines

Depending on the desired purpose for the captured heat in the cooling water, it is necessary to choose a model that fits these expectations. The graph shows a window of the Thermagy™ power panel work fields.

Example: How to apply the graphs for system design

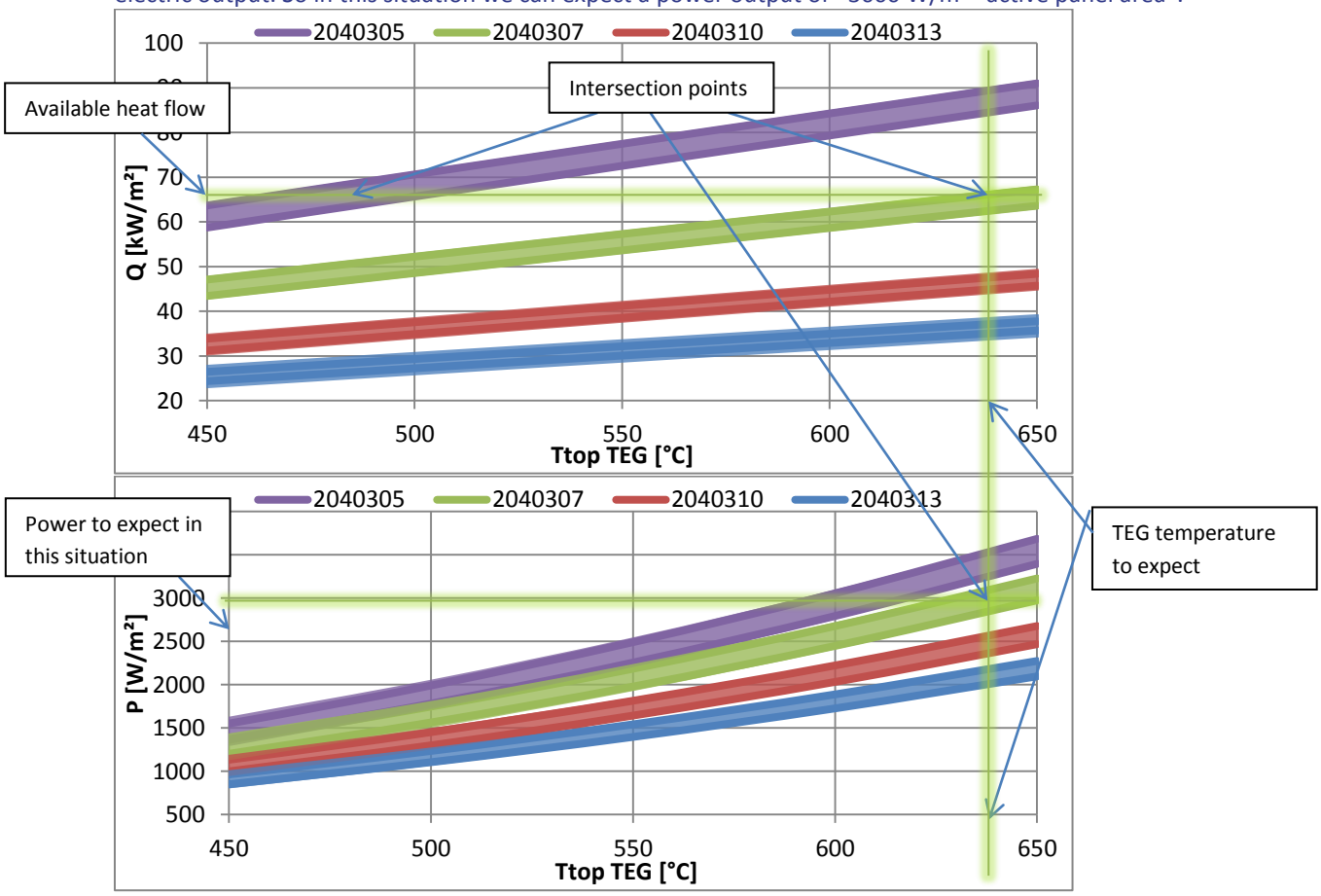
1) Check/measure/calculate the available heat flow from your system through the Thermagy™ power panel surface in dependence of the Thermagy™ power panel top temperature;
2) Draw a horizontal line from the available heat flow through the graph;
3) Check if there is an intersection with one or more of the model lines, choose the one with the highest temperature on the X-axis (the Thermagy™ power panels work the most efficient at high temperature);
4) Draw from this intersection a vertical line through both graphs;
5) Check in the other graph the intersection with the line of the same model;
6) Draw from this intersection a horizontal line to determine the electrical power generation.

Example

A radiating source of ~975°C with an emissivity coefficient of 0,75 to Thermagy power module of ~640°C and an emissivity coefficient of 0,95 and no need of a protective plate with a view factor of 0,95. The heat flow in this situation can be calculated with:

"$Q= S*\beta*\varepsilon*(T_{source}^4-T_{receiver}^4)$" = 0,95* 5,670373·$10^{-8}$*(0,95*0,75)*($975^4$-$640^4$)=66 kW/$m^2$

In this example we have an heat flow of 66 kW/m^2 to our availability, which has two intersection points (2040305 and 2040307). We choose the intersection with the green line of the 2040307 model because this one is working on a higher top temperature. In the power graph we see the vertical line crosses the 2040307 line at 3000 W/m^2 electric output. So in this situation we can expect a power output of ~3000 W/m^2 "active panel area".



Phone: +31 226 332 950 Email: sales@rgsdevelopment.nl Website: www.rgsdevelopment.nl