

Effect of Particle Size and Reactor Design on Performance of Salt Impregnated Matrix Materials for Thermochemical Storage of Solar Energy

Sara Walsh

UKES 2019

 info_specific

 ActiveBuildings

 GenerateStoreRelease



A Story from Small to Large Scale...

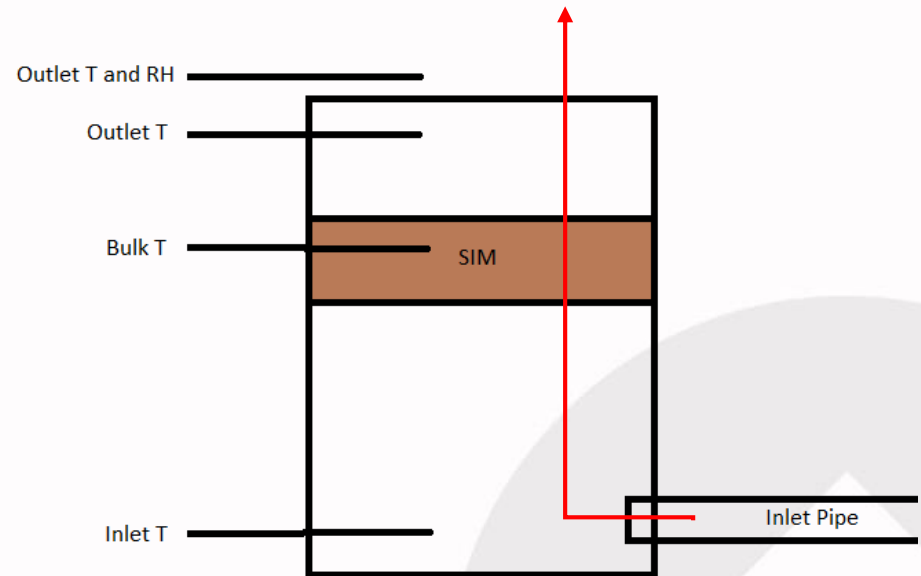


↗ Effect of
Particle Size
and Bed
Depth on
Performance-
Ernie



Ernie Parametric Study

- Variation of particle size, depth, and flow rate
- Salt In Matrix (SIM)
 - 2:1 Calcium chloride: vermiculite
- Particle size determination:
 - Small: Approx. 2mm
 - Medium: Approx. 4mm
 - Large: Approx. 6mm
- Flow rate, relative humidity, and temperature measured across reactor

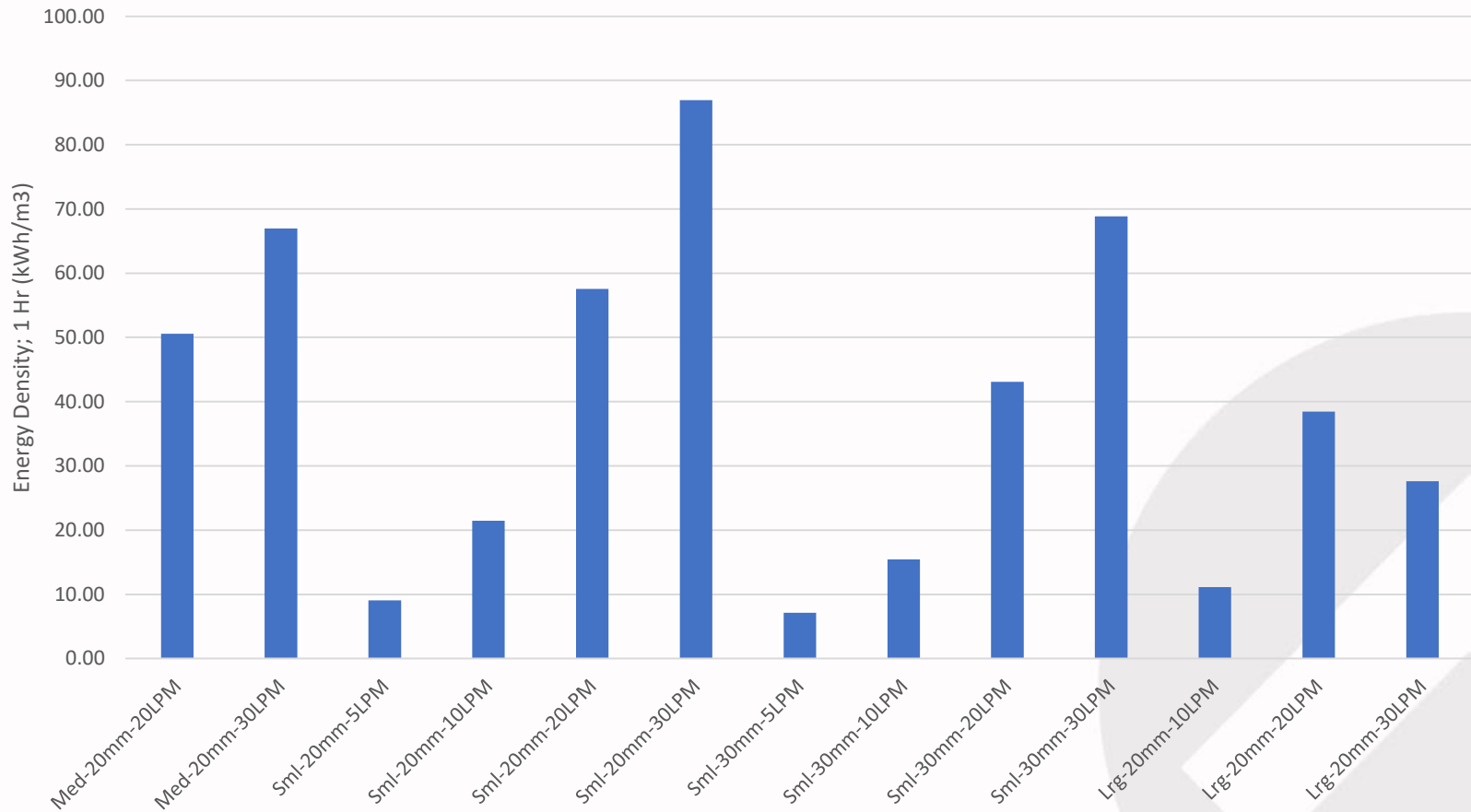


Ernie Parametric Study

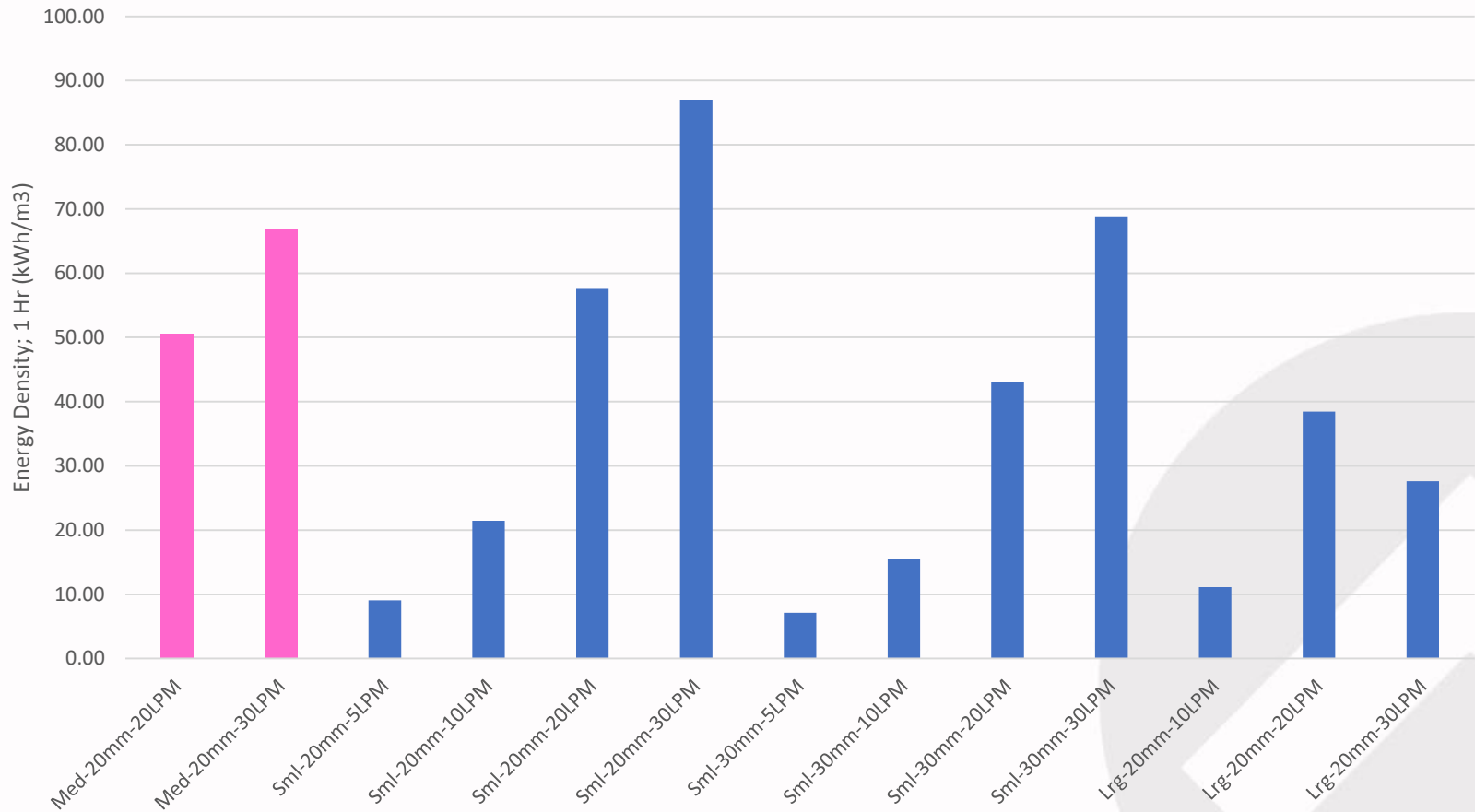
		<u>Volumetric Flow Rate</u>			
<u>Particle Size</u>	<u>Bed Depth</u>	5 L/min	10 L/min	20 L/min	30 L/min
Small	20mm	Completed w/ Repeatability	Completed w/ Repeatability	Completed w/ Repeatability	Completed w/ Repeatability
	30 mm	Completed w/ Repeatability	Completed w/ Repeatability	Completed w/ Repeatability	Completed w/ Repeatability
Medium	20 mm	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.	Completed w/ Repeatability	Completed w/ Repeatability
	30 mm	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.
Large	20 mm	In Progress of Being Completed w/ Rep.	To Be Completed w/ Rep.	Completed w/ Repeatability	Completed w/ Repeatability
	30 mm	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.	In Progress of Being Completed w/ Rep.

Key: Completed w/ Repeatability, In Progress of Being Completed w/ Rep., To Be Completed w/ Rep.,

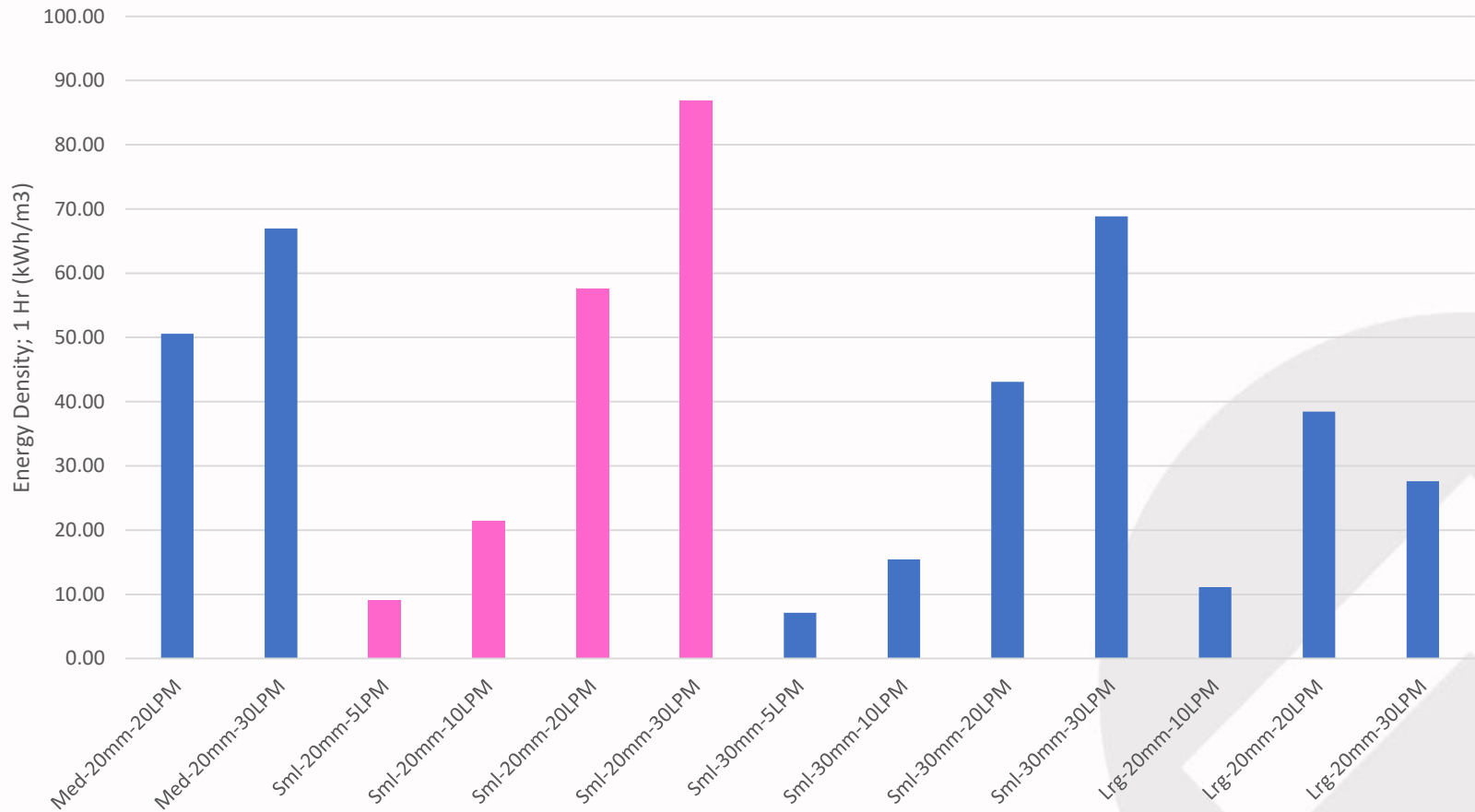
Ernie-Energy Density Comparison



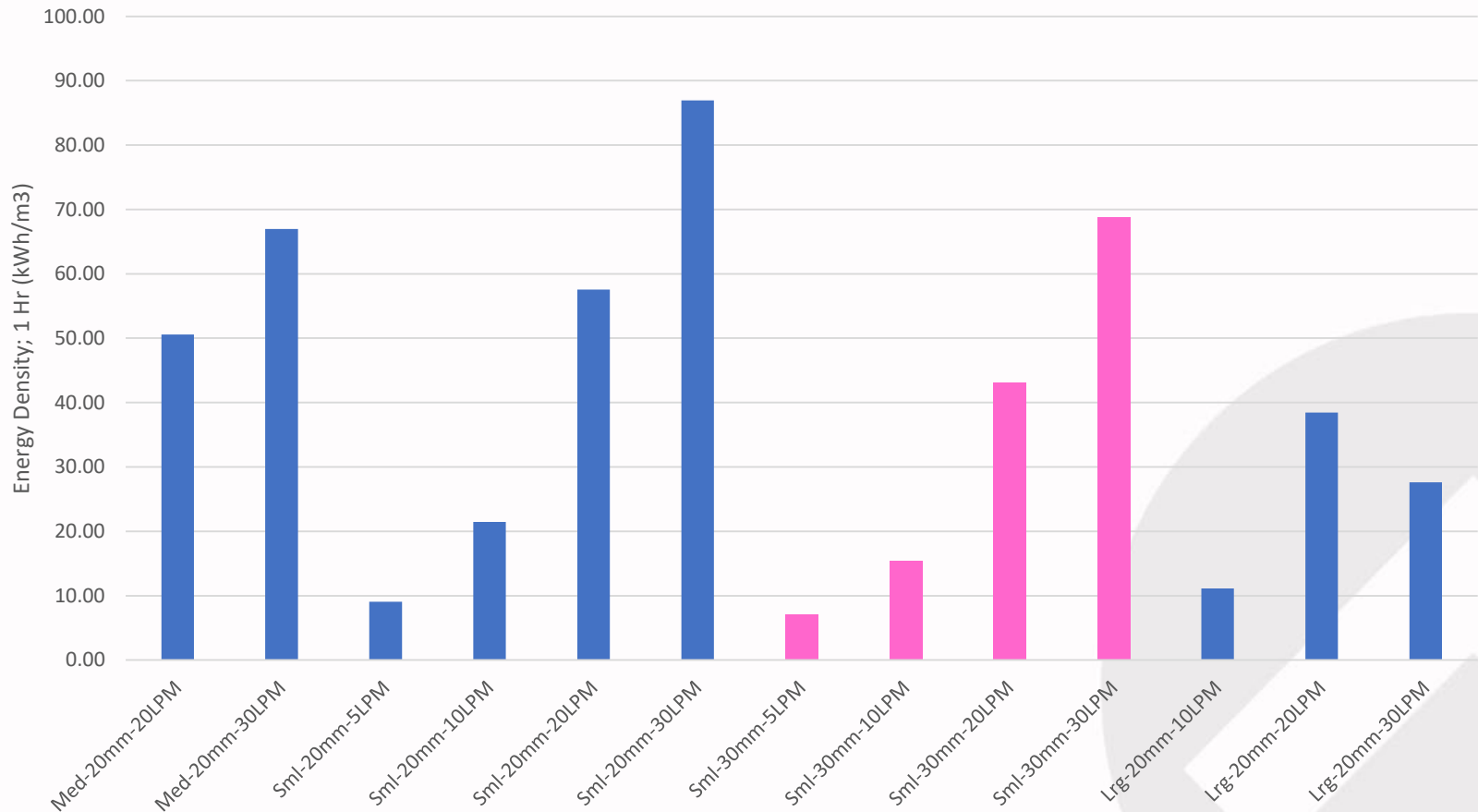
Ernie-Energy Density Comparison



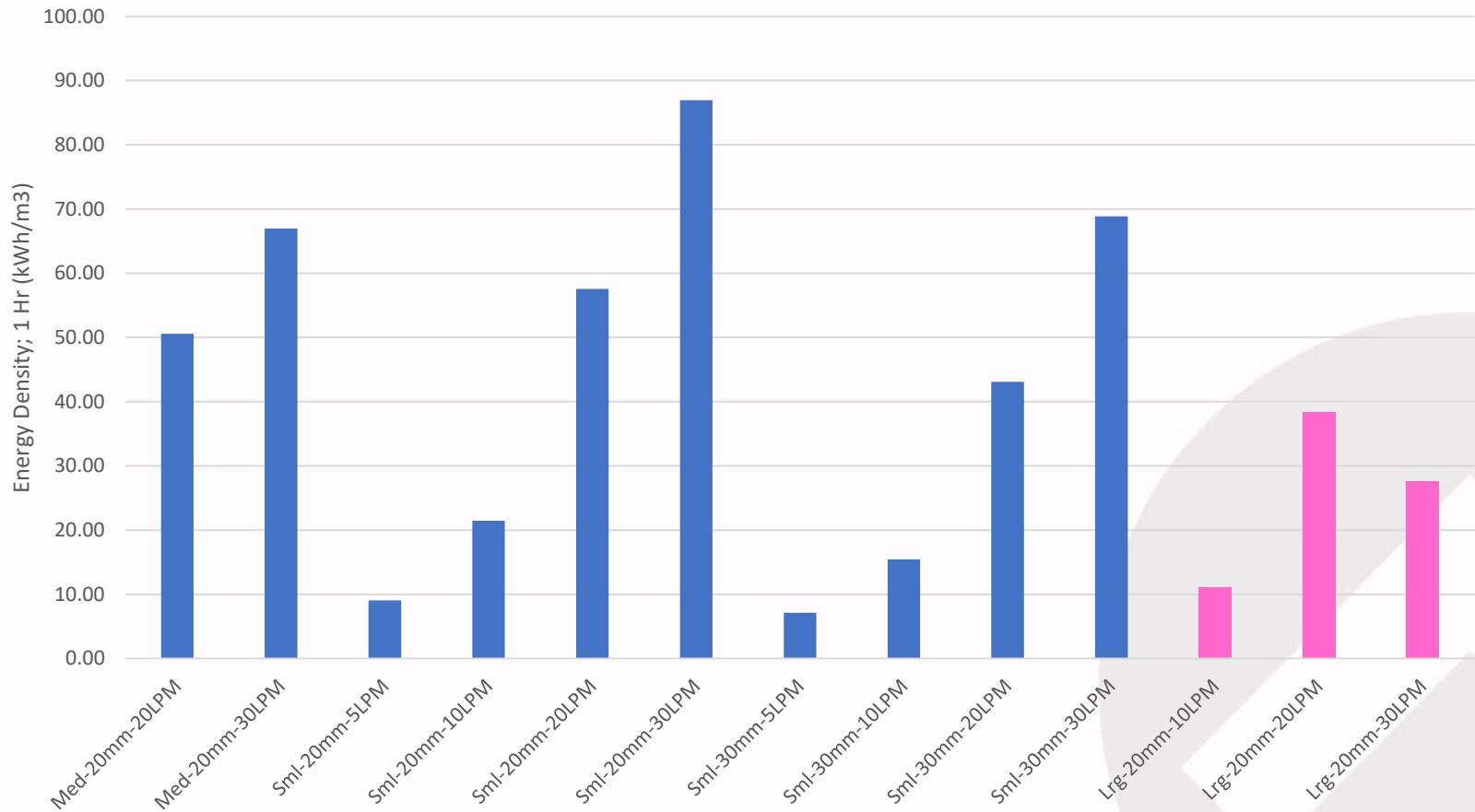
Ernie-Energy Density Comparison



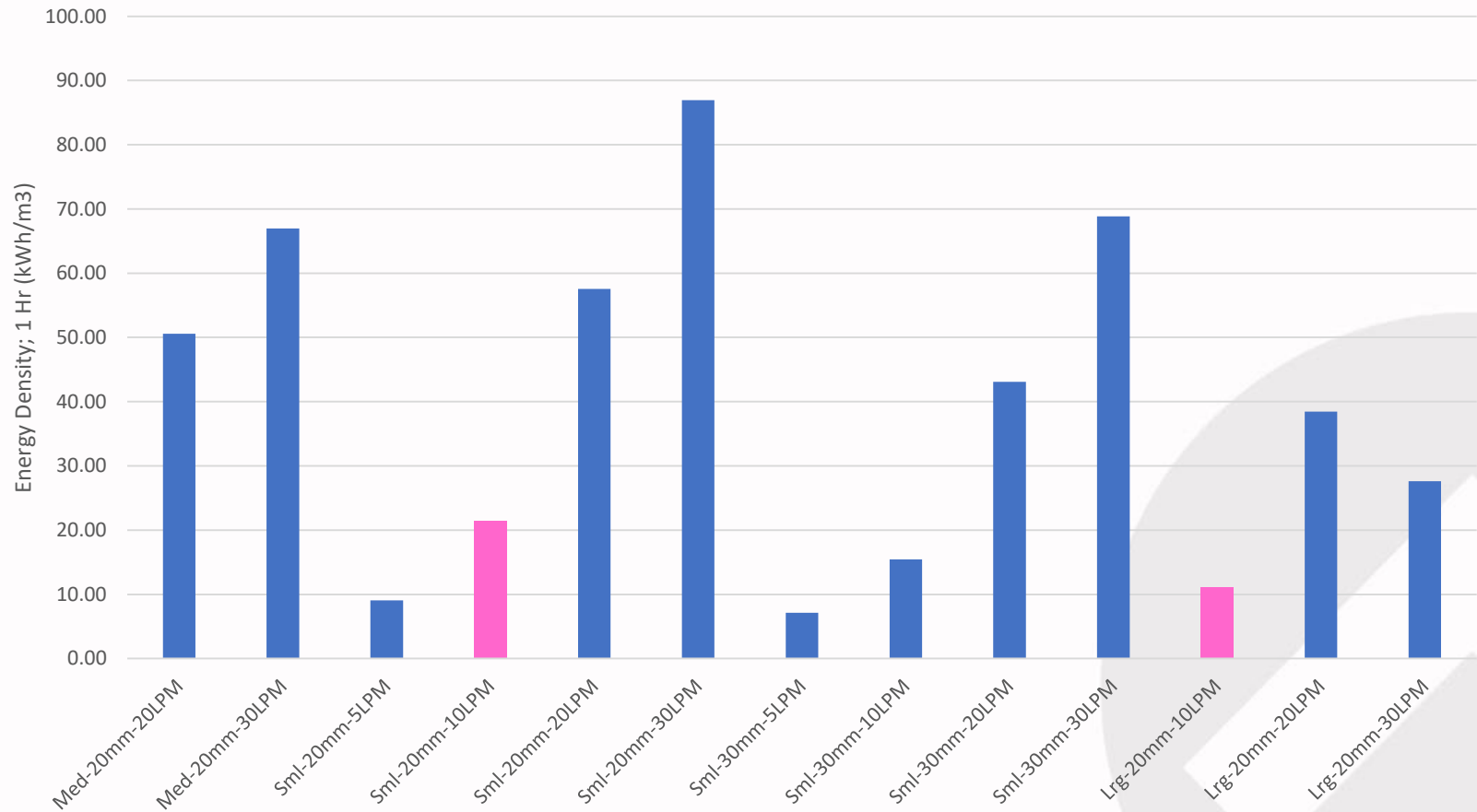
Ernie-Energy Density Comparison



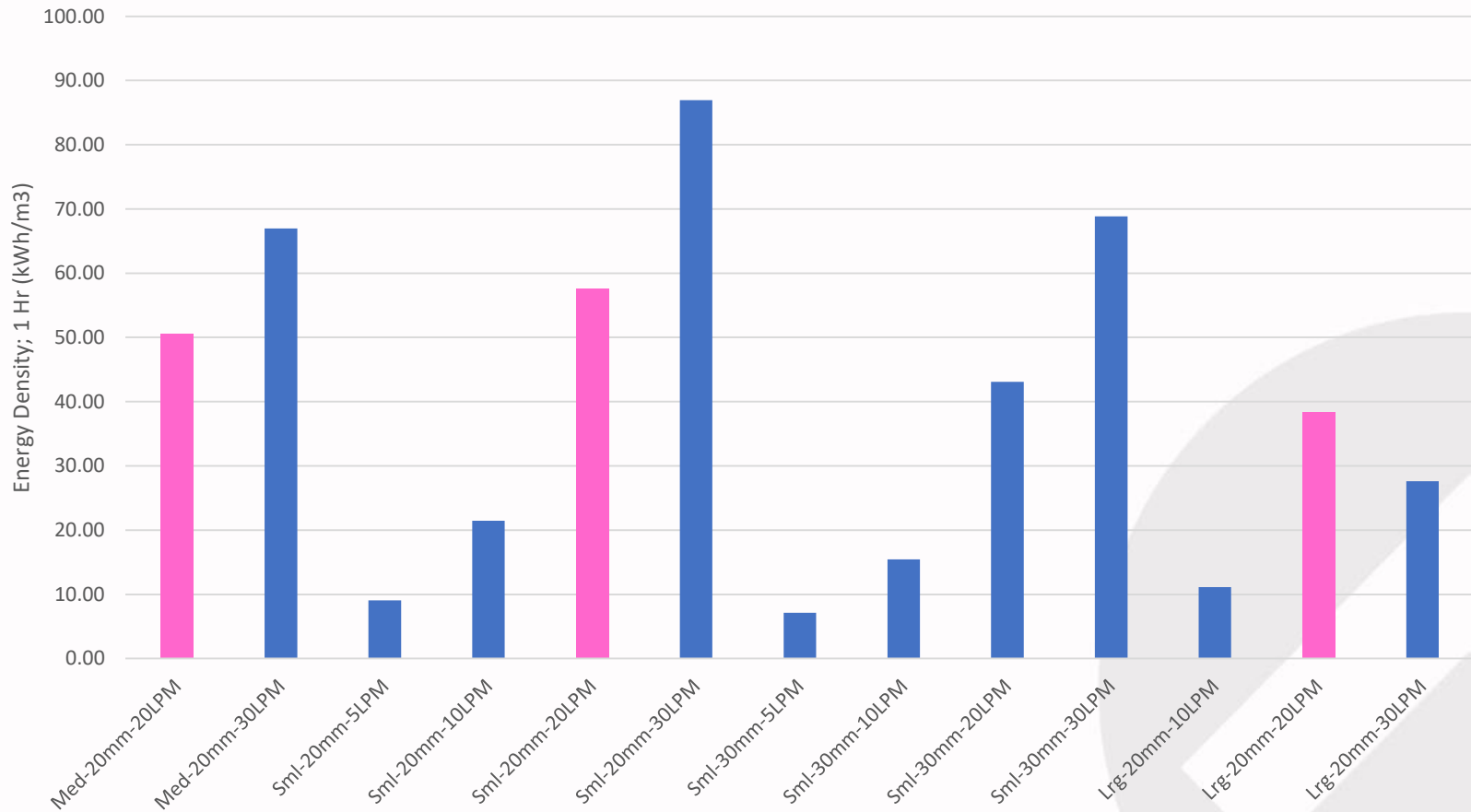
Ernie-Energy Density Comparison



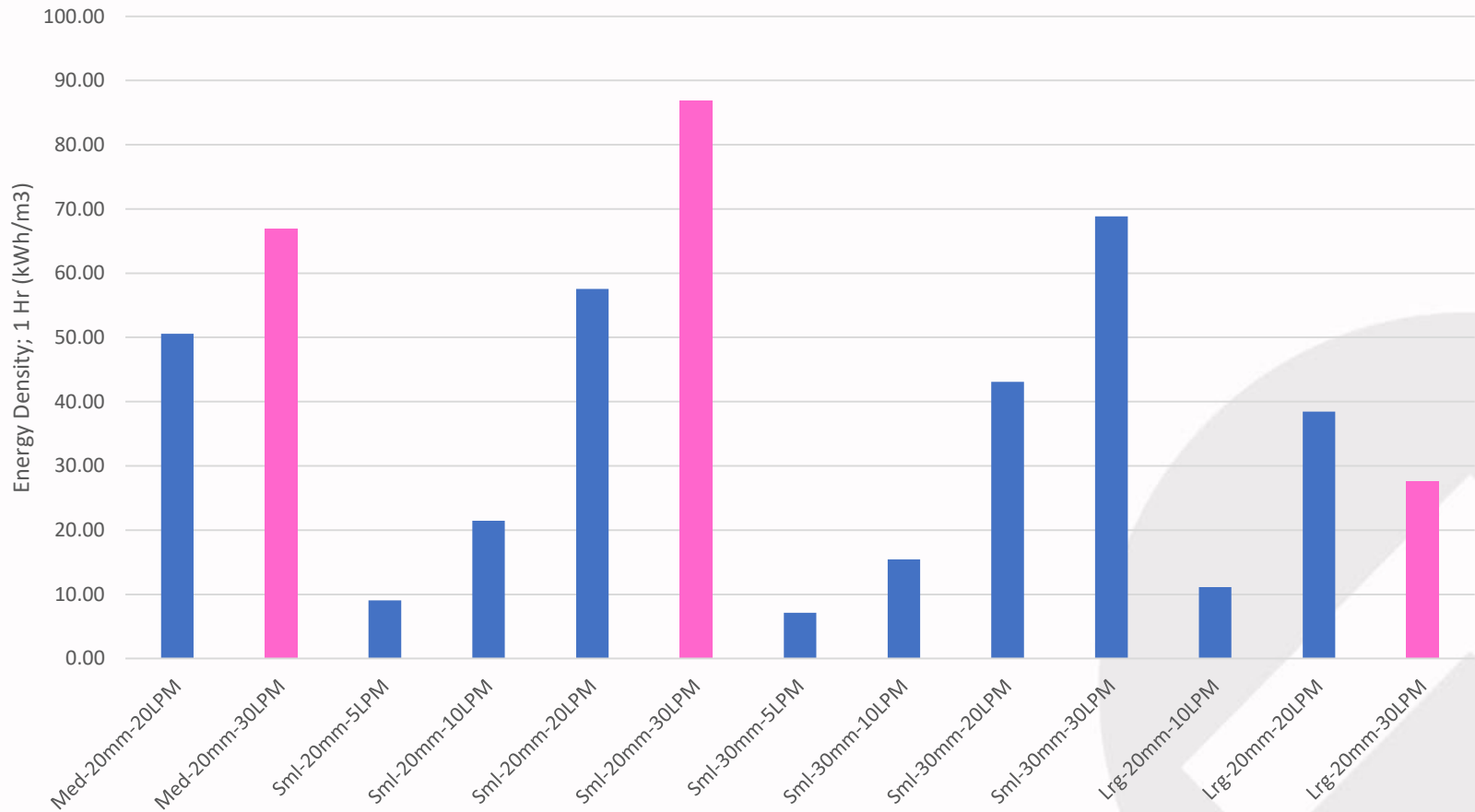
Ernie-Energy Density Comparison



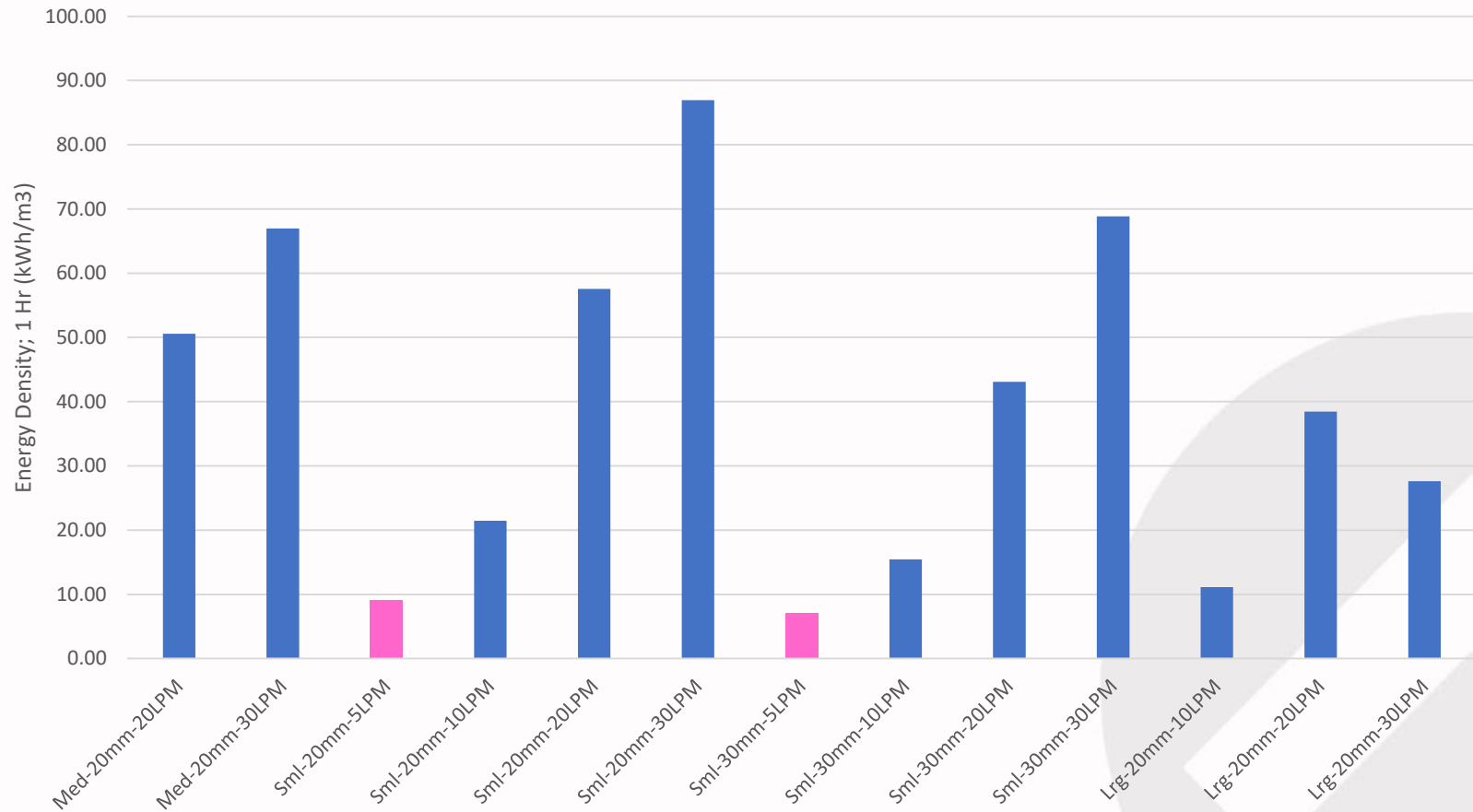
Ernie-Energy Density Comparison



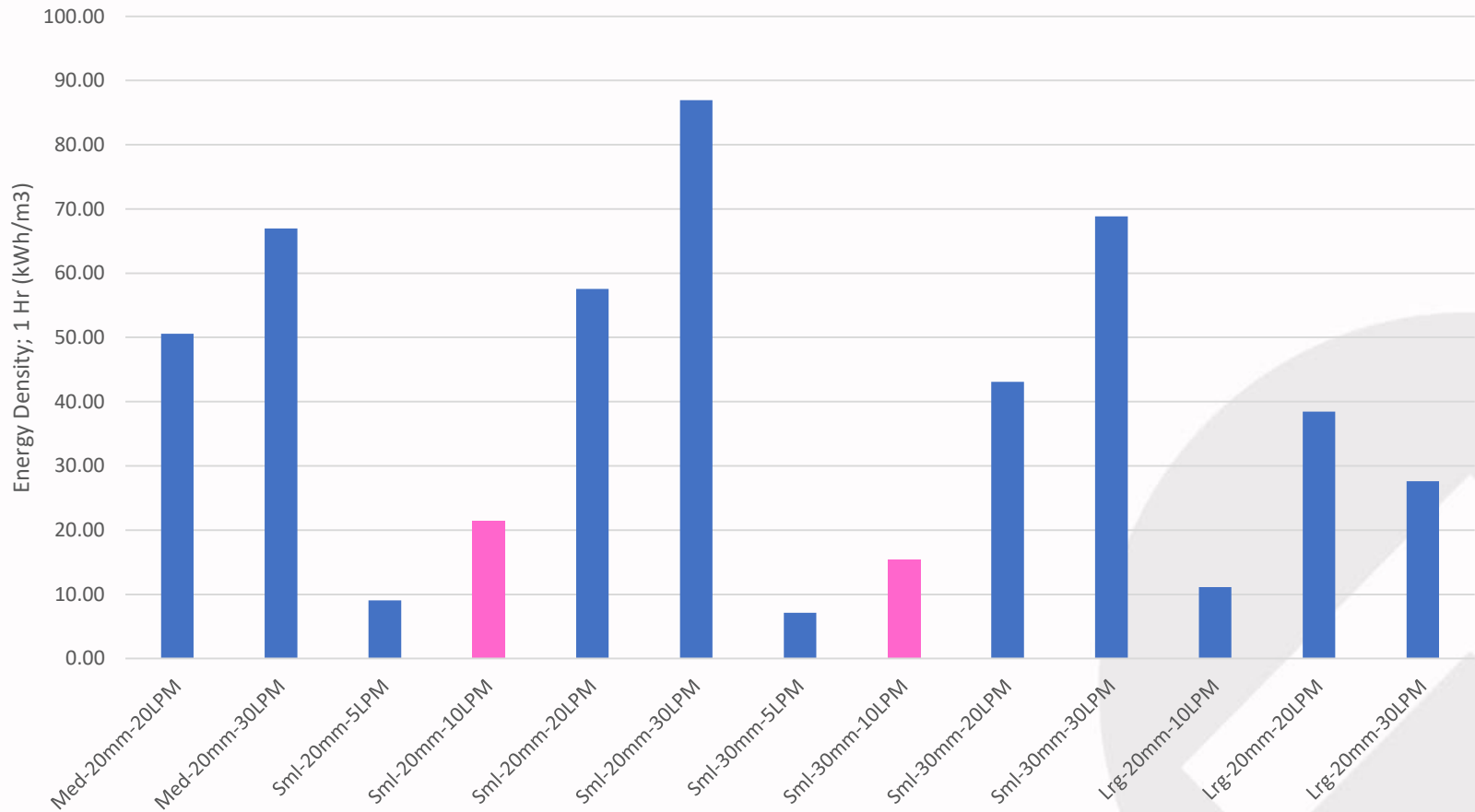
Ernie-Energy Density Comparison



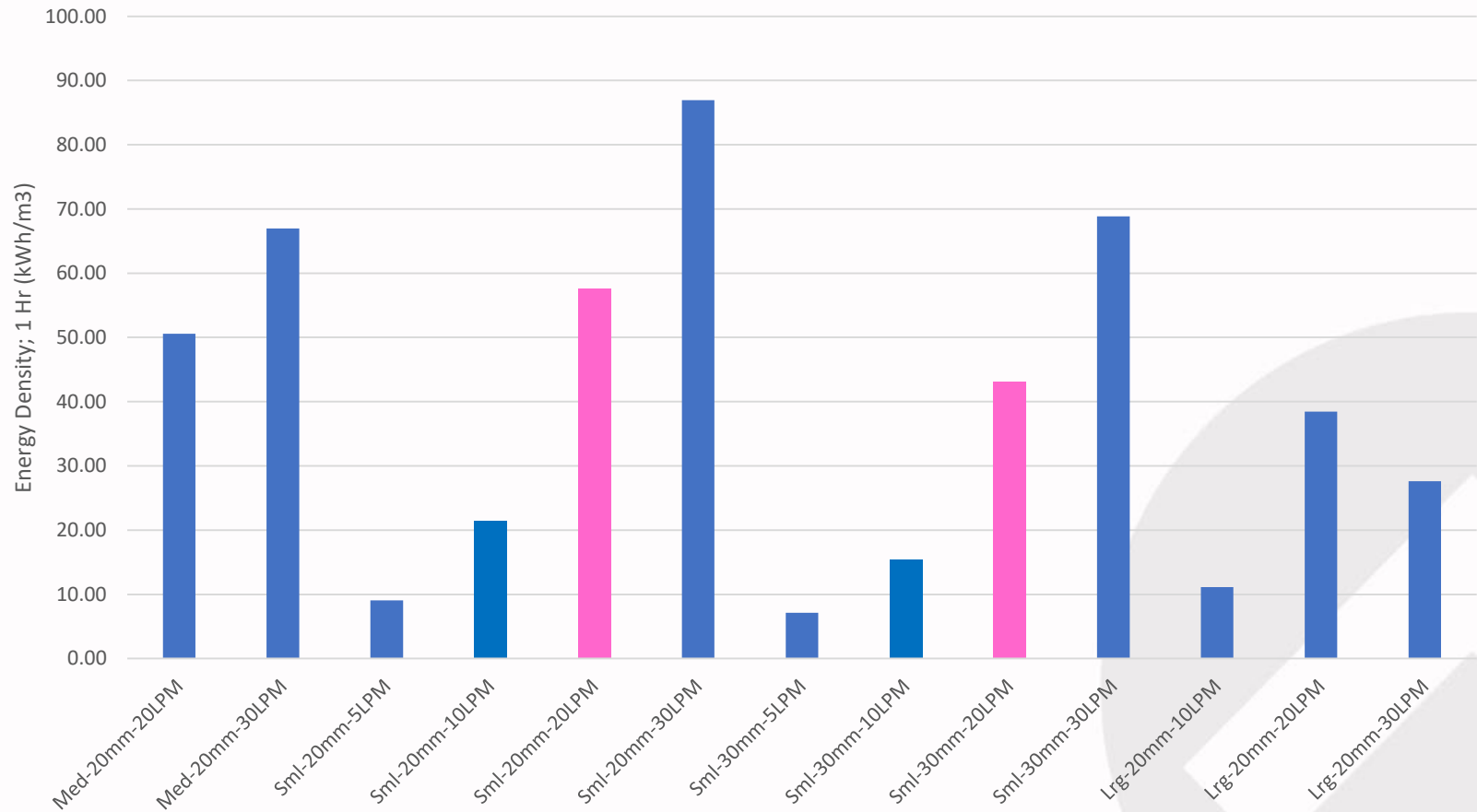
Ernie-Energy Density Comparison



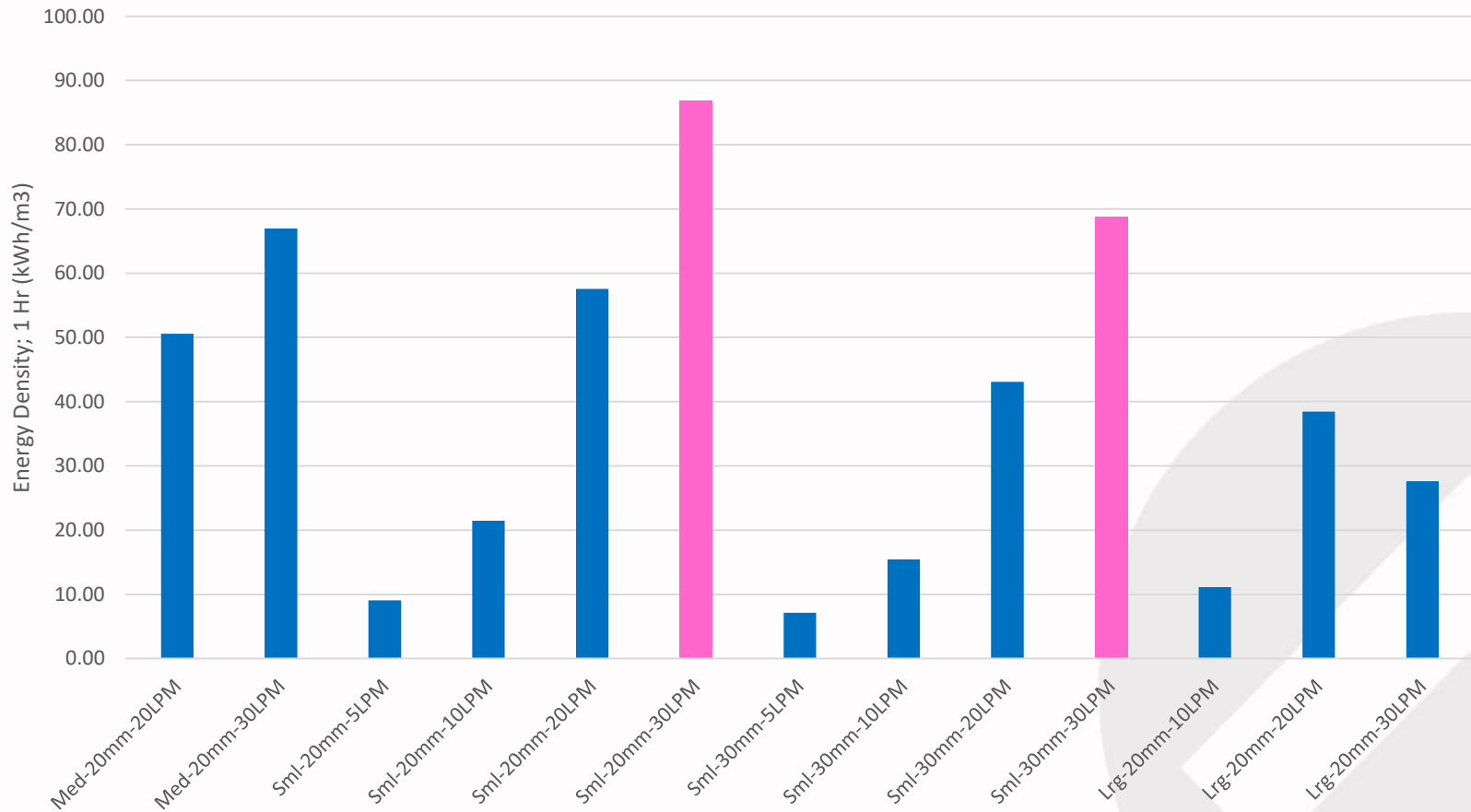
Ernie-Energy Density Comparison



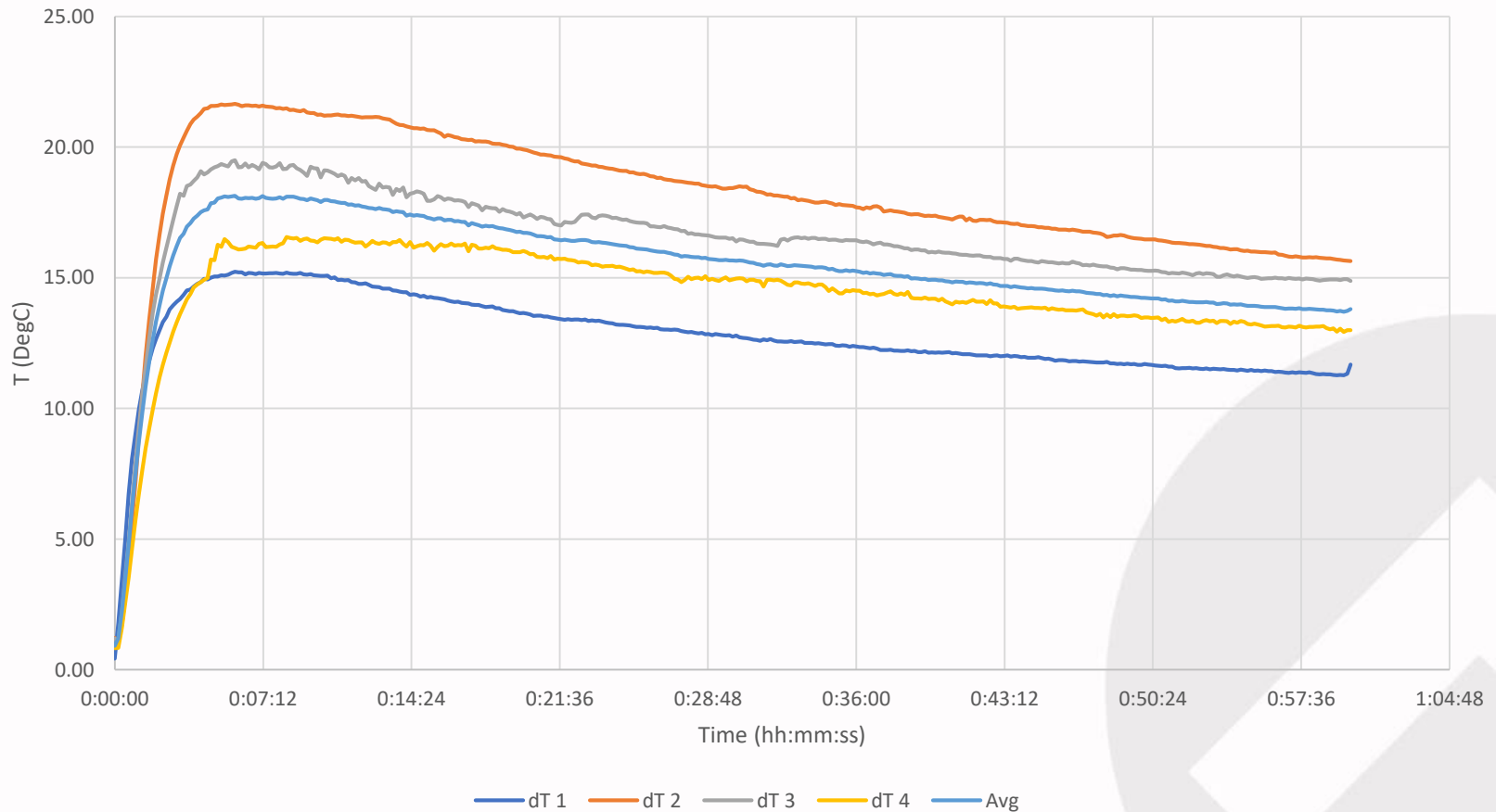
Ernie-Energy Density Comparison



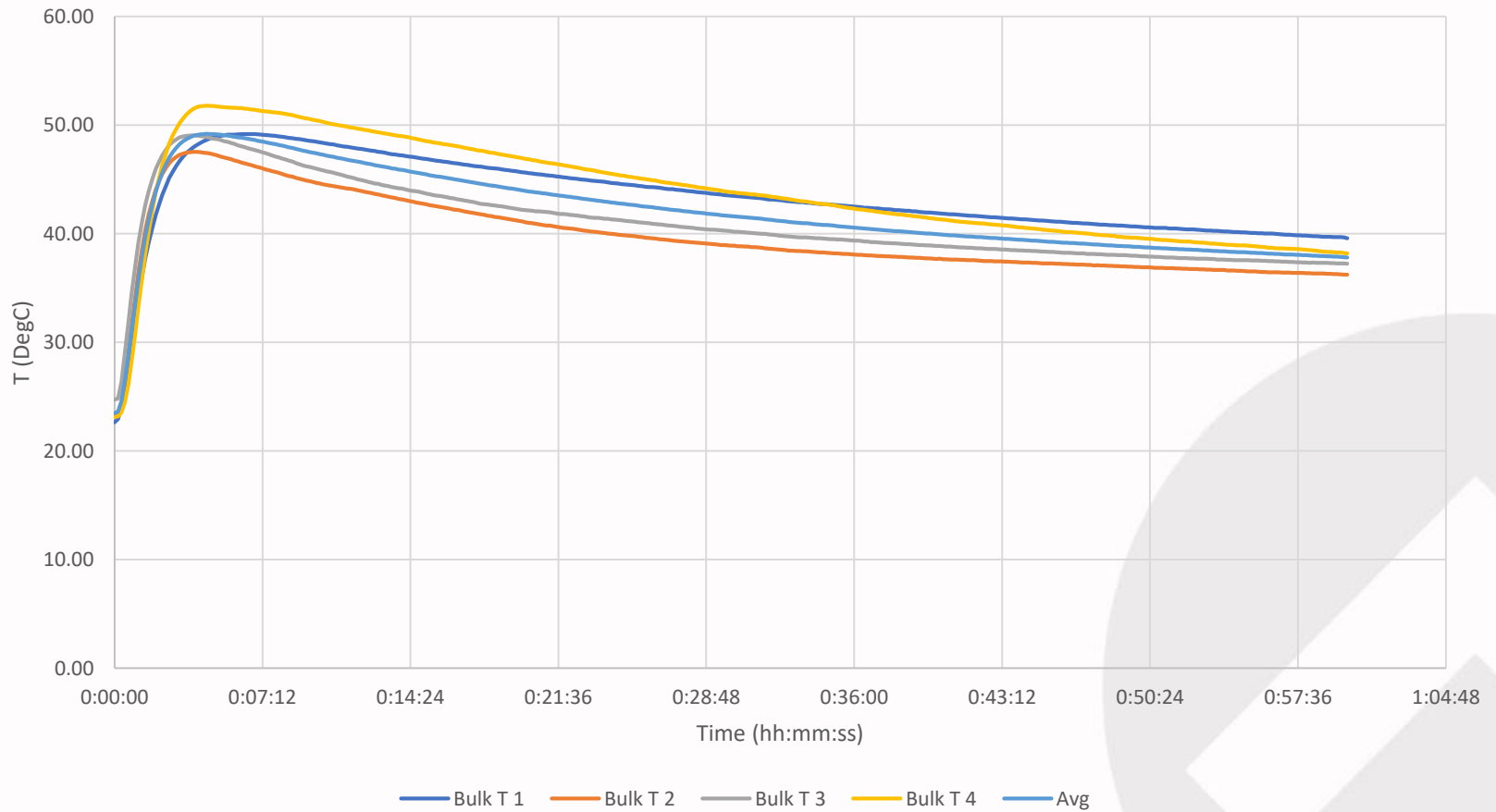
Ernie-Energy Density Comparison



Ernie- dT Repeatability



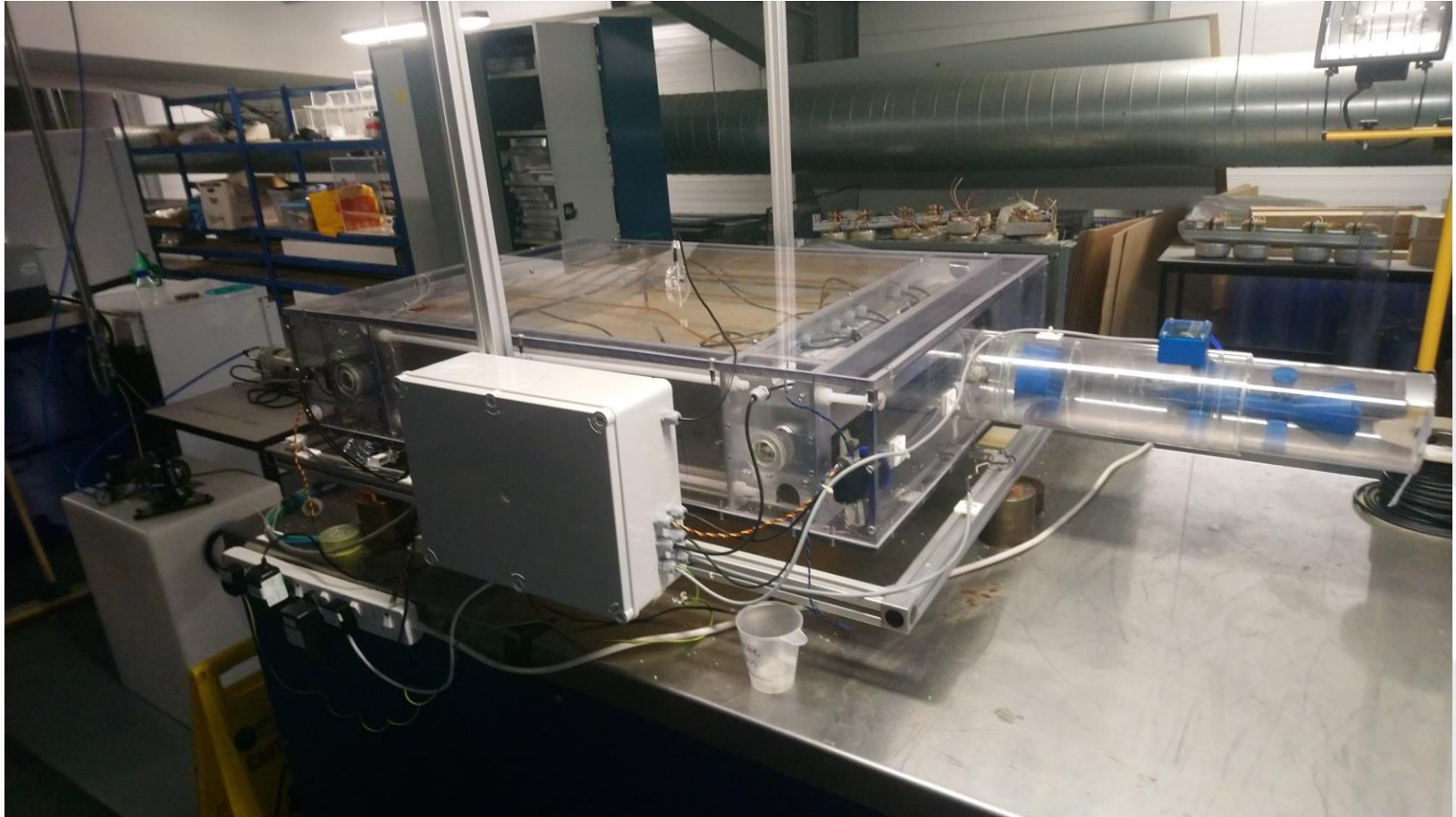
Ernie- Bulk T Repeatability



↗ Reactor
Design and
Scale Up
Effects on
Performance-
Kenny the
Cassette



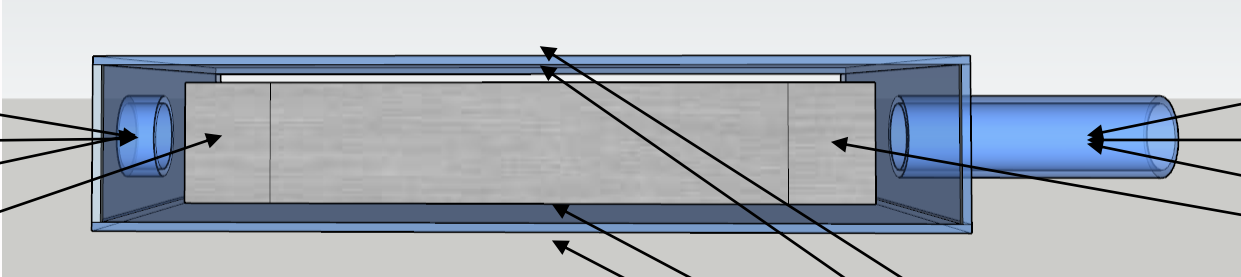
Kenny Design and Configuration



Kenny Sensor Locations

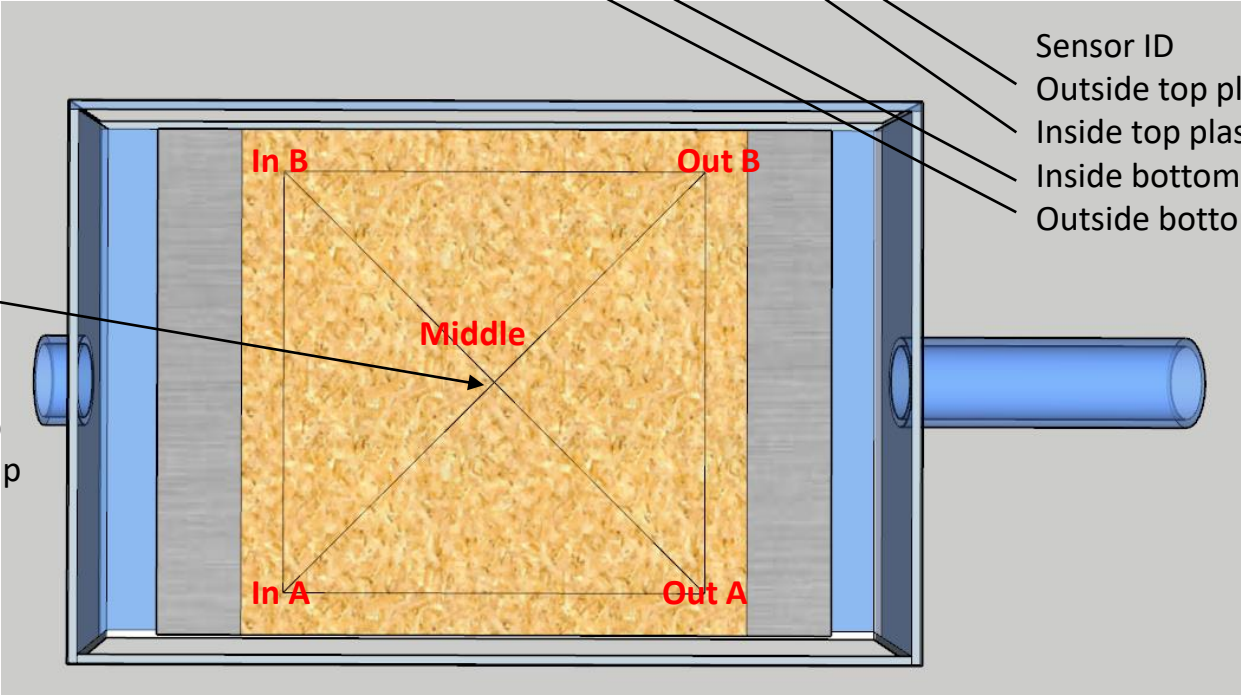


- Sensor ID
- Inlet %RH
- Inlet Temp
- Inlet airflow
- Inlet slot temp



- Sensor ID
- Outlet %RH
- Outlet Temp
- Outlet airflow
- Outlet slot temp

- Sensor ID
- Tray Centre temp
- Tray top left temp
- Tray top right temp
- Tray bottom left temp
- Tray bottom right temp
(only one indicated)

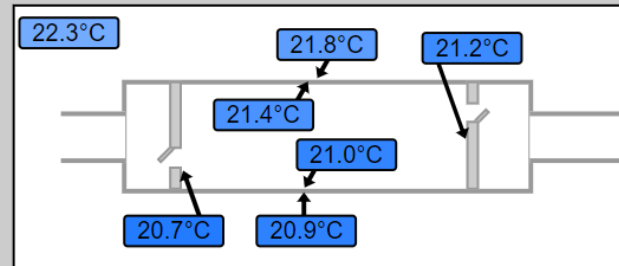
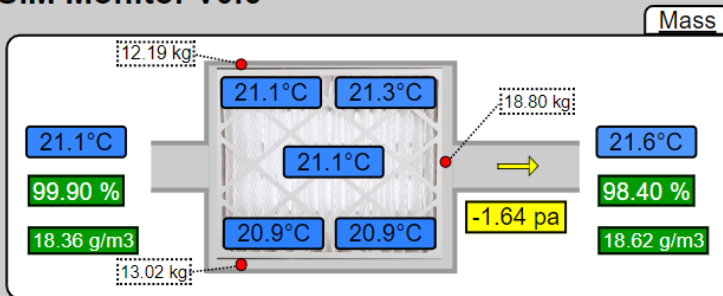


- Sensor ID
- Outside top plastic temp
- Inside top plastic temp
- Inside bottom plastic temp
- Outside bottom plastic temp

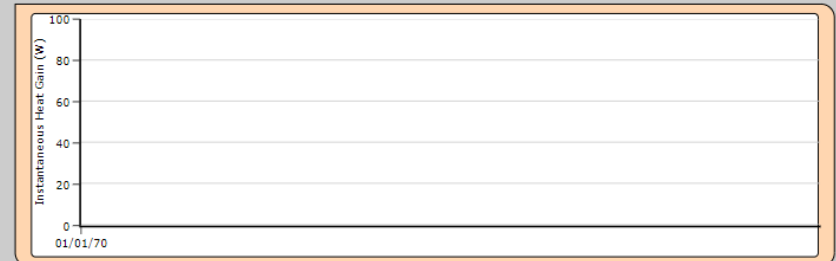
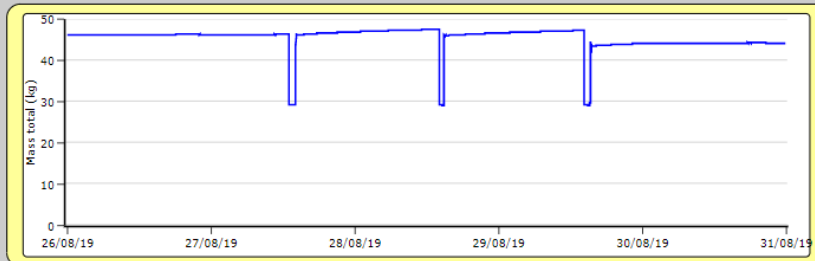
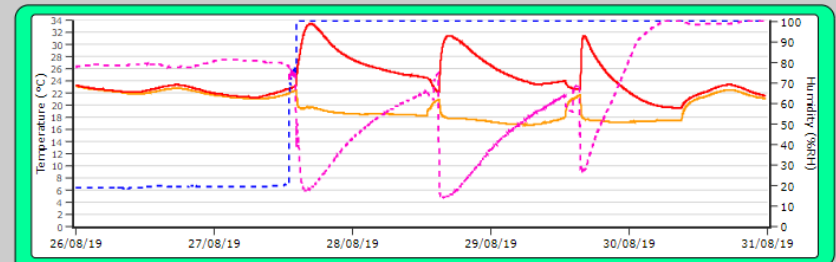
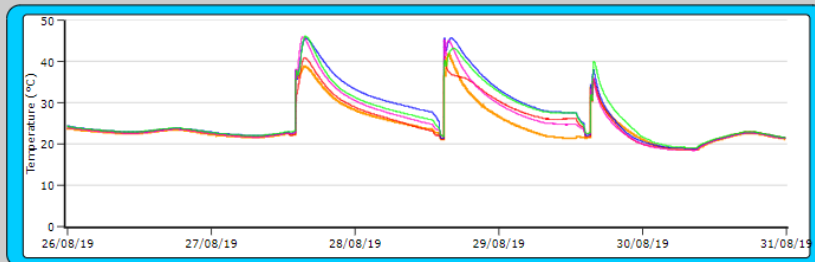
Kenny Data logging and Controls

SIM Monitor v0.6

Device status: **Ready**



Temp average in SIM (°C):	21.05
Temp change (Δ °C):	0.50
Humidity change (Δ %RH):	-1.50
Mass flow rate (g / ms-1):	0.00
Tare mass (kg):	6.38



Download all

2019-08-26T00:00:00/2019-08-30T23:59:59

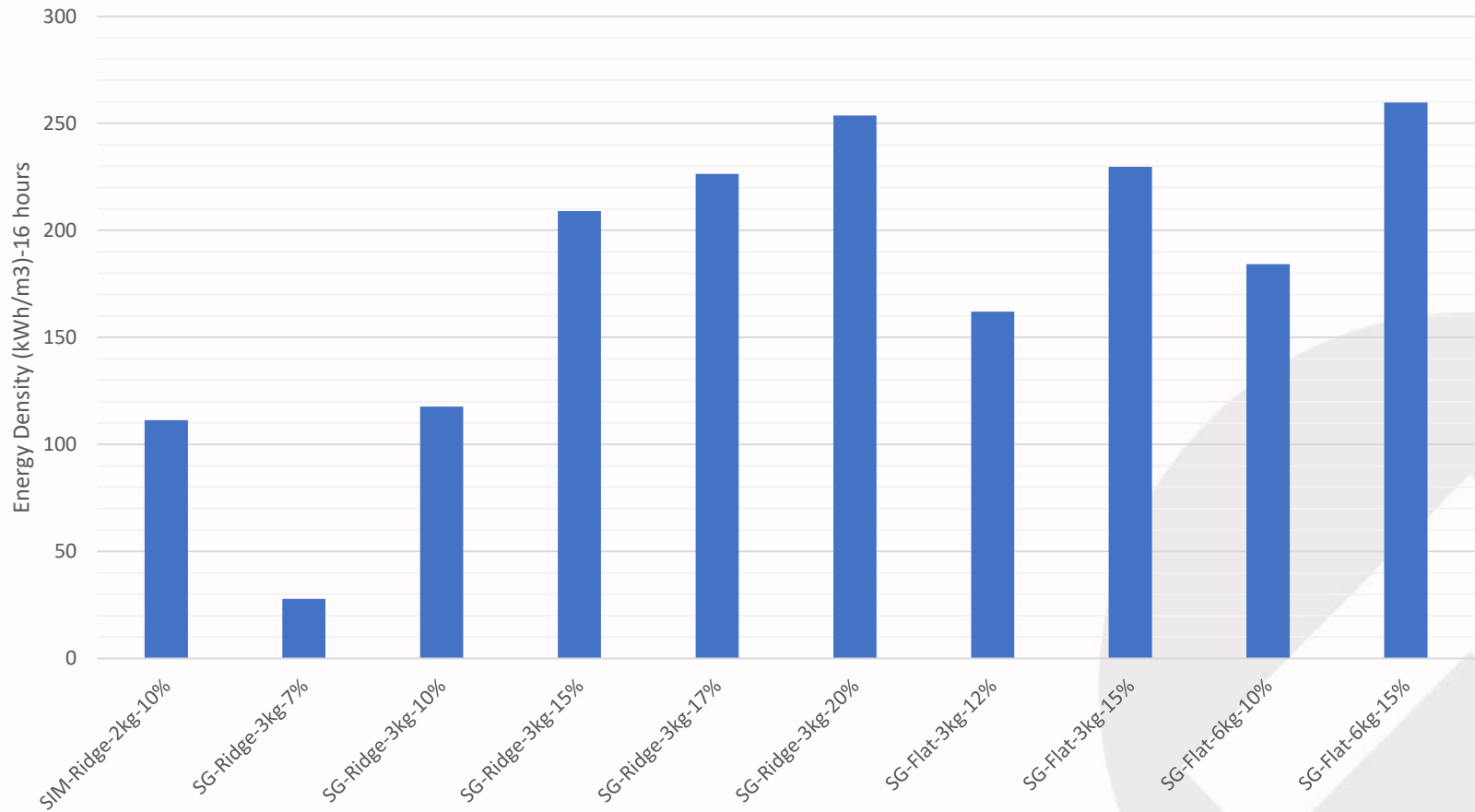
Reload

Kenny Initial Parametric Study

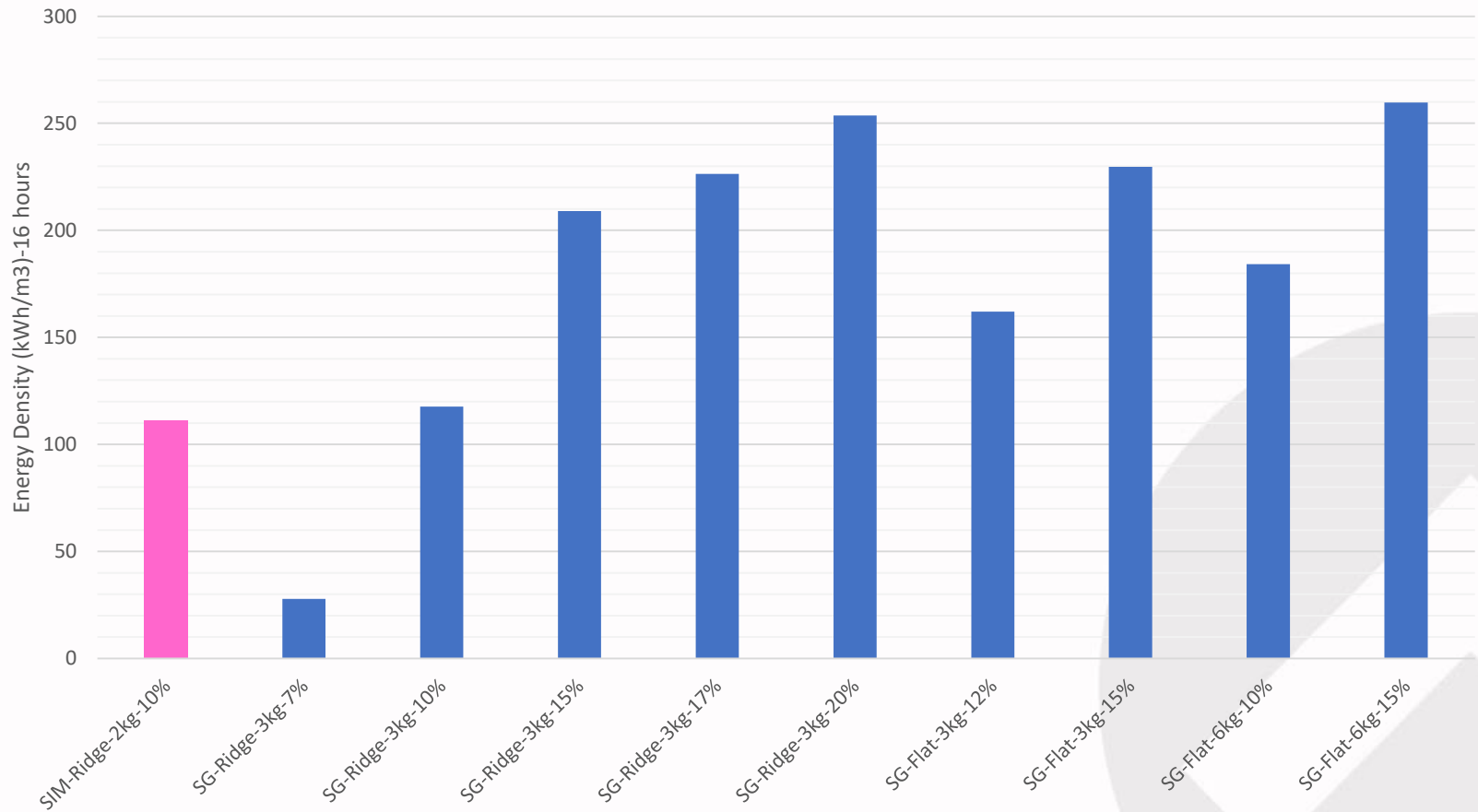
Material	Tray	Loading	Fan Speed					
			7%	10%	15%	20%	25%	30%
Silica Gel	Ridges	3 kg	Completed Once	In Progress of Being Completed w/ Rep.	Completed w/ Repeatability	In Progress of Being Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once
		3 kg	Completed Once	To Be Completed w/ Rep.	In Progress of Being Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once
	Flat	6 kg	Completed Once	Completed w/ Repeatability	Completed w/ Repeatability	To Be Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once
		9 kg	Completed Once	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once
SIM	Ridges	3 kg	Completed Once	Completed Once	Completed Once	Completed Once	Completed Once	Completed Once
	Flat	3 kg	Completed Once	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once
		6 kg	Completed Once	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	To Be Completed w/ Rep.	Completed Once

Key: Completed w/ Repeatability, In Progress of Being Completed w/ Rep., To Be Completed w/ Rep., Completed Once, To Be Completed Once

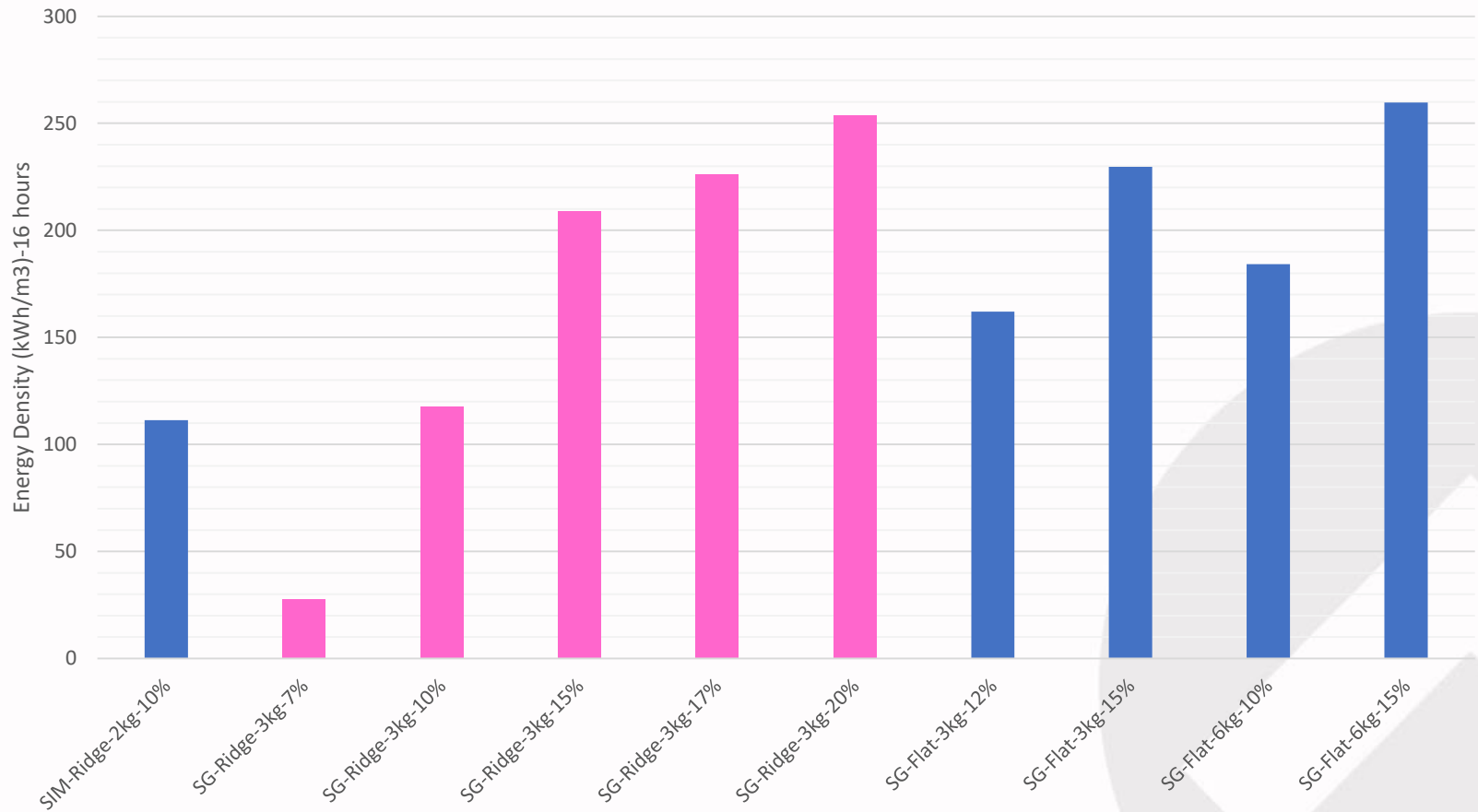
Kenny- Energy Density Comparison



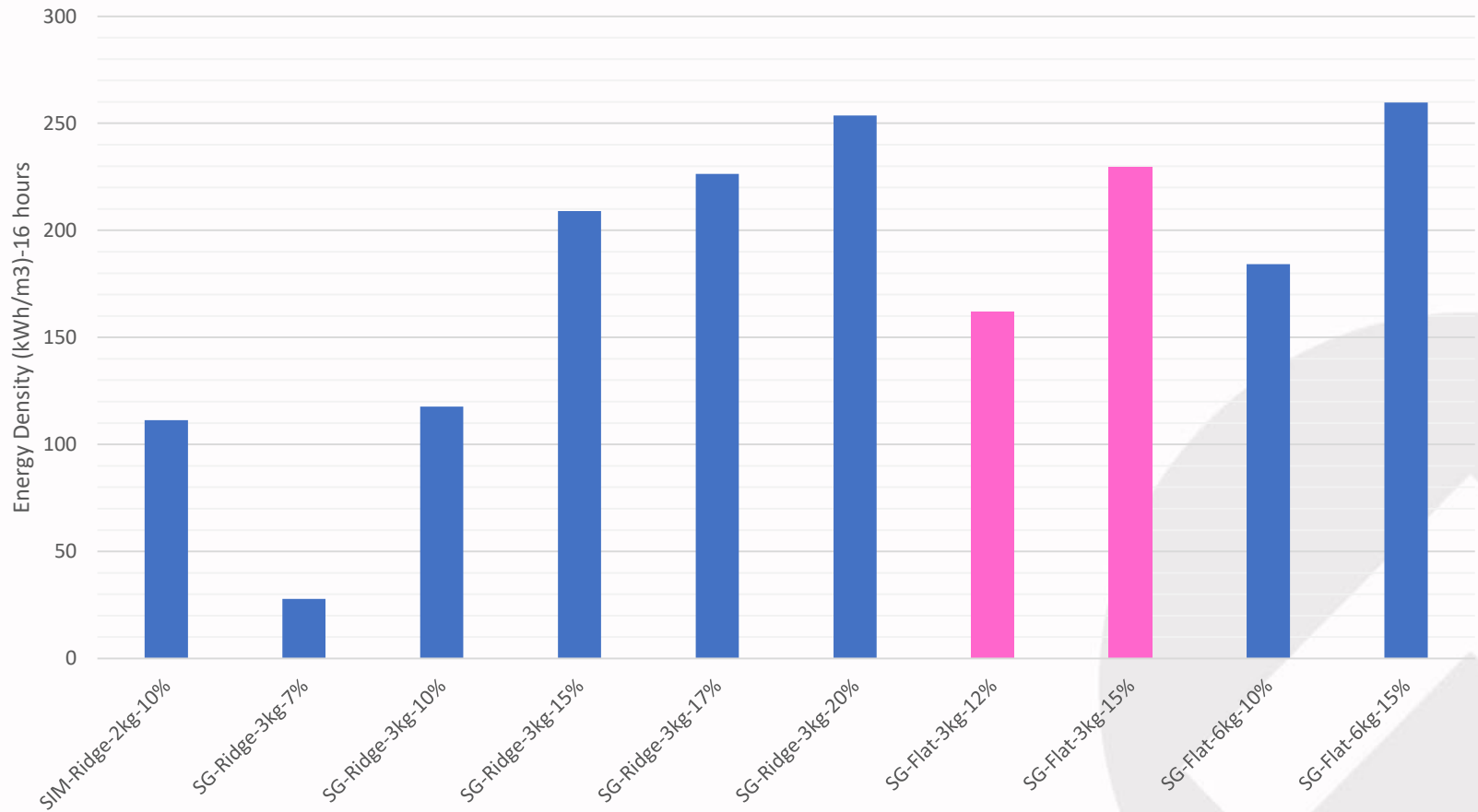
Kenny- Energy Density Comparison



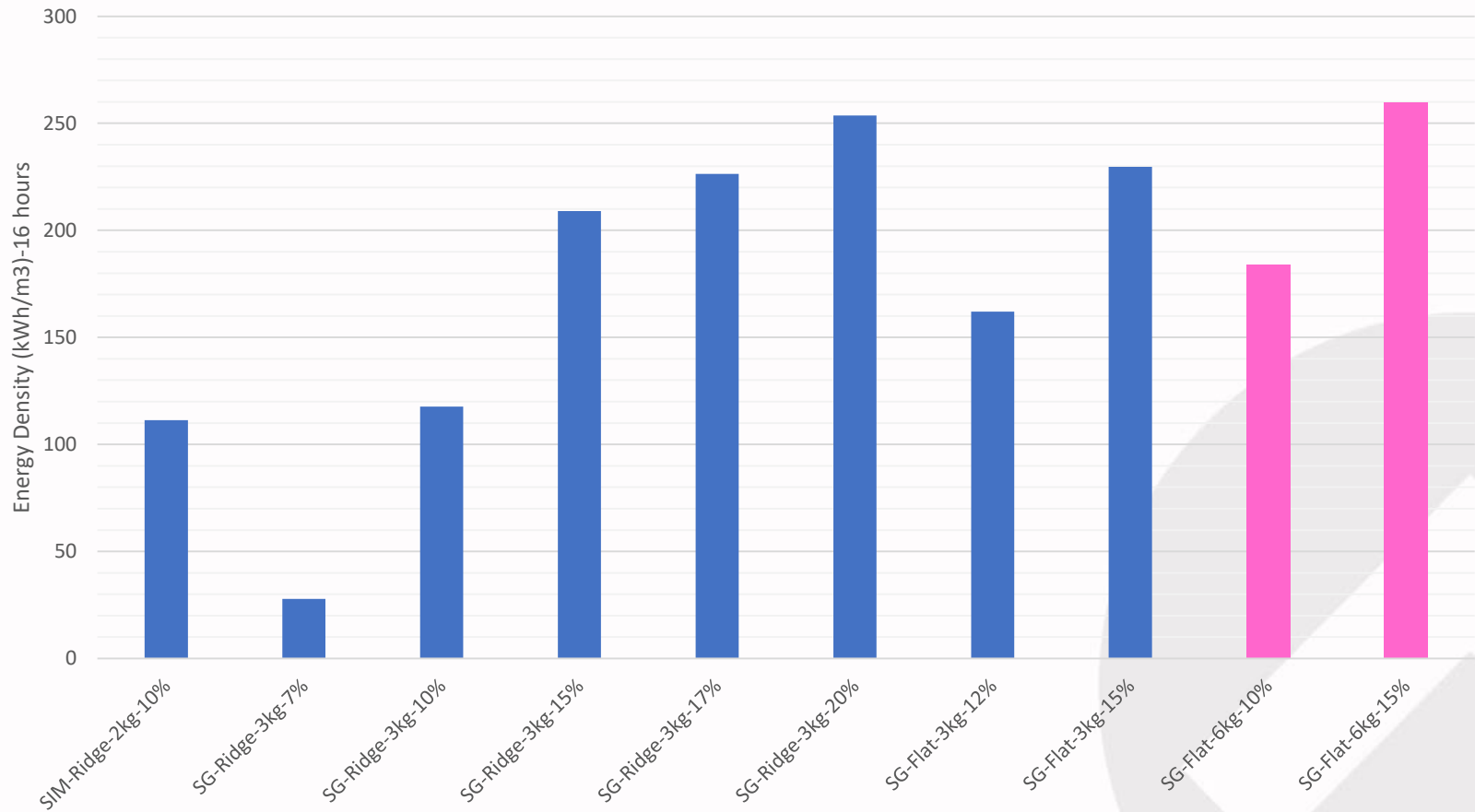
Kenny- Energy Density Comparison



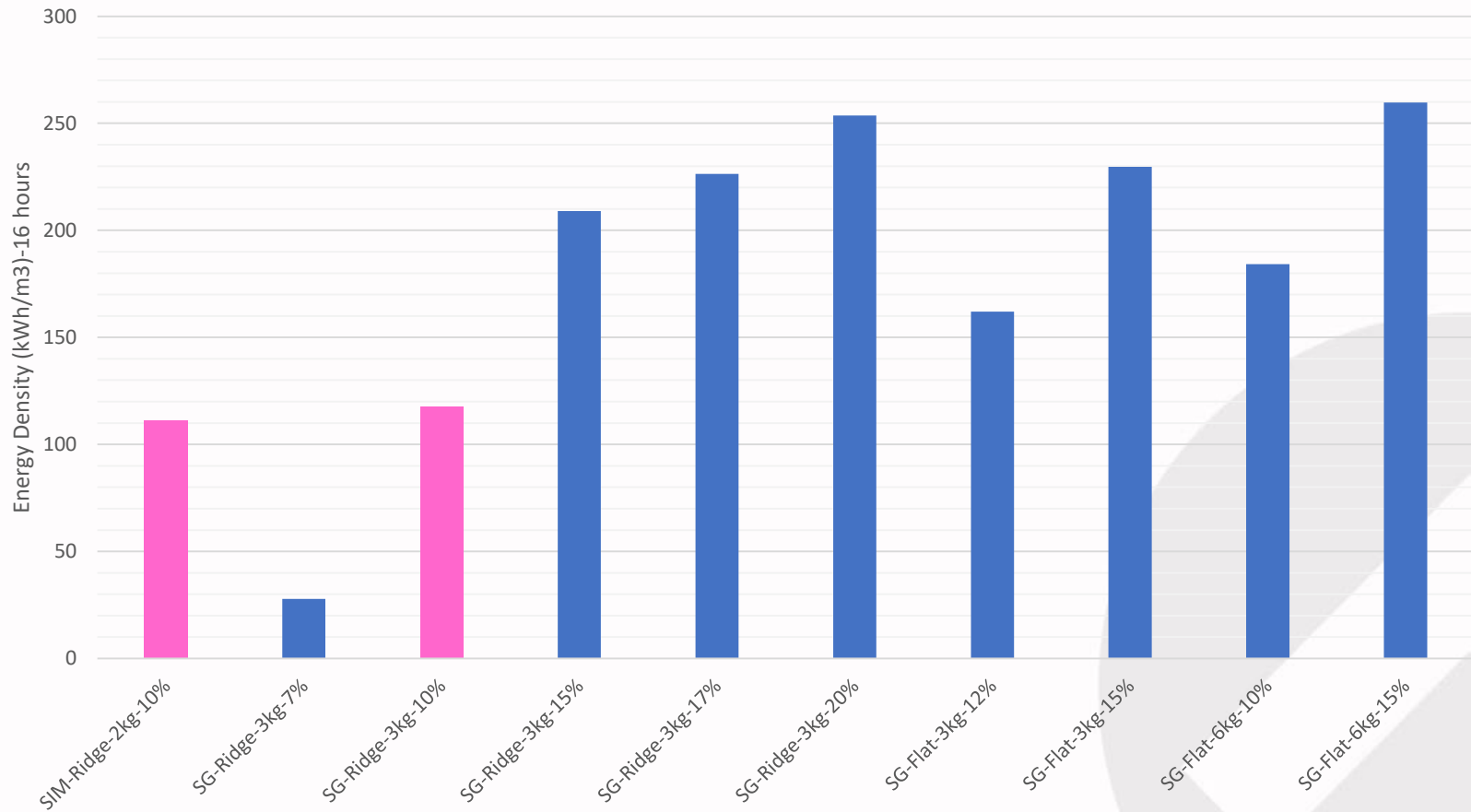
Kenny- Energy Density Comparison



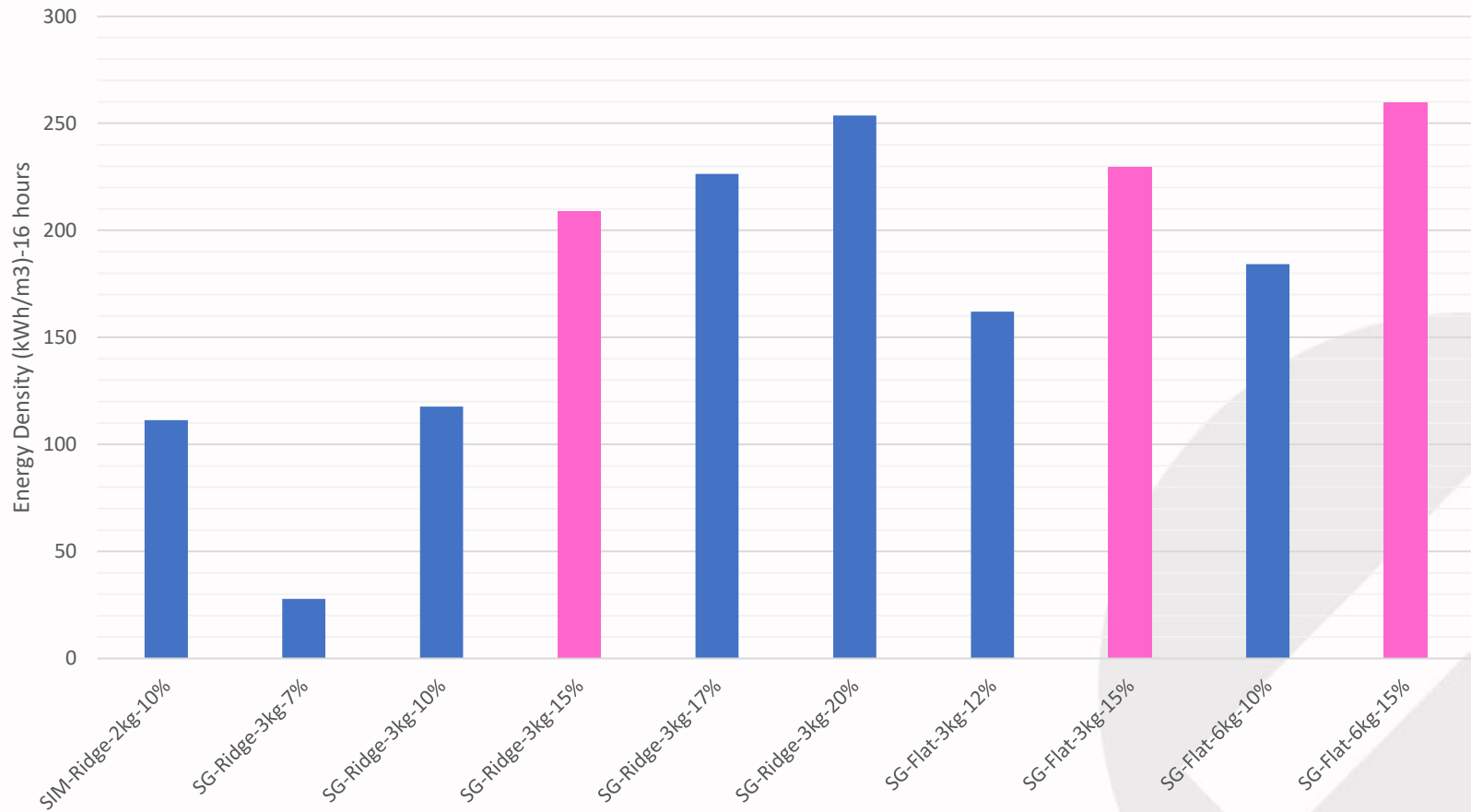
Kenny- Energy Density Comparison



Kenny- Energy Density Comparison



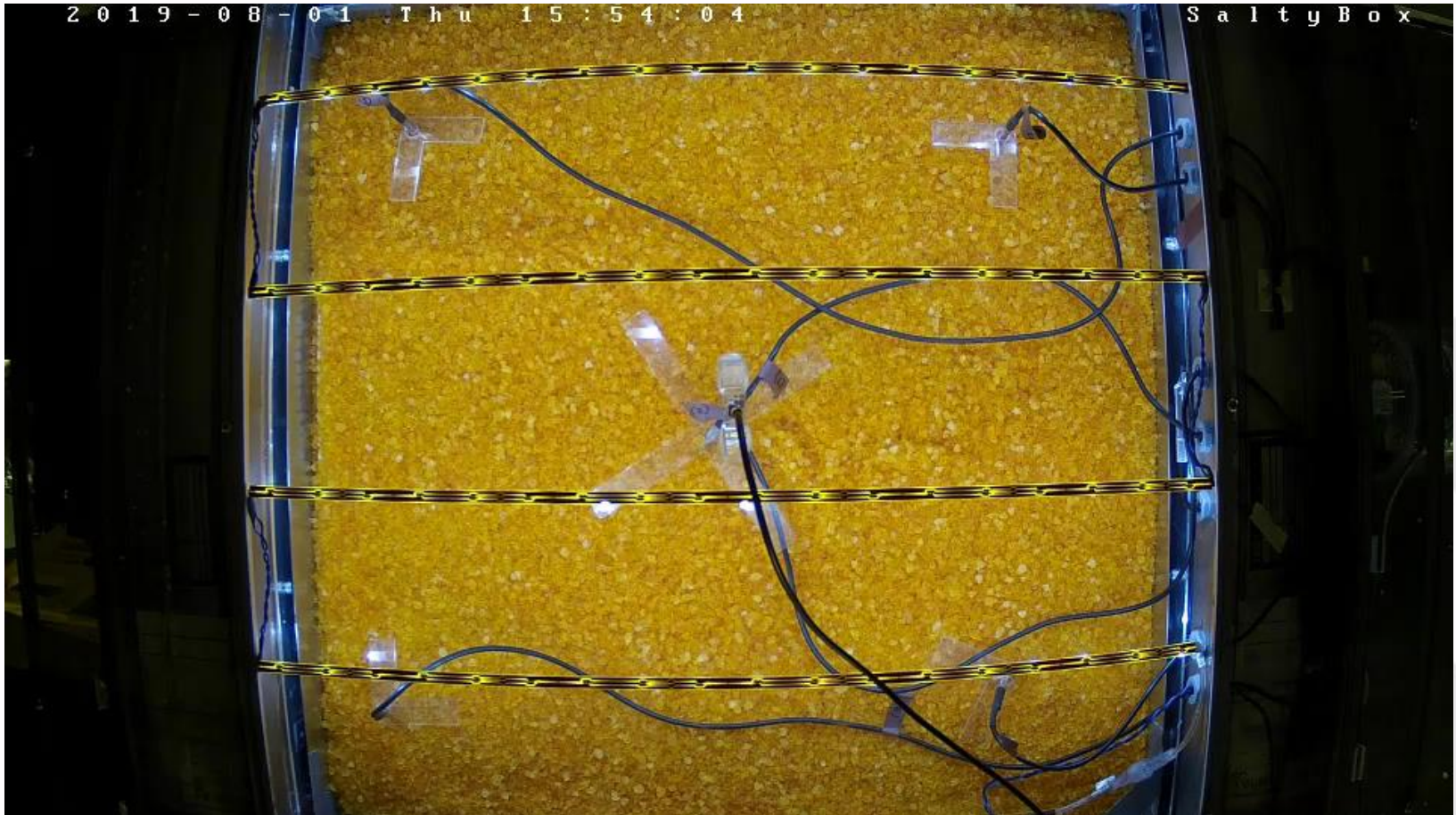
Kenny- Energy Density Comparison



Ridge Tray Profile



Flat Tray Profile



specific[®]

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generate



store



release