A2E ACCESS TO ENERGY INSTITUTE I

DATA RELEASE #2

April 29th, 2020

- ✓ RAW SMART METER DATA
  01.06.2019 - 24.04.2020
- ✓ SAMPLE DATA ANALYSES
- ✓ SMART METER LIST
  29.04.2020
- ✓ INTRODUCING THE STELLAR PLATFORM

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INTRODUCTION

We are pleased to announce the arrival of our second data release!

For this release, we stuck to what was done best: the smart-metering of generators and grids. This version improves upon the last release in several aspects.

Firstly, the number of smart meters in the field has increased. You'll find *216* individual smart meters amongst the new dataset. With this increase in data quantity comes increased confidence in conclusions derived from the dataset. When it comes to data, there is power in numbers!

Secondly, we've expanded and improved upon our data schema. Within the dataset, you will find a new column, frequency. Additionally, in the attached smart meter list, you will find new information regarding connected generator size, as well as a unique identifier representing the account, or location, a smart meter is connected. This helps track the movement of the meter if it changes location or generator, or was at some point put out of service.

Lastly, we're making constant improvements to our data collection and storage ecosystem. As we continue to migrate more and more meters to our new platform, we achieve greater data reliability and reduce transmissions errors.

As a sneak preview, we've installed 100 of our smart meters on electric pressure cookers in Tanzania and are looking forward to sharing the first set of usage and consumption data with you later in July this year.

1 - RAW SMART METER DATA

The data is represented in CSV format and has the following form:

COLUMN NAME	VALUE	DESCRIPTION
meter_number	ID	unique identifier of smart meter
record_time	YYYY-MM-DD HH:MM:SS (UTC)	timestamp of measurement
meter_count	kilowatt hours (kWh)	cumulative energy generated to date
a_voltage	volts (V)	active voltage at time of measurement
a_current	amperes (A)	active current at time of measurement
a_power	kilowatts (kW)	active real power at time of measurement
a_power_factor	ratio	apparent power / real power
frequency	herz (Hz)	frequency at time of measurement

For grid-connected smart meters (designated in the *smart meter list*), the following applies:

COLUMN NAME	VALUE	DESCRIPTION
meter_number	ID	unique identifier of smart meter
record_time	YYYY-MM-DD HH:MM:SS (UTC)	timestamp of measurement
a_voltage	volts (V)	active voltage at time of measurement
frequency	herz (Hz)	frequency at time of measurement

To identify potential grid outages, search for gaps in the time series of a grid-connected smart meter (large jumps in *record_time*), as the smart meters are designed to not send data when no power is present.

2 - SMART METER LIST

This list contains information about smart meter installations such as connected generator size, grid connectivity, and installation date. It is subject to change as meters are moved to new locations, new meters are installed, or meters are taken out of service.

The smart meter list is represented in CSV format and has the following form:

COLUMN NAME	VALUE	DESCRIPTION
meter_number	ID	unique identifier of smart meter
meter_status	*connected* OR *disconnected*	whether meter is currently installed at listed account
account_id	ID	unique identifier representing install location (e.g. shop)
connection_date	YYYY-MM-DD (UTC)	date meter was connected to listed account
disconnection_date	YYYY-MM-DD (UTC)	date meter was disconnected from listed account
type	*generator* OR *grid*	specifies what the smart meter is monitoring
generator_size	watts (W)	nominal power of generator (i.e. rated power)
type_of_business	-	describes the type of business
region	-	general location (e.g. country)
market	-	fine-grained location

3 - SAMPLE DATA ANALYSES

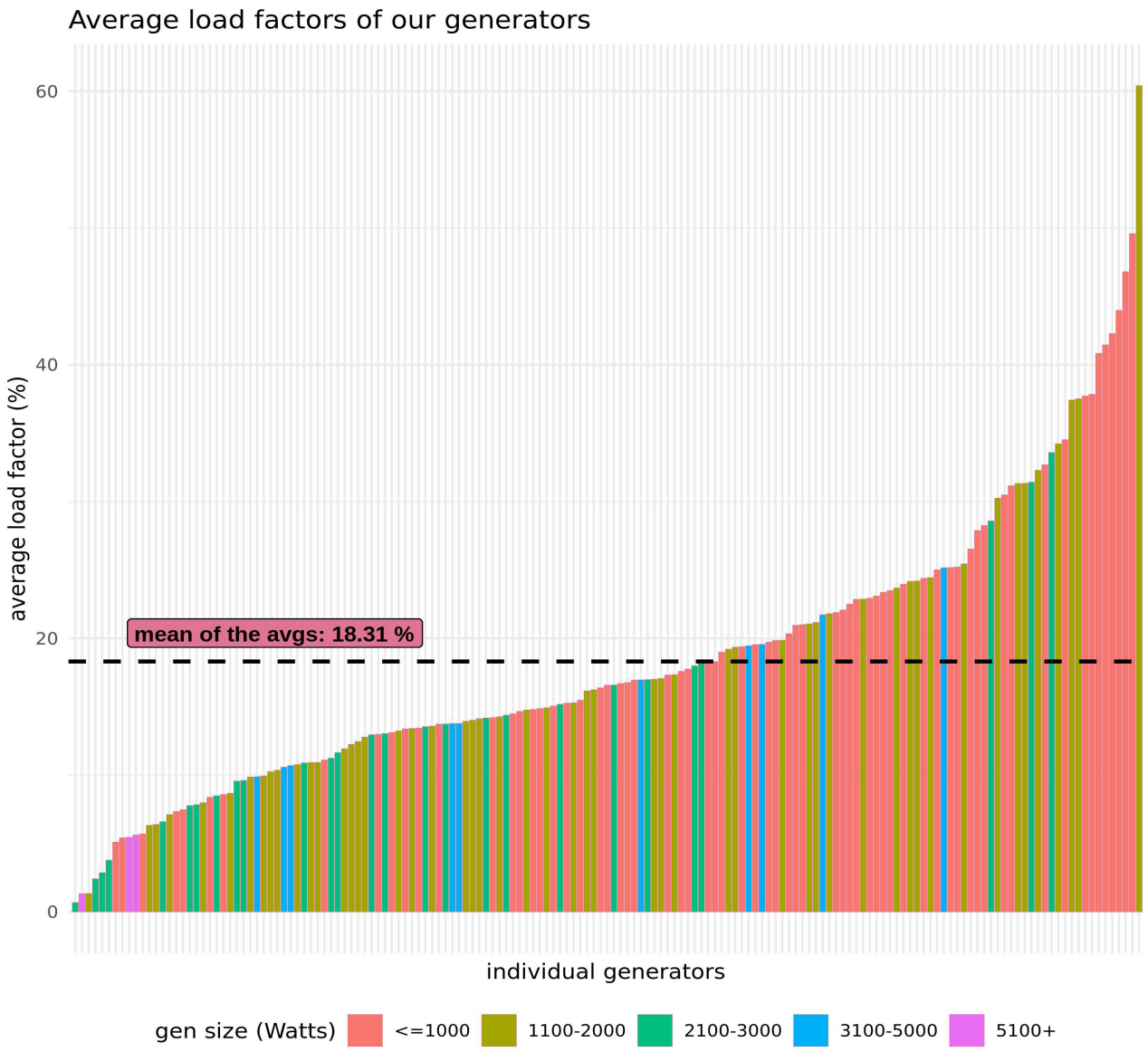
We compiled the most recent data of our generator-connected smart meters and performed some summary analyses. The analysis is based on *159* smart meters from the data release and exclude the following:

- grid-connected meters (546135, 546206, 546245, 541807, 541808, 541810, 541815, 541841, 541852, 541854, 541870, 541904, 541933, 541938, 541946, 541809).
- meters that have been relocated at some point, identifiable in the meter list by the presence of a 'disconnected_at' value (541809, 541810, 541825, 541828, 541837, 541843, 541859, 541862, 541863, 541864, 541879, 541903, 541939, 541977, 541991). It is possible to incorporate these meters into future analyses by making sure to filter their rows by the associated 'connected_at' and 'disconnected_at' values.
- meters attached to generators with unusually high power ratings (541976, 546222).
- meters lacking connected generator size information (identifiable in the meter list by lack of a 'generator_size' value.

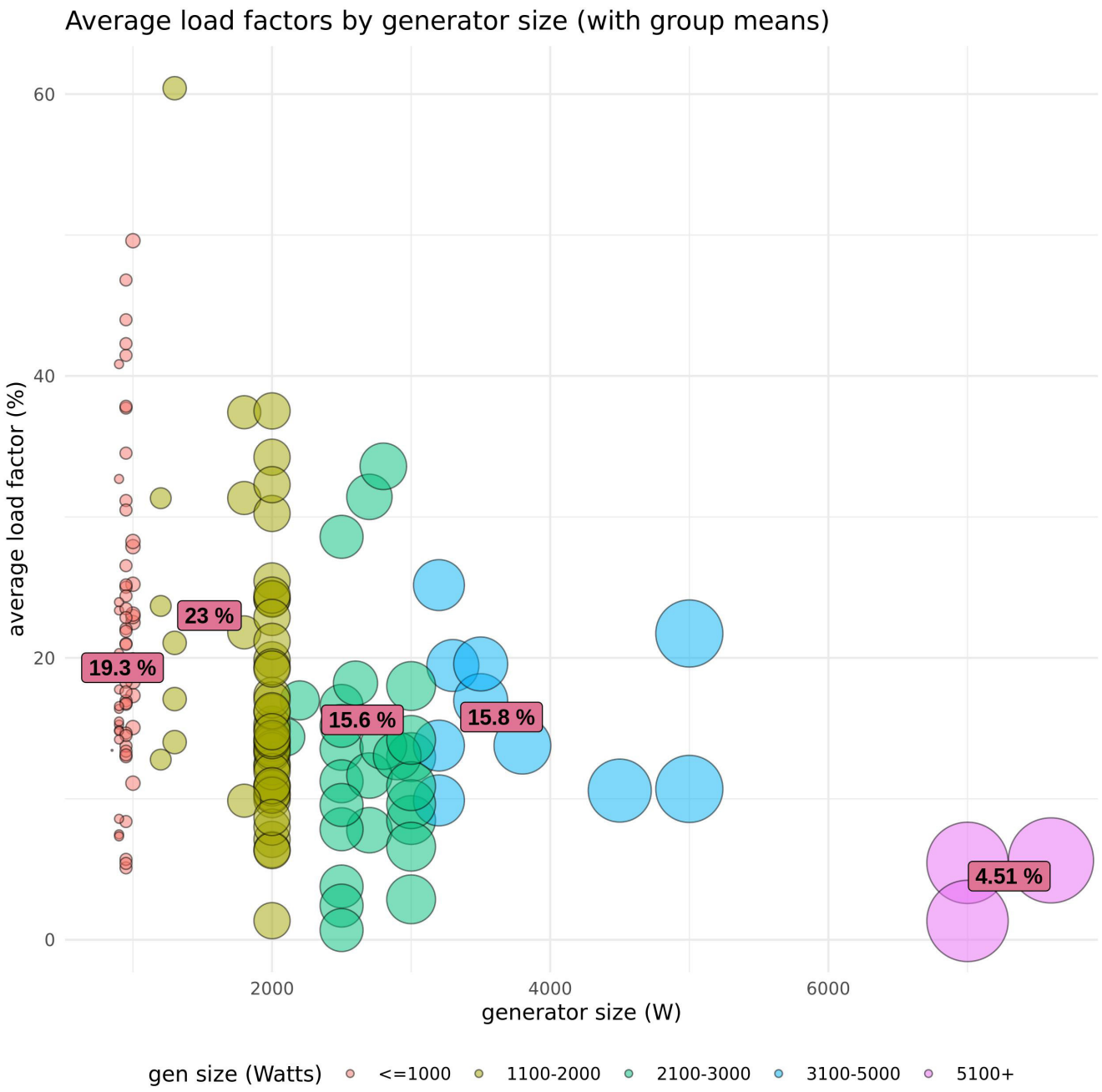
We are still able to replace a large portion of generators with relatively small solar systems. About 75% of our systems typically run at 450 Watts or lower, and 90% at 600 Watts....

AVG RUNNING POWER IN WATTS (<=)	NO. OF GENERATORS	% OF GENERATORS REPLACABLE AT THIS WATTAGE
100	12	7.55
150	11	14.47
200	17	25.16
250	27	42.14
300	16	52.20
350	16	62.26
400	12	69.81
450	11	76.73
500	9	82.39
550	8	87.42
600	3	89.31
650	2	90.57
700	4	93.08
800	5	96.23
850	1	96.86
900	2	98.11
950	1	98.74
1100	1	99.37
1200	1	100.00

On average, our generators run at only 18.31% of their capacities...



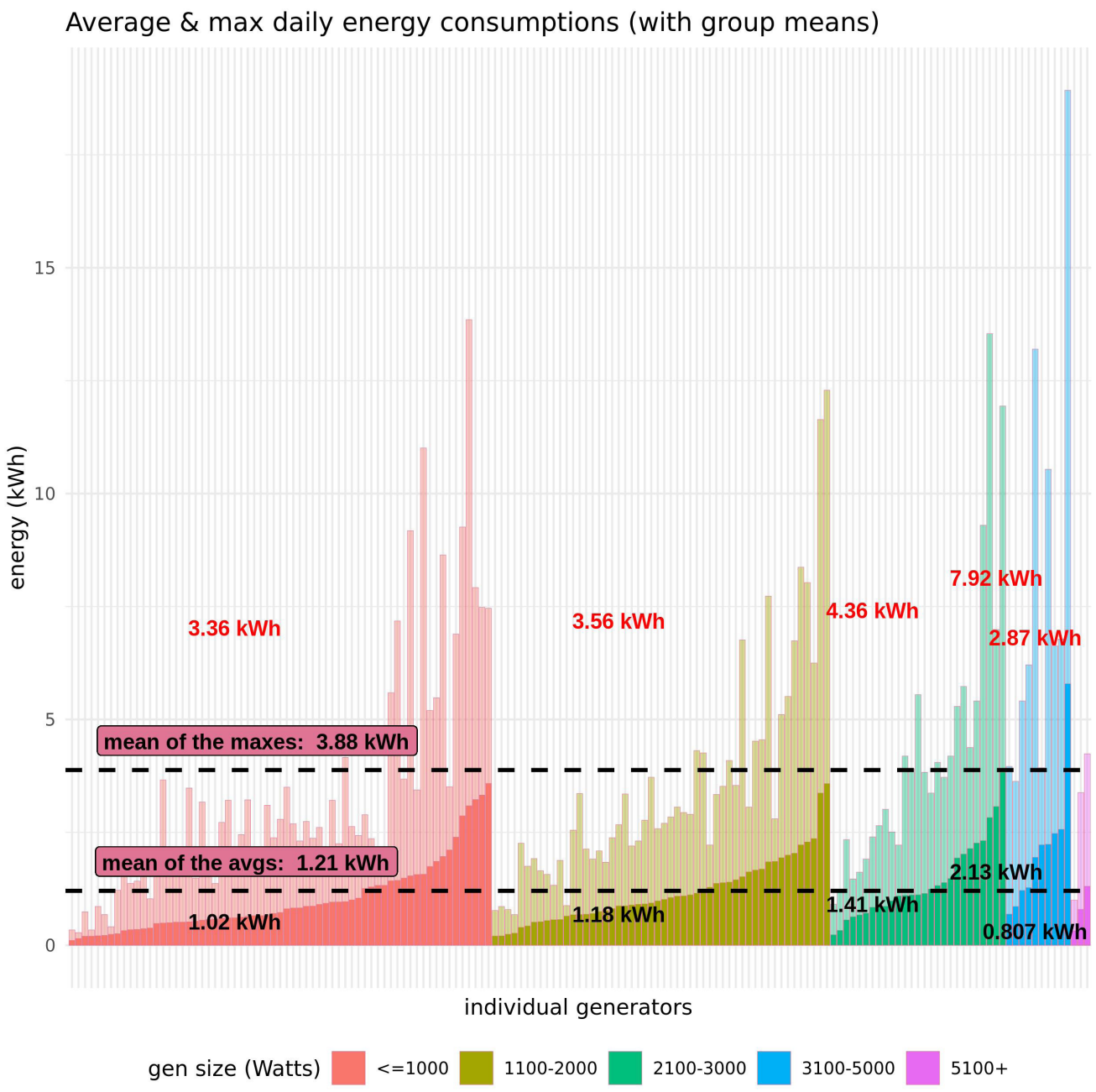
Interestingly, larger generators typically run at less of their total capacities than smaller generators. Large generators are purchased primarily because of their longer lifetime...



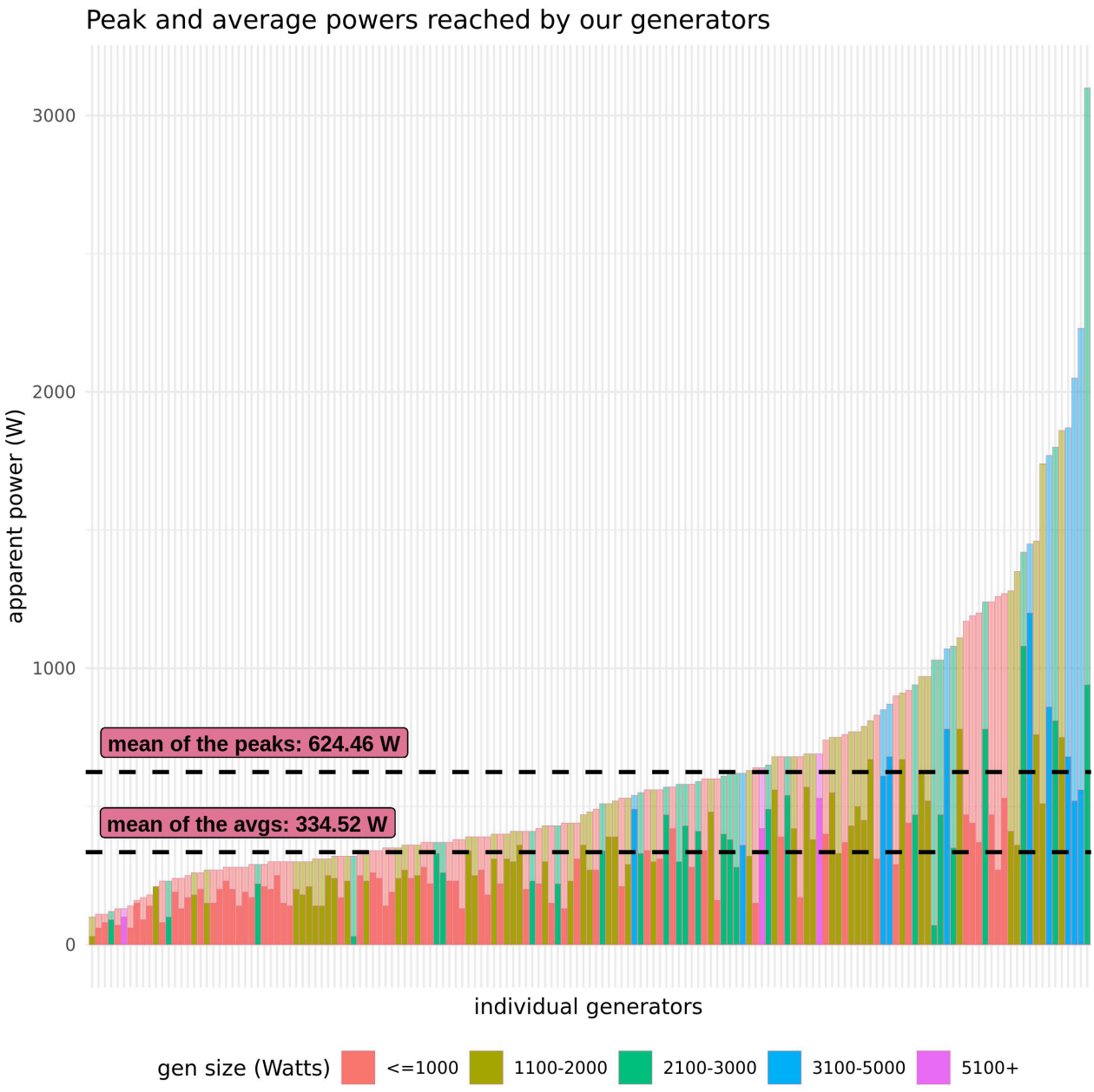
The average energy consumption in a given day of generator use is 1.21 kWh.

On average, the *record max* energy consumption in a given day of generator use is 3.88 kWh.

Generally, the larger the generator, the more daily energy consumed, except for very large generators, which seem to produce the least amount of energy.

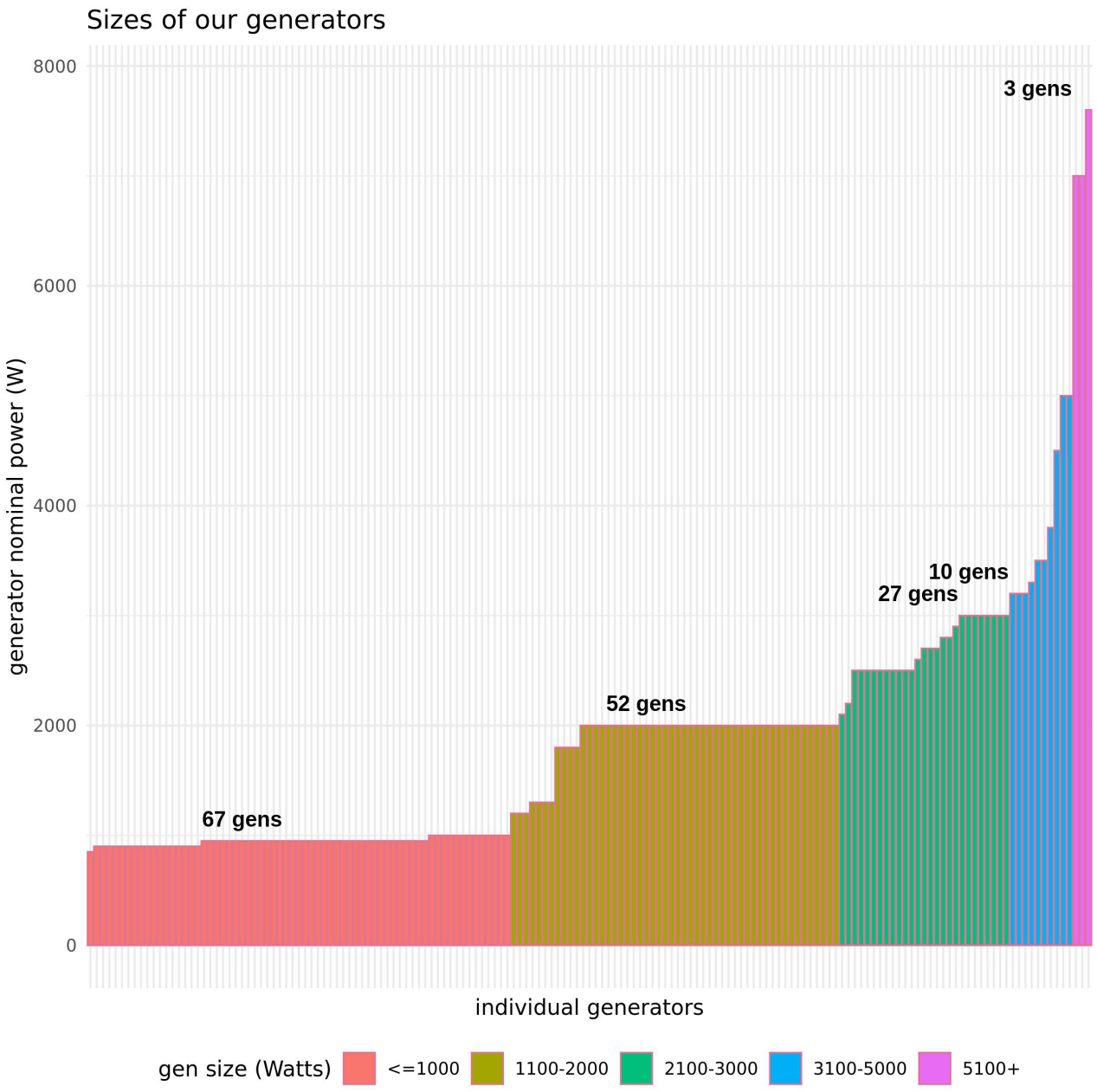


The *all-time peak power* reached by our generators depends in part on generator size, but seems to be about 624 Watts on average, as compared to an average normal running power of 335 Watts.



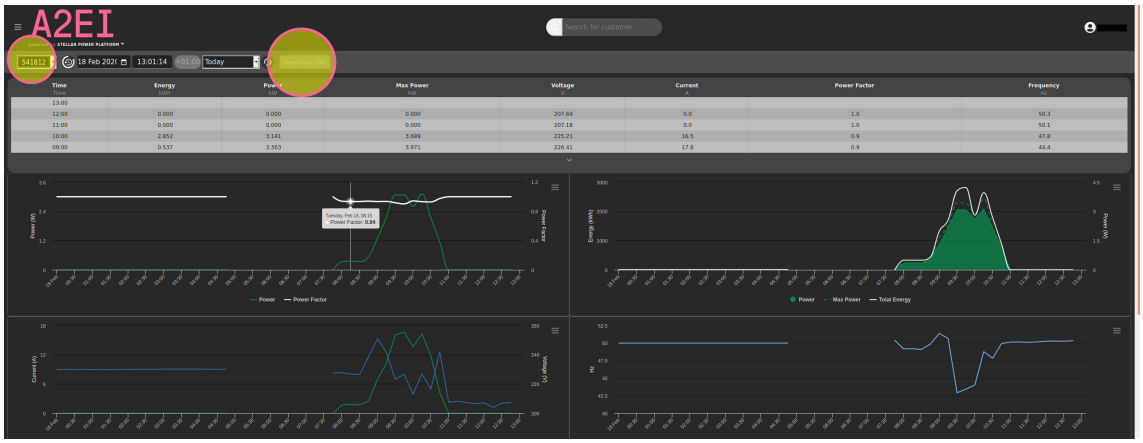
MAX RUNNING POWER IN WATTS (<=)	NO. OF GENERATORS	% OF GENERATORS UNDER THIS PEAK WATTAGE
100	1	0,64
200	10	7,01
300	24	22,29
400	31	42,04
500	14	50,96
600	19	63,06
700	16	73,25
800	7	77,71
900	5	80,89
1000	5	84,08
1200	8	89,17
1400	6	92,99
1600	3	94,90
1800	3	96,82
2000	2	98,09
2200	1	98,73
2400	1	99,36
3100	1	100,00

Our generators span a variety of sizes. The majority are below 2000 Watts.



4 - INTRODUCING THE STELLAR PLATFORM

Introducing our new web-based data warehousing and insights platform, Stellar Power Platform, courtesy of our new partners at New Sun Road (https://www.newsunroad.com/). The platform is currently A2EI-internal and is undergoing constant improvements.



Now we can monitor our accounts and meters, view summary statistics and interesting visualizations, and access and download raw data. It's a significant upgrade for the A2EI and its partners, and we're excited to be able to add such streamlined and functional front-end access to our data ecosystem.

Ultimately, this platform will help the A2EI to do our best work when it comes to data collection and data preparation for you, the data subscriber.