
California Renewable Energy Independence (EI)

Bao Nguyen
CTO – Renewable Energy Science
Rocklin, CA

Electrification Towards Energy Independence with Smart Private Grid (SPG™)



The information contain herein is
confidential and intended for
knowledge and educational purposes

Introduction



- In the past few years, we achieved **no** energy costs and Energy Independence (EI). You can as well!
- No energy costs = no electric, gas, heating, cooling, driving, cooking, pool heating costs!
- Goals of meeting:
 - Overview of Electrification ecosystem and strategy, leading to Energy Independence
 - Introduction of my **Smart Private Grid (SPG™)** design integration to truly be Energy Independence (EI) with clean, renewable energy
 - **Share EI knowledge and Energy Innovation R&D – Leading the way towards Energy Independence**
- This is a meeting series as EI technologies is vast and there are many details to understand
- *The key is knowledge - enabling smart & strategized implementation without filing for bankruptcy 😊!*

Introduction

You say, who, why, what is this dude talking about? Knowledge is power – pun intended!

About Bao Nguyen: Silicon Valley career in technology

- CTO Libertycompanies – Clean Energy Independence & construction company
- Former
 - SVP @Cybage Software – Tech consulting
 - SVP @Nexant – Energy Management System for public utilities
 - VP of R&D @Aol / Verizon – AI / Machine Learning Advertising Analytics
 - VP of Engineering @LexisNexis – Software, Information, and Subscription as A Platform
 - Engineer @AT&T, Honeywell
 - Founder of Telecom and FinTech algorithmic trading startups
- Passion in clean, renewable technologies, and integration of energy technologies / products
- Spent over a decade researching, experimenting, tech integrating to accomplish energy independence - and contributing to a cleaner earth!
- Excited to share learned lessons and knowledge with you!



E Executive Summary



- **Electrified** – move as much to electric as possible
- Electric can be cheap, take advantage by electrified
- Natural gas & fossil fuels are expensive and cost / supply volatile
- Ultimately, electric can be low cost in long-run, clean, renewable
- Leverage technologies like solar, storage, and Smart Private Grid (SPG™) to be truly free from grid while ensuring clean energy

Agenda



- 01 Goals
- 02 Terminologies
- 03 Energy Independence Strategy
- 04 Why Electrification?
- 05 Electrification Strategy
- 06 A Word on Inflation Reduction Act (IRA)
- 07 California's PG&E NEM 3.0 Key Points
- 08 What's Next?
- 09 Smart Private Grid (SPG™) Research, Design, & Implementation
- 10 EngTech Integration and Energy Management
- 11 EngTech Integration and Inverters
- 12 EngTech Integration electrification heating, cooling, cooking
- 13 Real-time Energy Monitoring
- 14 Smart Private Grid (SPG™) Evolution
- 15 Actual 2021 PG&E Billing Results
- 16 Electric Vehicle Integration for total Energy Independence
- 17 Smart Private Grid (SPG™) Concept
- 18 Smart Private Grid (SPG™) Vs Microgrid
- Q&A

EI

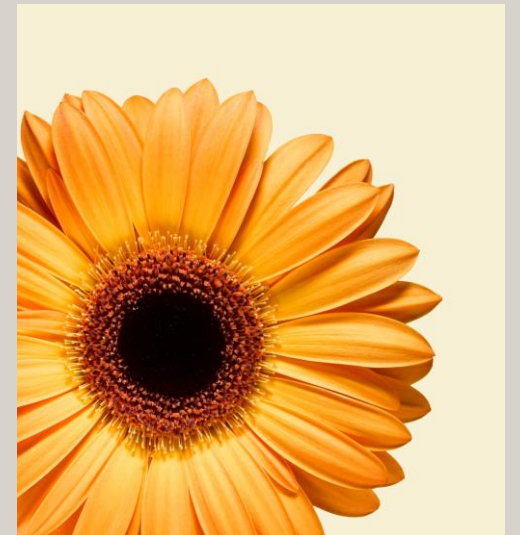
Energy Independence: Not a new concept!
Example: Treuenbitzen, Germany – no energy bills!



Treuenbitzen, Germany

01 Goals

- Sharing renewable energy technology integration knowledge – first of multiple sessions
- Helping homes and businesses strategically achieving 100% Clean and 100% Renewable. Key is Electrification
- Powering towards Energy Independence (EI)
- Providing knowledge for both DIYs and non-DYIs
- Introduction to my innovated Smart Private Grid (SPG™) architecture
- The meeting is for you! Comments and ask questions!





- **Energy independence:** Generating all your energy needs with renewable energy – No fossil fuel required
- **Renewable energy:** Energies that are clean, reliable, and infinite like sun or wind energy (the sun will shine for another 5B years)
- **Electrification:** Transition to all electric power
Motto: If it runs on electricity, it can be powered by the sun
- **Energy Efficiency:** Implementation of energy efficient practices and equipment
- **Net Metering:** Utilities electric connect, buy & sell policies - Smart Metering
- **Smart Meter:** Electric meter that measures bi-directional power flow
- **Heat Pumps:** Electric appliances that provides both cooling and heating with typical +300% efficiency (in heating mode)
- **EngTech:** Energy technologies, innovations, and the integration of renewable technologies and products
- **Energy Analytics:** The science of energy usage, monitoring and generation + prediction and optimization
- **Smart Private Grid (SPG™)** – Self consumption & smart managed private grid with public utility as backup. Normally, public utility provides main power and solar as supplemental power

02 Terminologies

03 Energy Independence Strategy

Solar required but not necessary the first implementation!

- ❑ Understand your energy usage vs energy efficient peers
- ❑ Set your energy budget goals
- ❑ Balance energy demand (efficiency) and supply (power) to fit your budget
 - Solar might not be your first energy implementation step but required for Energy Independence
- ❑ Systematic implementation plan – driven by budget and timeline
- ❑ **It's all about Electrification – key!**
- ❑ **It's all about Heat pumps:** Replace broken heating, cooling, water heating appliances with heat pumps
- ❑ 2nd life equipment – Batteries & PVs can be large savings. Non-profit and low budget organizations, take note!
- ❑ California NEM 3.0 accentuate need for battery storage systems
- ❑ DIY if you can, and I can refer you to the pros if needed
- ❑ Know your energy efficiency incentives (IRA)
- ❑ Research and ask questions and ask more questions



- If it runs on electricity, it can be powered by the sun
- Sun energy is clean, reliable, renewable, and infinite – 5 B more years!
- Electrification enables energy independence using electricity
- Heat generation is very efficient with electric modern heat pump technologies
- Heat pumps for house heating, cooling, clothes dryer, water heater
- Federal and State \$ incentives (up to 2/3 costs)
- Fossil fuels are polluting, supplies are finite, and not eco friendly
- Worldwide unstable energy costs
- Some electrification are DIY
- 2nd life PVs and batteries are great on tight budget

My actual Jan 2023 Gas & Electric Bill

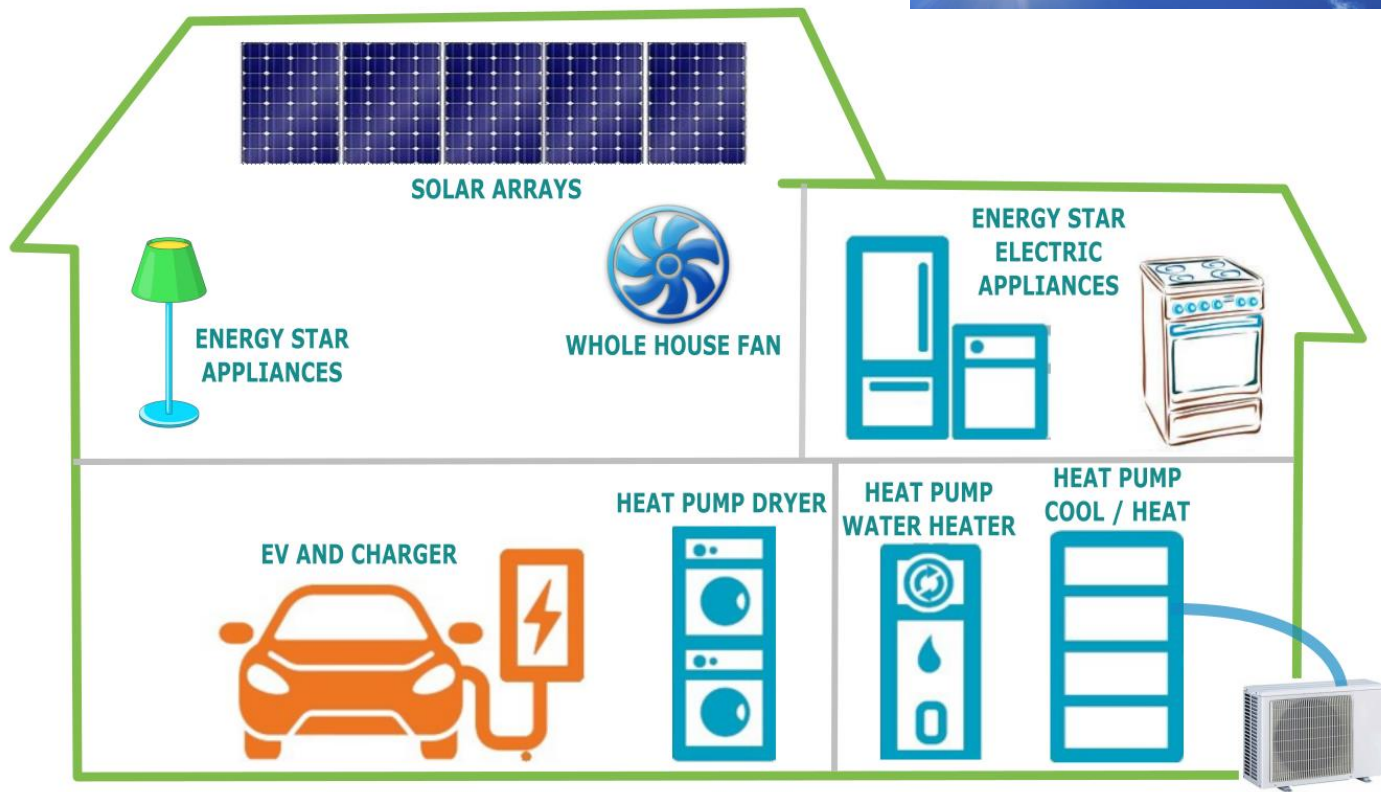
04 Why Electrification?

ENERGY STATEMENT		Statement Date:	01/05/2023
 www.pge.com/MyEnergy		Due Date:	01/26/2023
Service For:	Your Account Summary		
	Amount Due on Previous Statement		\$15.82
	Payment(s) Received Since Last Statement		-15.82
	Previous Unpaid Balance		\$0.00
	Current Gas Charges		\$48.70
			<hr/>
			\$48.70
Questions about your bill?		Total Amount Due by 01/26/2023	

05

EngTech Electrification Strategy

100% ELECTRICIFIED & STANDARDIZED



I'm refining on these innovations

Electrification in phases - driven by goals & budget

- ❑ Energy audit – know your energy situation
- ❑ Energy efficient lightings
- ❑ Whole house fan
- ❑ Energy efficient doors, windows, skylights, etc
- ❑ Solar, grid inverters, possibly SPGTM
- ❑ Specific Hybrid Inverters for SPGTM
- ❑ Sun thermal pool heating
- ❑ Heat Pumps – mini-split, central: cooling & heat (Main living, fam / kitchen, upstairs)
- ❑ Heat pumps – water heater, dryer (ventless)
- ❑ Induction and my hybrid induction cooktop
- ❑ Managed and generic Li-ion battery storage
- ❑ EVs and Plug-In hybrid EVs planning
- ❑ SPGTM: Solar > Battery > 2nd Battery, Utility
- ❑ Energy Analytics – Monitoring, usage planning, energy optimization & management
- ❖ *Smart Private Grid (SPGTM) – Self consumption private grid with public utility as backup*
- ❖ *AI Predictive Energy Management & Optimization goal for 100% self-sufficient*

Tax credits:

- Tax credit will be = 30% of the costs for all eligible home improvements during the year (to 2032)
- \$150 for home energy audits
- \$250 for an exterior door (\$500 all exterior doors)
- \$600 for exterior windows, skylights, electric panels
- \$2,000 for electric / natural gas heat pumps
- \$7,500 for new EV and \$4,000 for used EV starting in 2023 (EVs must be built in U.S. and battery from U.S.; no 200,000 EVs cap starting in 2023)
- Bidirectional charging equipment

Rebates up to:

- \$840 for stove, cooktop, range, oven, or heat pump clothes dryer
- \$1,750 for heat pump water heater
- \$8,000 for space cooling or heating heat pumps
- \$1,600 for insulation, air sealing, ventilation
- \$2,500 for electric wiring
- \$4,000 electric load service center upgrade



06 Inflation Reduction Act (IRA) – Check with your tax advisor

07 California NEM 3.0



- Approved by CA's CPUC on 12/15/2022
- Current solar owner remains in existing NEM
- New Interconnection Agreement needed to be approved by 4/13/23 to grandfathered in existing NEM program
- NEM 3.0 solar will credit power @75% less than existing rate
- NEM 3.0 buys power back at a much lower rate than selling
- NEM 3.0 has a real-time true-up by the hour and time of day
- NEM 3.0 tends to make solar and solar + battery systems attain near same payback period
- **NEM 3.0 encourages battery installation to help grid capacity**

08 What's Next?

Continue to check off your goals list – low hanging fruits first

- Energy audit – know your energy situation
- Energy efficient lightings
- Whole house fan
- Energy efficient doors, windows, skylights, etc
- Solar, grid inverters, possibly SPGTM
- Specific Hybrid Inverters for SPGTM
- Sun thermal pool heating
- Heat Pumps – mini-split, central: cooling & heat (Main living, fam / kitchen, upstairs)
- Heat pumps – water heater, dryer (ventless – nice!)
- Induction and hybrid induction cooktop
- Managed and generic Li-ion battery storage
- EVs and Plug-In hybrid EVs planning
- SPGTM: Solar > Battery > 2nd Battery, Utility
- Energy Analytics – Monitoring, usage planning, energy optimization
- ❖ *Smart Private Grid (SPGTM) – Self consumption private grid with public utility as backup*
- ❖ *AI Predictive Energy Management & Optimization goal for 100% self-sufficient*



SPG™ Research & Design and Implementation Journey:

- Over the years, we have researched, experimented, tested, and integrated many clean technology components / systems
- We have completed our Energy Independence implementation and continued to enhance it as well as sharing knowledge
- We are now integrating and refining the latest clean technologies and implementing Smart and Behavioral Predictive Software... Yes, AI has come to Energy Optimization!
- The next section shares some of our Energy Independence journey, Electrification journey, and concepts



09 SPG™ Research & Design



Multiple Optimized Solar Array Strings to increase energy harness efficiency

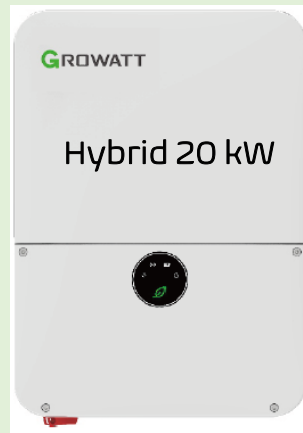
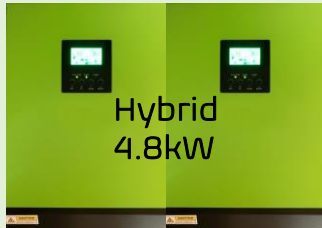


Low cost, highly effective suspension Whole House Fan



2nd Life, high quality thermal panels for pool

10 EngTech Integration & Energy Management



Hybrid inverters, multi-string, storage
Smart Private Grid SPG™ compatible

Multi-string high efficient
basic grid-tied inverters



Optimizer based, highly integrated grid-tied
storage inverters and higher costs



12K BTUs Heat Pump



24K BTUs Heat Pump



My innovation: Hybrid Induction Cooktop



12K BTUs Heat Pump

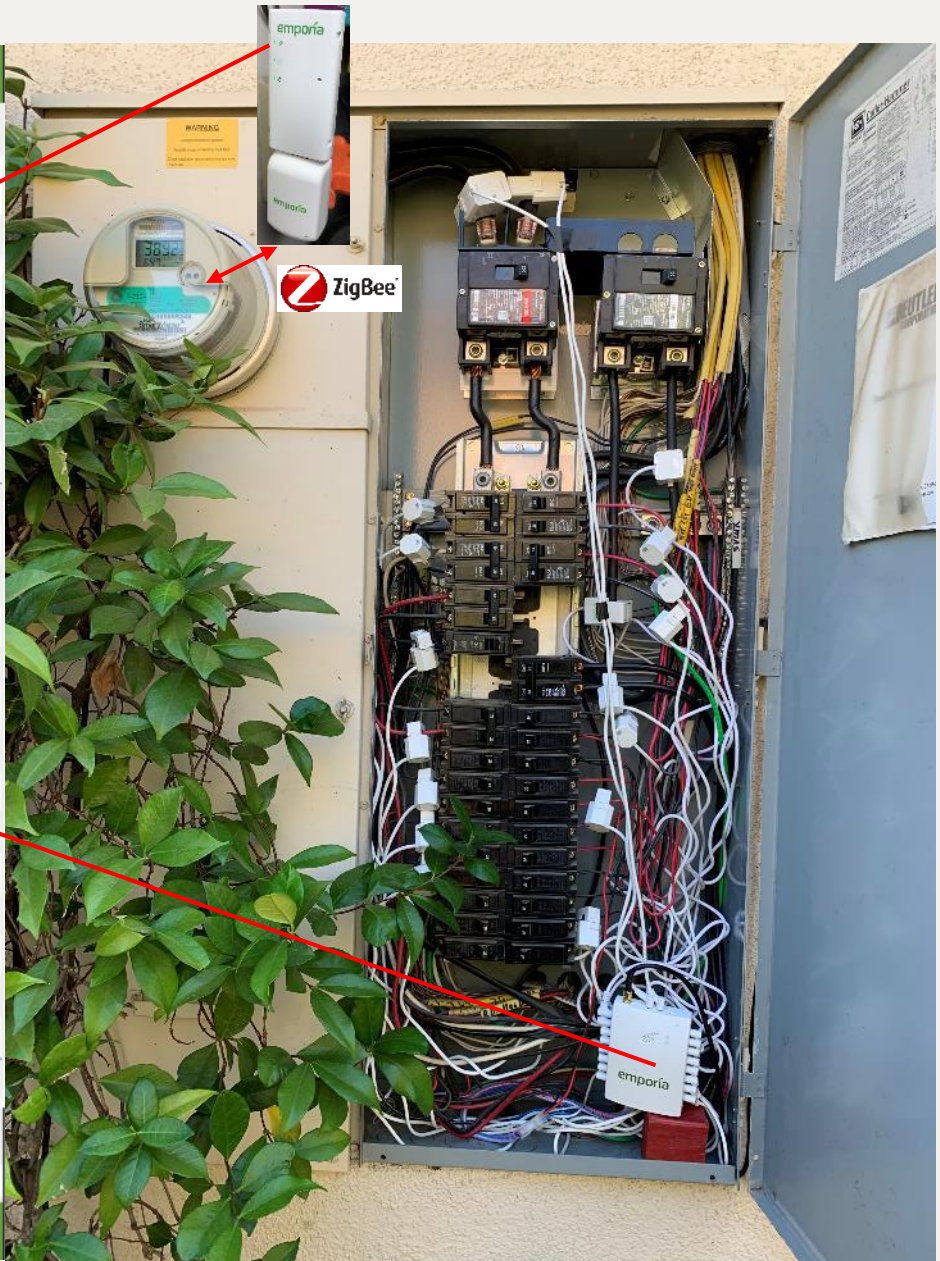
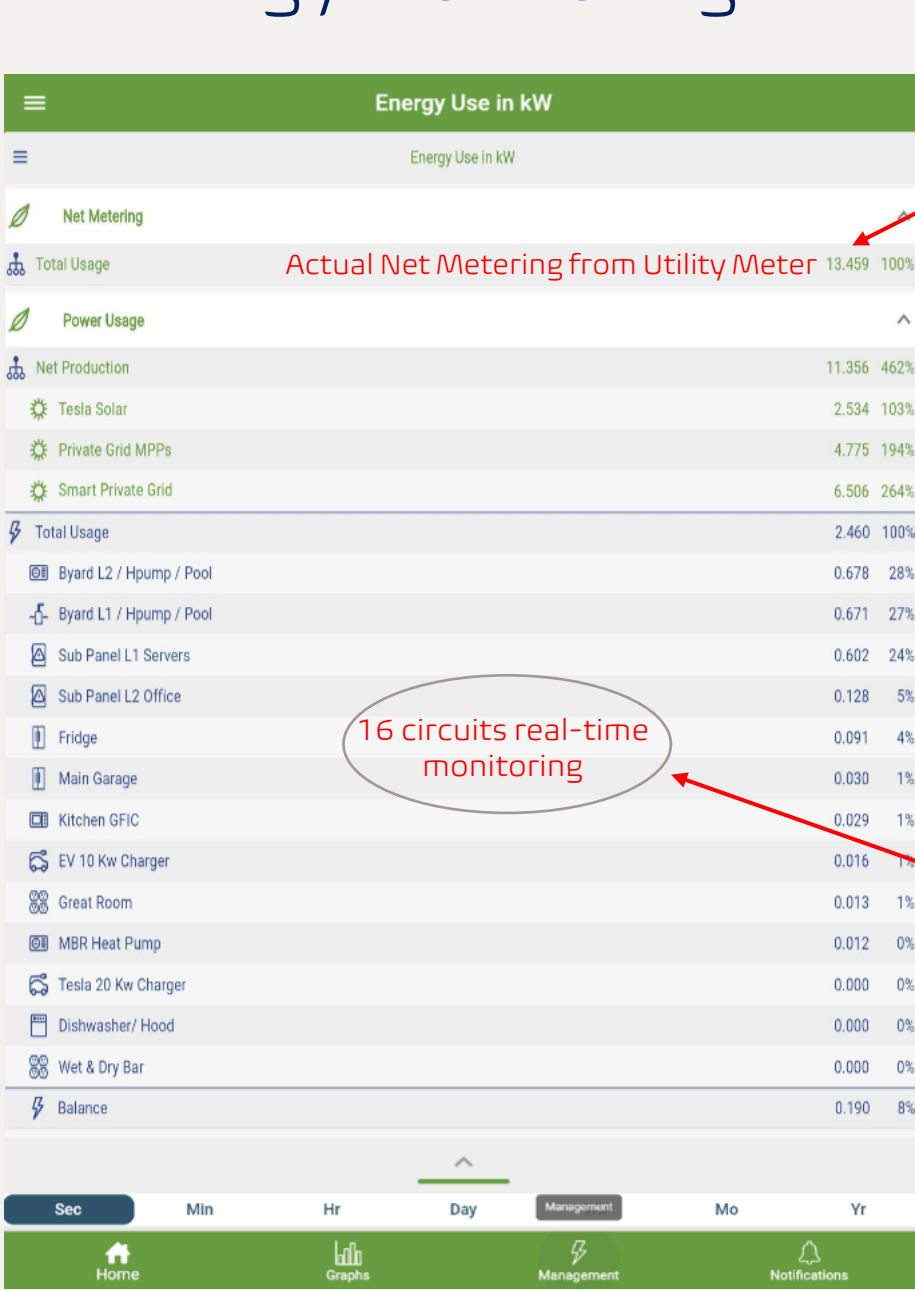
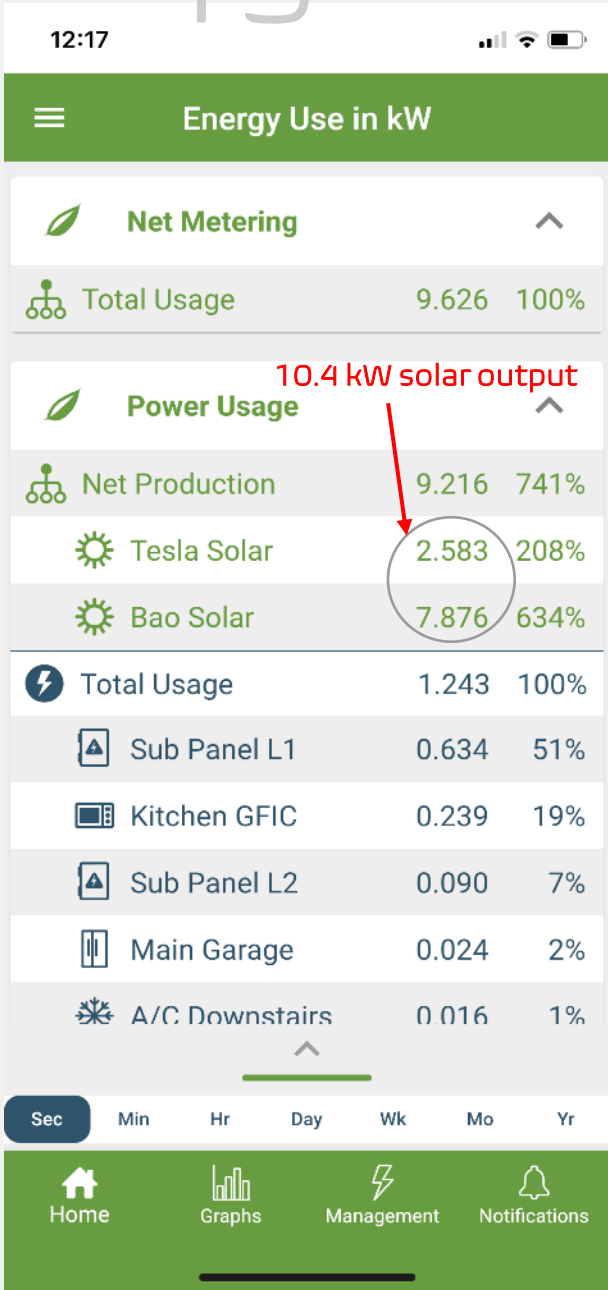
12

EngTech Integration & Electrification

February 11th, 2023 - Confidential

• 13

Real-time energy monitoring – Know your power





28 kWh Li-ion

SPG™ Evolution: 2nd, 3rd and 4th Generation

14

EngTech Integration & Smart Private Grid (SPG™) Evolution

Actual Net Metering Results - a 4,922 kWh credit – Source: PG&E

Summary of NEM Charges

Bill Period End Date	Net Usage (kWh)	Estimated NEM Charges Before Taxes	Estimated NEM Charges After Taxes
12/23/2020	324	\$53.69	\$53.90
01/25/2021	121	21.83	21.91
02/24/2021	-304	-55.16	-55.32
03/25/2021	-684	-154.44	-154.77
04/26/2021	-1433	-347.95	-348.64
05/25/2021	-1320	-322.65	-323.28
06/24/2021	-791	-174.93	-175.31
07/26/2021	-854	-187.20	-187.61
08/25/2021	-372	-71.93	-72.11
09/26/2021	19	3.70	3.71
10/25/2021	372	79.24	79.41
TOTAL	-4922	-\$1,155.80	-\$1,158.11

4.9 MWh Credit for Winter Usage



15 SPG™ Actual 2021 Results

Electric Vehicles Integration 16

Plug-in Hybrid: Local use – 50 miles on battery plus 300 miles using onboard gas generator as backup. Use on 50 miles or less round trips so gas is not use



Regular EV: Longer trips of 220 miles or more



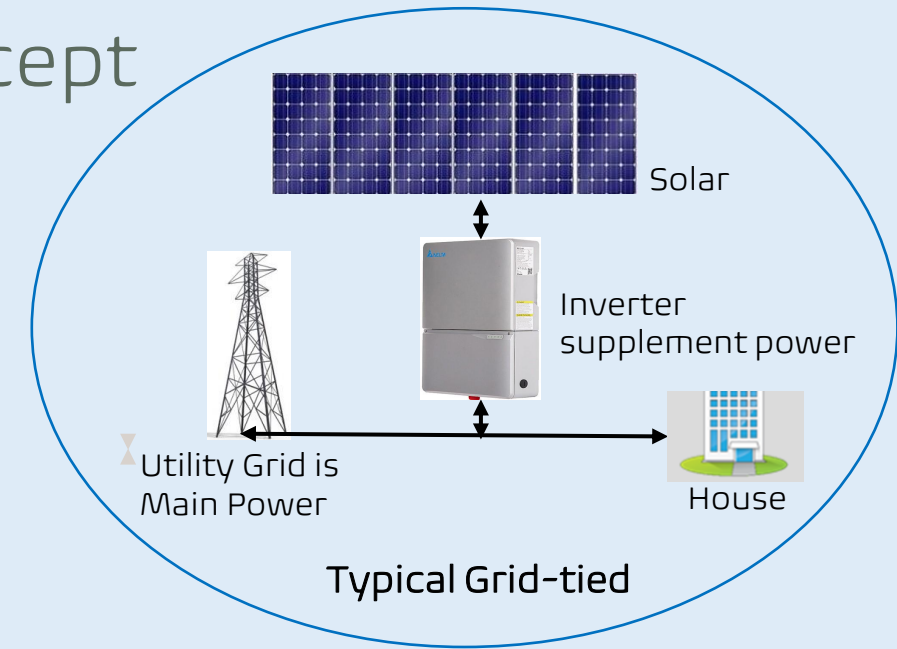
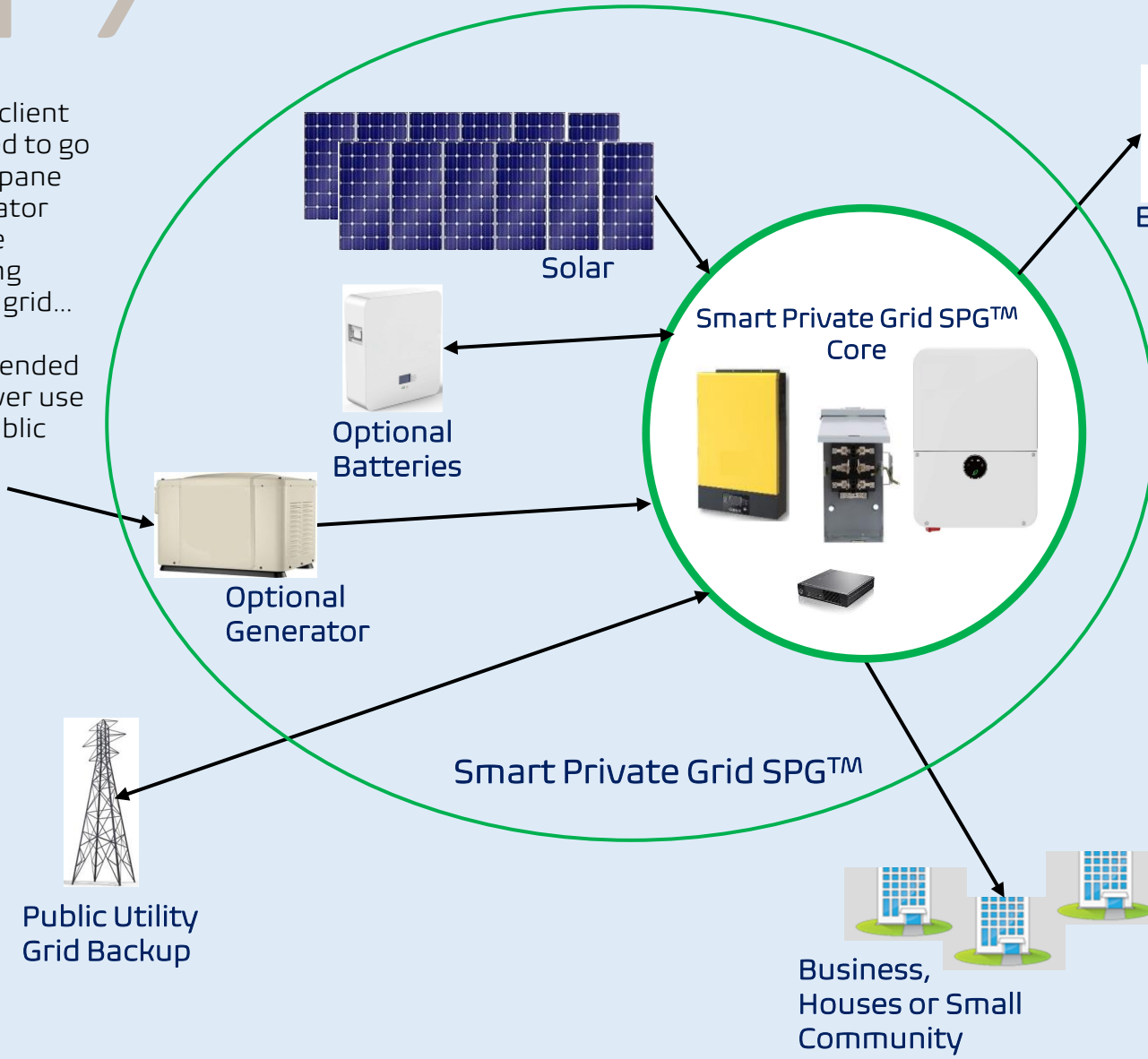
Smart Private Grid (SPG™)

17

Smart Private Grid (SPG™) System Concept

Had a client wanted to go to propane generator before utilizing public grid...

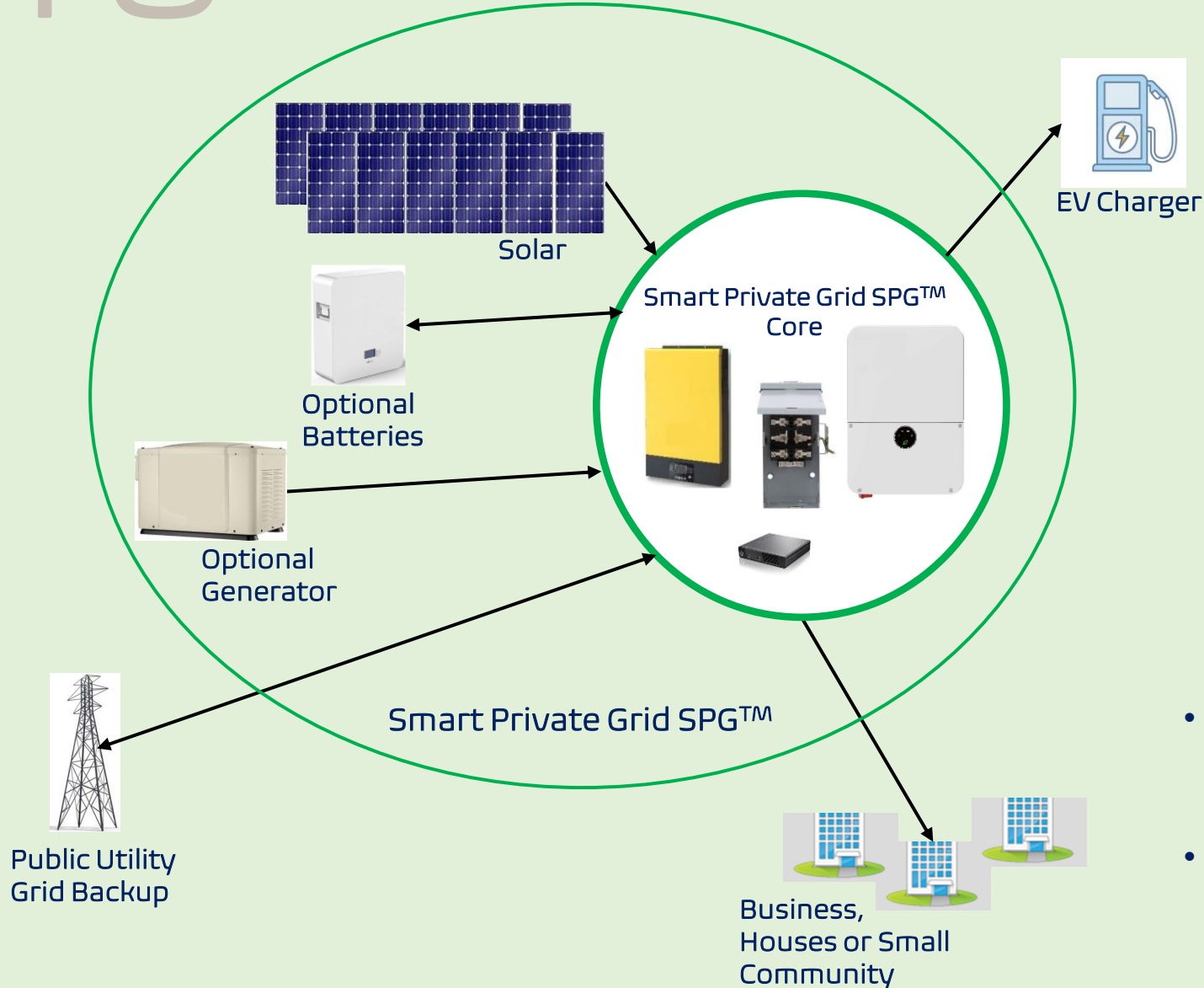
Client ended up never use the public grid!



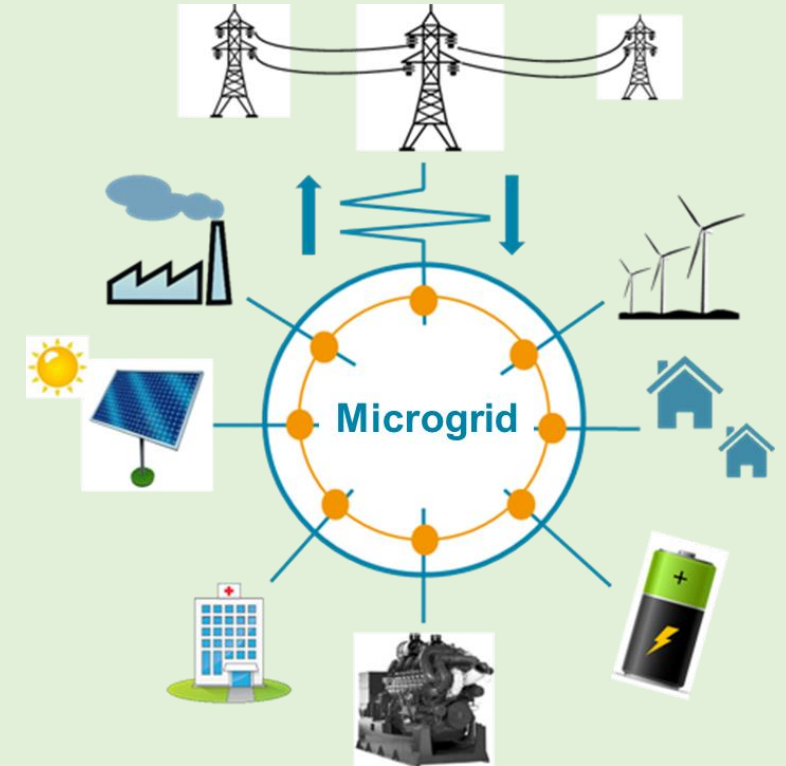
- SPG™ uses Public Utility Grid as a power backup as oppose to main power
- SPG™ is sun energy derived
- SPG™ is hybrid off-grid and on-grid capable
- SPG™ is not directly connected to grid
- SPG™ is smart: Solar, Battery, Generator, Utility
- SPG™ uses multiple inverters and types to scale to meet power consumption requirement
- SPG™ AI uses weather API and energy usage behavior to predict, optimize, and manage power to get as close as possible to 100% Energy Independence
- SPG™ AI is not ready and still in testing

18

Smart Private Grid (SPG™) vs Microgrid



VS



- **SPG™** is user implemented and privately own. Microgrid is implemented by utility companies or cooperative
- **SPG™** is a small & private version of the Microgrid that targets Energy Self-sufficient and can be implemented rapidly, in scale, to reduce fossil fuels dependence

EI

Q&A

Bao Nguyen

email: bnguyen1998@outlook.com

Thank you!