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*Docket Number: 19-SPPE-04*

## Solar+storage is superior to diesel generators for backup power

*Additional submitted attachment is included below.*

29 June 2020
California Energy Commission
1516 9th St, Sacramento, CA 95814

**RE: Solar+storage is superior to diesel generators for backup power**

Dear Chair, California Energy Commission Members, and Staff,

On behalf of the Clean Coalition, I am writing to urge the Commission to require that Microsoft consider solar+storage, a more cost-effective solution than 100% diesel generators, for backup power at its proposed data center project in San Jose. In the San Jose City Data Center Project, demarked by the Commission as proceeding SJ2, Microsoft is requesting permission to build 120 MW of backup diesel generation along with a private substation adjacent to the existing PG&E substation, trying to skirt existing regulations enough to avoid an Environmental Impact Report (EIR) under CEQA. An EIR necessitates a complete study of all solutions, including renewables that would not cause the same damage to the environment as polluting diesel generators. In this proceeding, an EIR has not been completed, nor has a comprehensive study of what is best for the data center and the surrounding community. Before granting Microsoft a permit to install the diesel generators, the CEC must require – and has the power to require – Microsoft to do its due diligence by examining a situation that would not require 100% fossil fuel generation. Even without a requirement for an EIR, the CEC should mandate that the existing project plan cannot move forward without a careful comparison of the total life cycle cost of the proposed diesel backup generators versus solar+storage. This is a matter of best practices related to cost-effectiveness, holding a high-profile business accountable for its actions, minimizing unnecessary pollution, and adhering to state climate goals mandated by the legislature.

As one of the largest and most influential tech companies in the world, Microsoft should lead the way in adopting modern technologies and best practices for mitigating pollution. The San Jose City Data Center Project petition proposed by Microsoft presents a perfect opportunity, especially given that the project is in a disadvantaged, low-income community.[1] As an occupant of that space, Microsoft should be especially conscientious of the community surrounding its data center; the proceeding should consider questions of environmental justice and the ethicality of installing 100% fossil-fuel generation. The answer to the question of backup power must be solar+storage. It would be

[1] California Air Resources Board Priority Investment Populations. https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/communityinvestments.htm

a mistake to install diesel generators, which pollute and have serious health consequences, without a thorough consideration of available renewables options — especially considering the significant stakeholder input the Commission has received, urging them to reject Microsoft's petition. Any discussion about backup power is inherently related to resilience, and diesel generators cannot be considered resilient: they don't generally have enough fuel on hand to last through extended power outages, and the fuel needed to run them may be difficult or impossible to replenish during disasters.

According to the initial project description, to sustain a total electrical load of 99 megawatts (MW) Microsoft proposes installing 40 generators, each with a capacity of 3 MW. Using the numbers referenced below[2], it is safe to assume that a single 3 MW generator will use about 213.3 gallons of diesel fuel in a single hour. In any given outage, not all of the generators will be running at the same time, since Microsoft has proposed oversizing the generators relative to the building's load. According to the project details, on average, the expected load will be around 92 MW, which means that only 31 generators will be used at any given time. Operating 31 diesel generators for just an hour would require 6,612.3 gallons of diesel fuel.

However, this calculation only considers an outage that is a single hour long, which is a conservative estimate. In 2018, even before the start of Public Safety Power Shutoffs (PSPS), the average length of time to restore power in the event of an outage in PG&E service territory, called the Customer Average Interruption Duration Index (CAIDI), was 117 minutes.[3] Thus, at the very least, the data center would actually need 13,224.6 gallons of diesel fuel to maintain the electrical load through a normal outage. PG&E's 2020 Wildfire Mitigation Plan suggests that power will be restored within 12 hours following the conclusion of a severe weather event.[4] If a PSPS lasts a day or longer, it will be extremely difficult to sustain the levels of diesel fuel needed to support the electrical load for the data center. It is worth noting that in October 2019, parts of San Jose lost power in two multi-day PSPS, meaning it is a contingency that must be planned for to achieve true resilience.[5] That being said, to prepare for a PSPS or other outage of only 12 hours, it would be necessary to acquire almost 80,000 gallons of diesel fuel to run at least 31 diesel generators 100% of the time. A container capable of

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[2] Based on approximate calculations for an hourlong outage, a 1 MW generator would use 71.1 gallons of diesel fuel per hour when sustaining the full electrical load at this facility, and a 2 MW generator would use 141.9 gallons per hour.

[3] https://www.pge.com/en_US/residential/outages/planning-and-preparedness/safety-and-preparedness/grid-reliability/electric-reliability-reports/electric-reliability-reports.page

[4] https://www.sonomacountygazette.com/sonoma-county-news/pg-amp-e-actions-for-safety-during-2020-wildfire-season

[5] San Jose Clean Energy PSPS Preparation Page https://sanjosecleanenergy.org/psps/

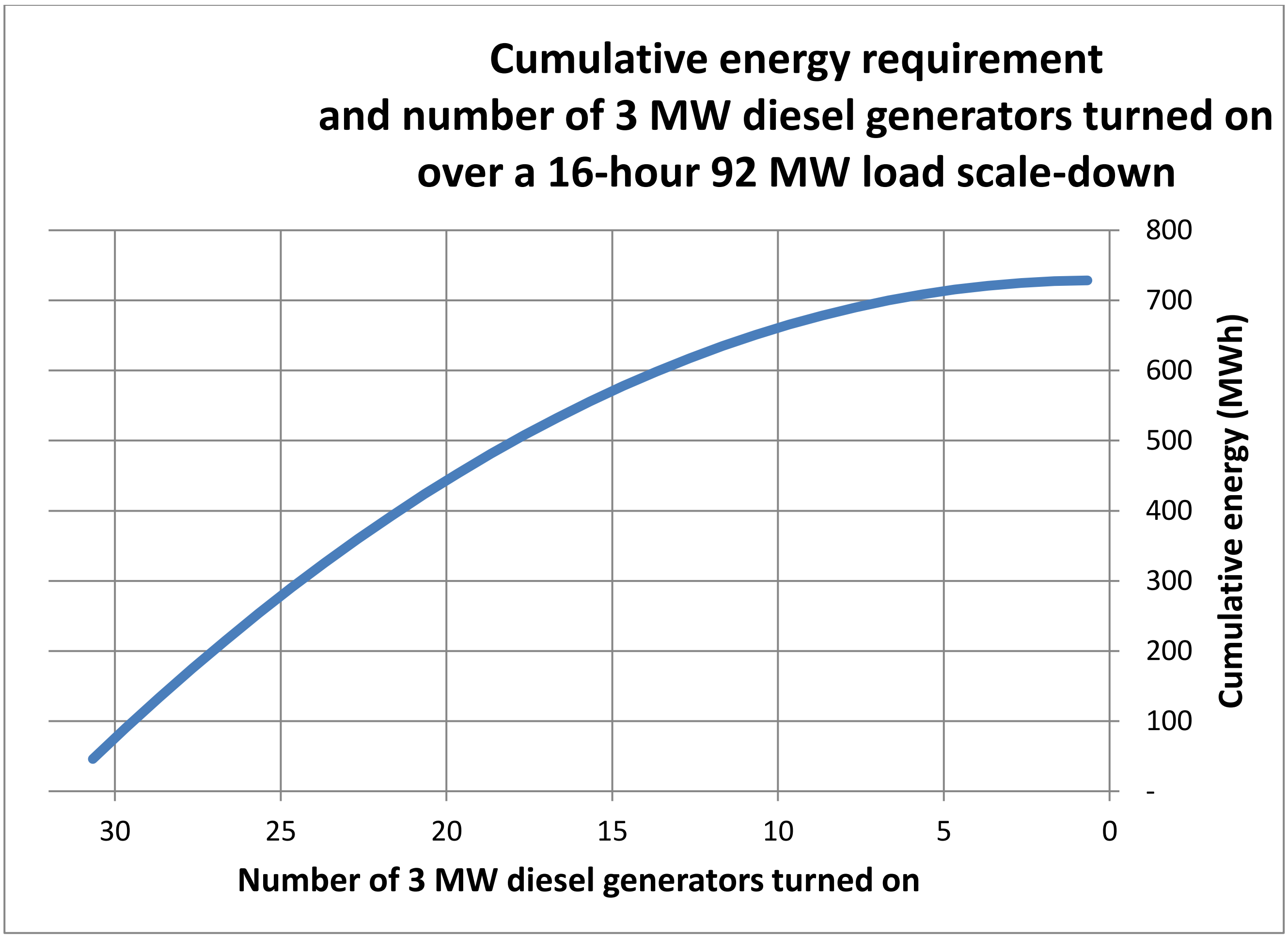
holding that much liquid would take up a space 18 feet in diameter and 40 feet high. Preparing for a 24-hour or longer outage would require multiple of those 80,000 gallon containers. And such containers would have to be close to the generators it would be dispensing diesel to — in the middle of a data center and an interconnection substation that is directly adjacent to an existing PG&E substation. Since an outage of more than 12 hours would be even harder to prepare for and several PSPS events have lasted for multiple days, is 100% diesel even a realistic option? How could this plan possibly be considered resilient? It isn't. In fact, it is not an understatement to consider that much diesel stored in one place as a danger to everything around it, which is why this proceeding would be remiss to allow the petition to go forward without serious consideration of other options.

The comments that follow refer to a 2015 Clean Coalition presentation on renewable options for backing up data centers; the presentation is more pertinent now than ever. The comments reference specific slide numbers, and the presentation is attached in its entirety as an appendix.

Solar+storage is a truly resilient option. Beyond providing emergency backup power for resilience, generating solar energy will allow the Microsoft Data Center to use solar during the day as a power source for the building. Slide 17 of the attached presentation shows that data centers do not follow the classic electrical load profile of a normal residential or office building but instead have a high electrical load that must be maintained all the time. Solar+storage can satisfy the special needs of a data center while also providing unparalleled resilience. The key to resilience is having enough backup power available for use whenever it is needed. This is considered in slide 19; slide 18 visually represents the solution by graphing how solar+storage can flatten the daily solar curve by allowing a certain portion of energy to be distributed evenly throughout the day. Even if the focus of the petitioner is on emergency backup power only, charging the battery during the day will allow the solar power to last through the night, if it is needed.

Solar+storage is a viable option. Slides 21-23 represent the ratio of diesel generators that can be replaced by a solar+storage system. In general, for every 1 megawatt-hour (MWh) of renewables and energy storage, three diesel generators can be removed. As shown on slide 24, even on the worst weather days in California, 2 MW of installed solar supplies 1 MWh of energy. These estimates hinge on a data center downshifting the total load the more prolonged an outage is. Moreover, the larger the size of the battery, the more diesel generators solar+storage can replace. Since the cost of energy storage continues to fall, a solar+storage system is a much more resilient and cost-effective option than buying 40 permanent diesel generators. By the time Microsoft is ready to proceed with construction after the proceeding has considered renewable options, there is no doubt that the price of energy storage will have dropped further. Thus, it is worth considering the potential of standalone energy storage as well.

The Clean Coalition calculated the minimum state of charge of a battery needed to replace 3 MW diesel generators that Microsoft has proposed. The figure below assumes a total load of 92 MW sustained by 3 MW diesel generators, which are scaled-down over the course of a 16-hour to represent load shifting.




The larger the energy storage, the more diesel generators it will be able to replace. When all 31 generators are running at the start of an outage, the full discharge from a 200 MWh battery could replace 5 generators. The more that the data center is able to scale-down the total load, the more effective a larger sized battery would be. For example, the increase of a battery from 500 MWh to 700 MWh is enough to replace 11 generators. There is certainly reason in this proceeding to consider the value of standalone storage, in addition to solar+storage options.

Microsoft is an innovative company and should behave as such in this proceeding. The best way to live up to its reputation and existing company pledges is to consider innovative options such as a combination of complementary renewable energy generation sources. Wind and solar generation profiles are highly complementary; when one is not producing energy, the other one often is. As shown on slide 20, a single 3 MW wind turbine averages 24 MWh per day. Microsoft should consider whether there is enough space at the facility to install a wind turbine. According to the original project plan, there is about 68 acres of unused land; a single 2 MW wind turbine uses 1.5 acres of land. There is space, meaning the only question is one of interest on the part of Microsoft. It is clear that if Microsoft wants 100% backup power in any situation, renewable energy and storage are more than capable of delivering a significant amount of that energy.

The final consideration is one of Microsoft's interest in true resilience. Clearly, the petitioner is interested in 100% resilience, even at the cost of procuring extra diesel generators for the sake of system redundancies. We have already addressed the lack of resilience in Microsoft's plan for relying on diesel generators. However, the Clean Coalition also urges the petitioner to consider the possibility of an outage stemming from the physical infrastructure interconnecting the proposed substation to the adjacent PG&E substation. In the case that the entire PG&E substation is de-energized, as part of a PSPS or other outage, the most effective way to provide resilience would be with a combination of software and hardware that would turn the property into a microgrid. A solar+storage microgrid would optimize the configuration with any other renewable resources – such as wind turbines – and the backup diesel generators (and the two administrative generators), potentially providing other services such as demand response or electric vehicle charging, as detailed in slide 20.

California needs to set a good example. Other states (and even other nations) look to California to set precedent on climate change and clean energy. That starts with the way that the state chooses to regulate all new power-generating developments, especially such a high-profile case as this one. In January, Microsoft pledged to be carbon negative by 2030.[6] But why should Microsoft be allowed to pollute in our cities here in California and then install carbon negative technology in another state or buy trees on anther continent to claim a carbon offset? The Microsoft plan specifically calls for, "driving down our own direct emissions and emissions related to the energy we use to near zero by the middle of this decade," which is only possible if plans for backup generation – here and in the future — are approved solely with renewable generation. Otherwise, achieving net zero goals are impossible without carbon negative technology, which is another added cost to the project, making a solar+storage microgrid seem even more cost effective. Approving dirty fossil-fuel generation when cost-effective, renewable options are available is a step in the wrong direction. That is especially egregious when it is

[6] https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/

done without an environmental review under the California Environmental Quality Act (CEQA). Though this project is legally exempt from the CEQA requirement, it does not take an Environmental Impact Report to understand that approving such a project will have negative effects on the health of San Jose residents and will result in large amounts of pollution whenever the generators are turned on, whether that is during an outage or the regularly scheduled maintenance required to maintain such a large supply of diesel generators.

The January announcement by Microsoft also included, "a new initiative to use Microsoft technology to help our suppliers and customers around the world reduce their own carbon footprints," which is important, but it is the second part of the equation. Carbon reduction needs to start here at home, and it must start with limiting the irresponsible deployment of additional fossil-fuel generation — especially when superior options are not only possible but also make economic sense. Considering renewable energy and storage options in this proceeding will demonstrate that regulators are prioritizing environmental goals set forth by the California Legislature.

Thank you,

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Clean Coalition
Making Clean Local Energy Accessible Now

# Renewables-driven Microgrids for Data Centers

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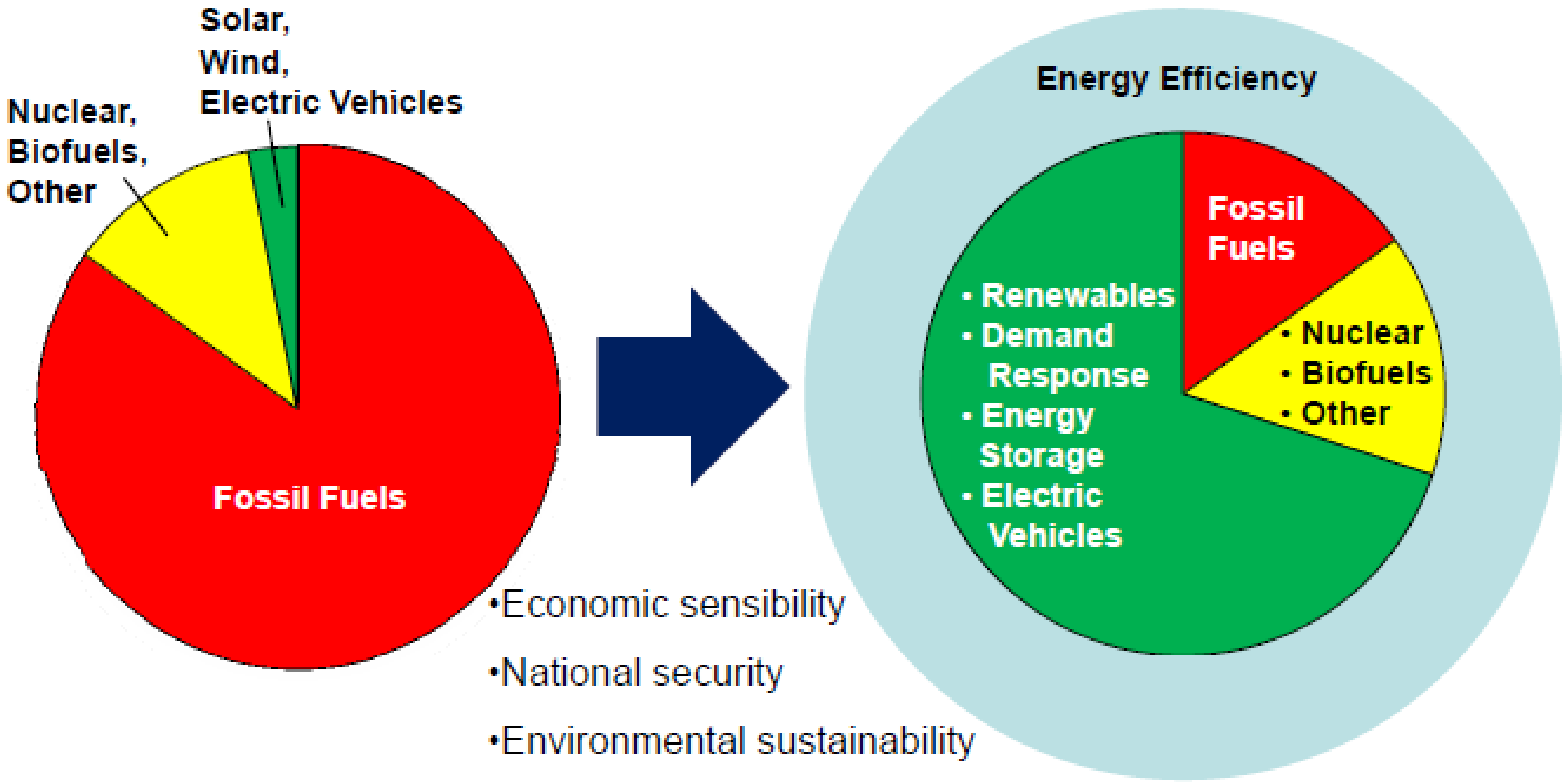
15 September 2017

# Clean Coalition (non-profit) Mission

Clean Coalition

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise

# Clean Coalition Vision

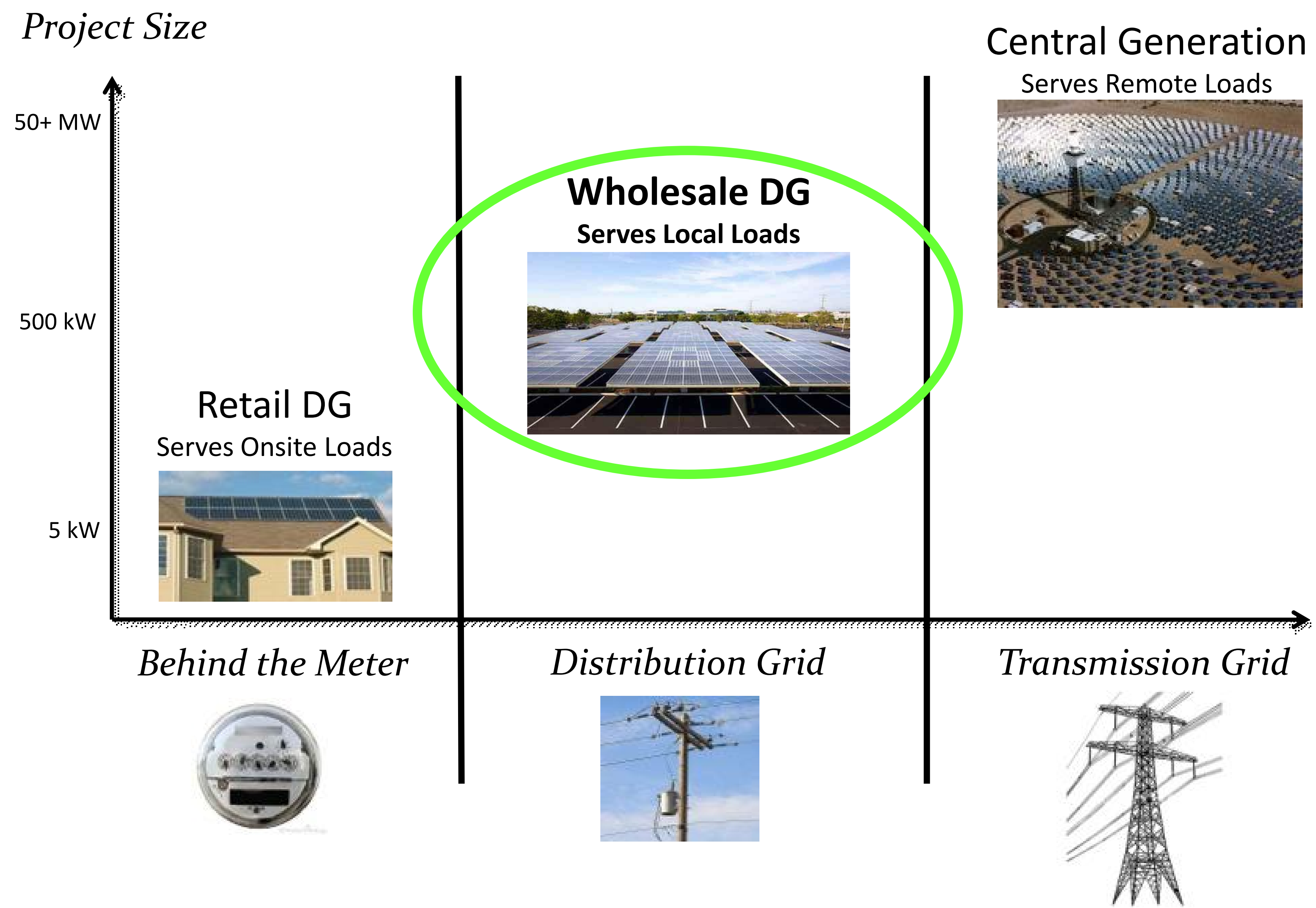



- Economic sensibility
- National security
- Environmental sustainability

**The $6 trillion energy market will transition to Smart Energy**

# WDG Unleashes Renewables

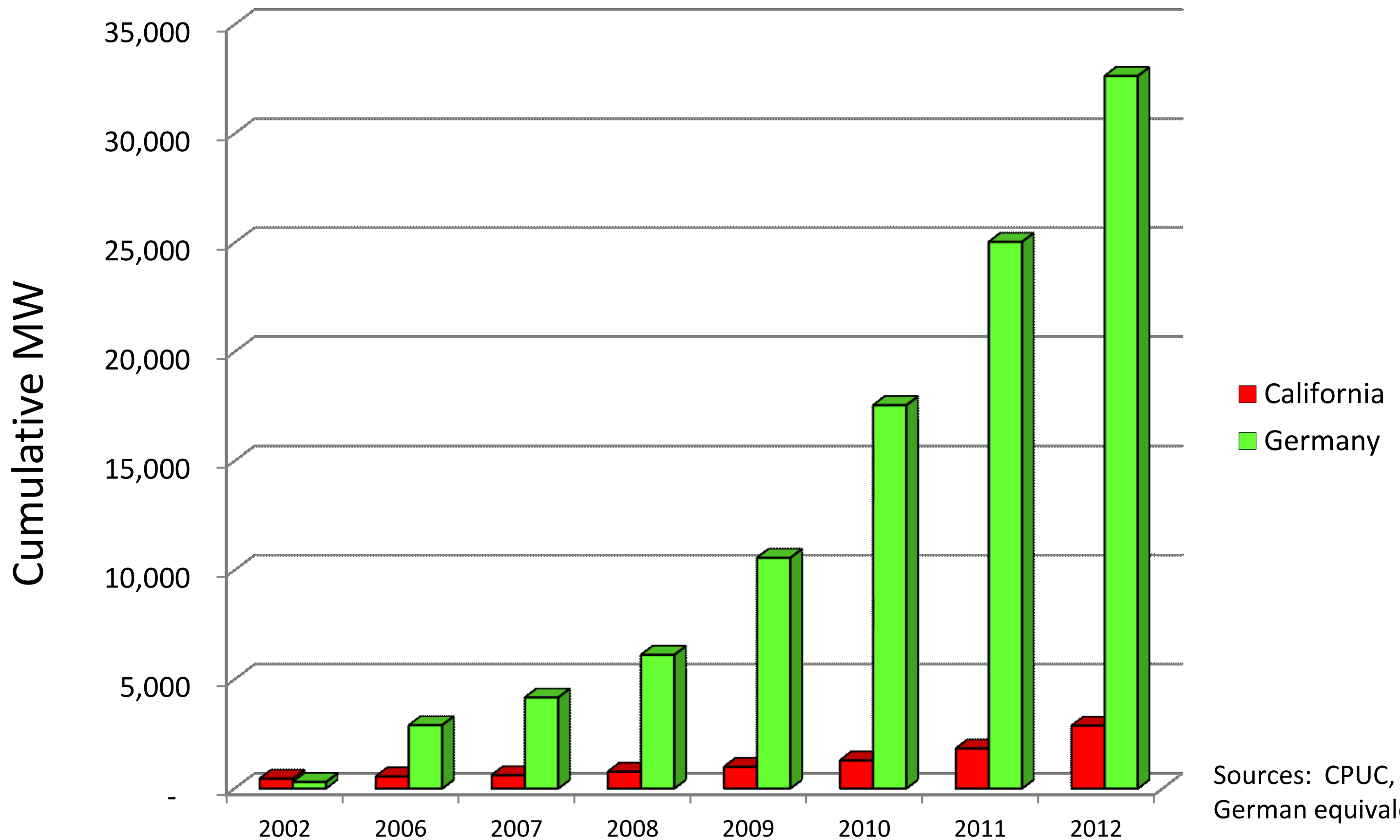
Clean Coalition



# WDG Unleashed Solar in Germany

Clean Coalition

## Solar Markets: Germany vs California (RPS + CSI + other)




Sources: CPUC, CEC, SEIA and German equivalents.

**Germany deployed over 10 times more solar than California in the decade from 2002 despite California having 70% better solar resource**

# Community Microgrid Vision

Clean Coalition

# What is a Community Microgrid?

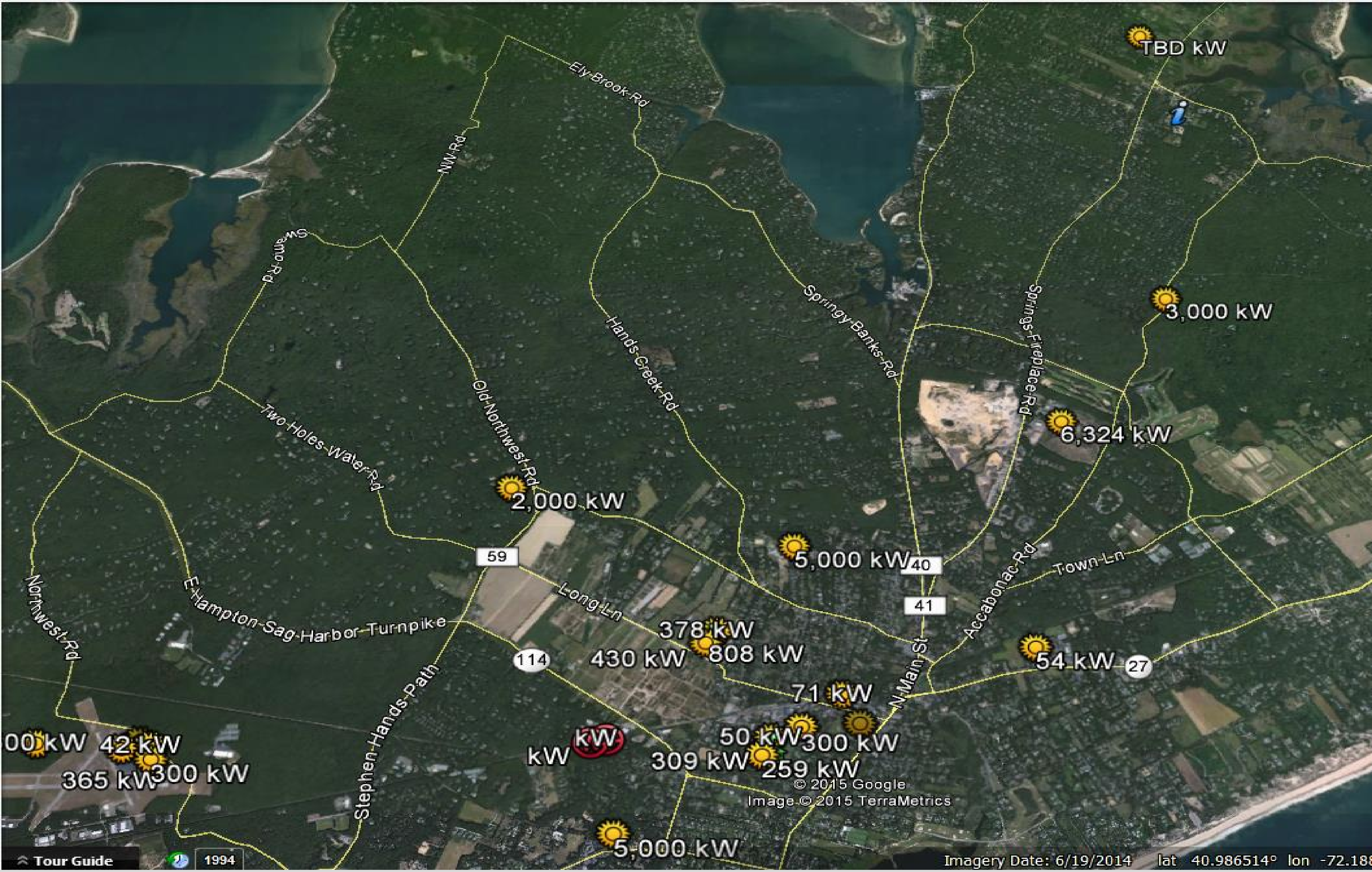
CLEAN COALITION

**A Community Microgrid is a new approach for designing and operating the electric grid, stacked with local renewables.**

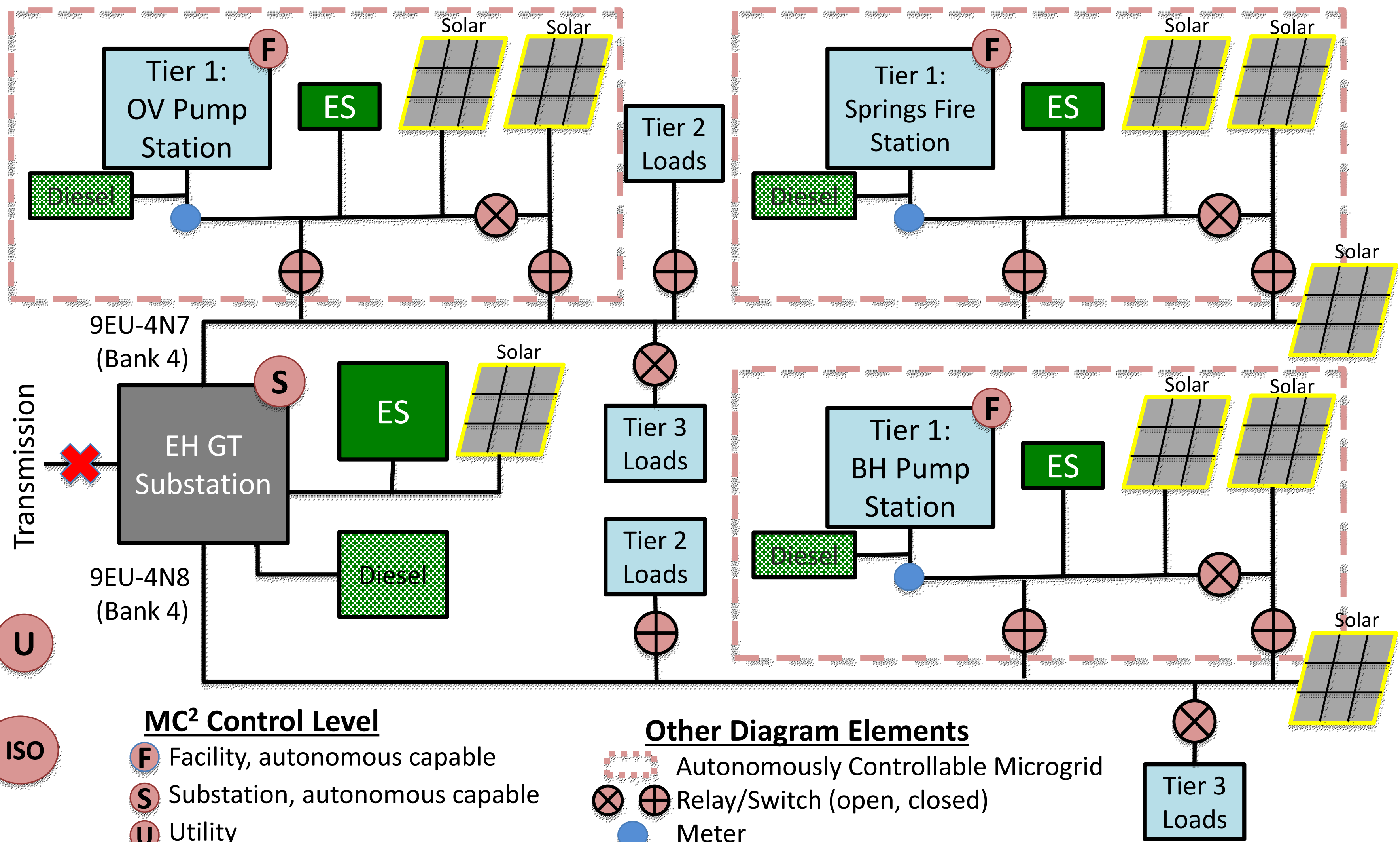
**Key features:**

- A targeted and coordinated local grid area served by one or more distribution substations
- High penetrations of local renewables and other Distributed Energy Resources (DER) such as energy storage and demand response
- Staged capability for ongoing renewables-driven power backup for critical and prioritized loads across the grid area
- A solution that can be readily extended throughout a utility service territory – and replicated into any utility service territory around the world

# Long Island Community Microgrid – Map View



# Long Island Community Microgrid - Diagram




**MC² Control Level**

- F Facility, autonomous capable
- S Substation, autonomous capable
- U Utility
- ISO Independent System Operators

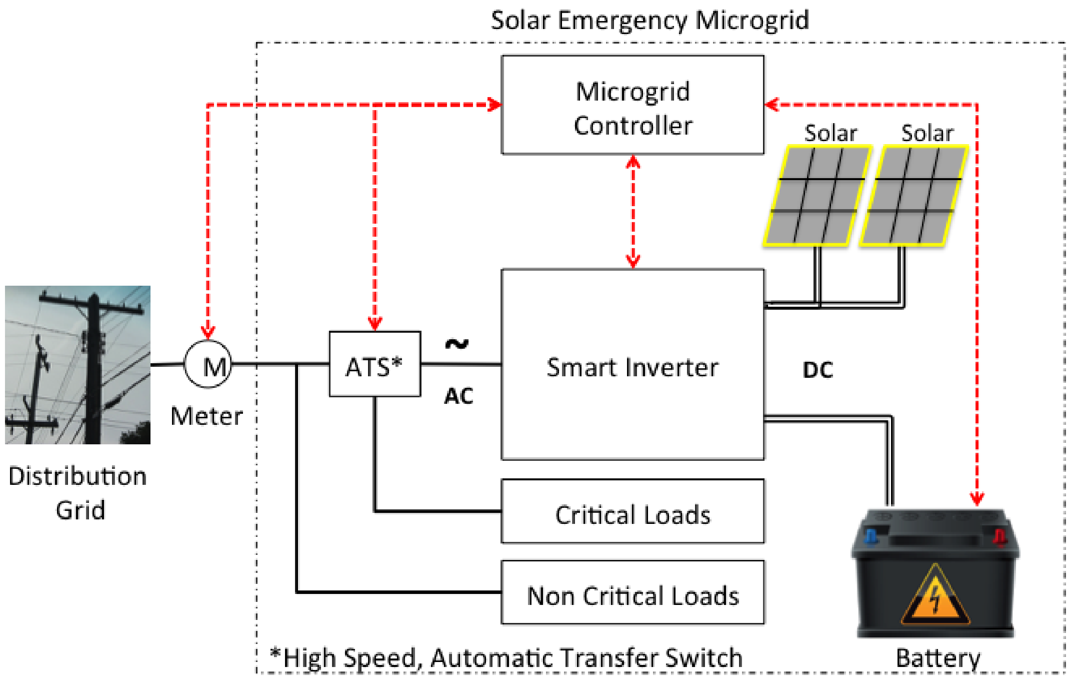
**Other Diagram Elements**

- Autonomously Controllable Microgrid
- Relay/Switch (open, closed)
- Meter

# Solar Emergency Microgrid overview

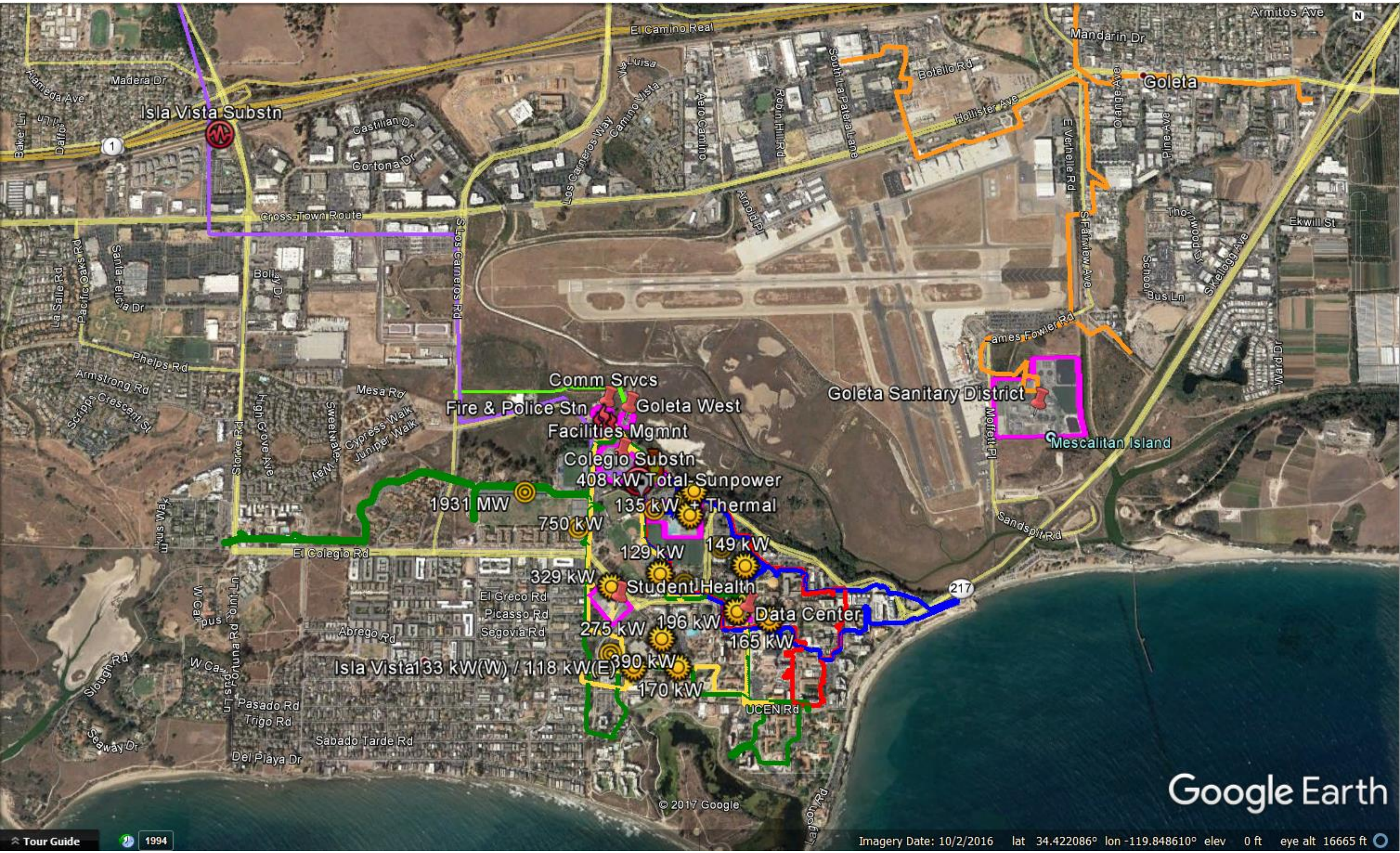
Clean Coalition

- A Solar Emergency Microgrid (SEM) has 3 basic components:
  - Solar; energy storage; and monitoring, communications & control
- A SEM provides <u>indefinite</u> back-up power for critical loads
  - Ideal for police and fire stations, emergency operations centers and shelters, critical communications and water infrastructure, etc
- Displaces dirty, expensive, non-renewable diesel generators



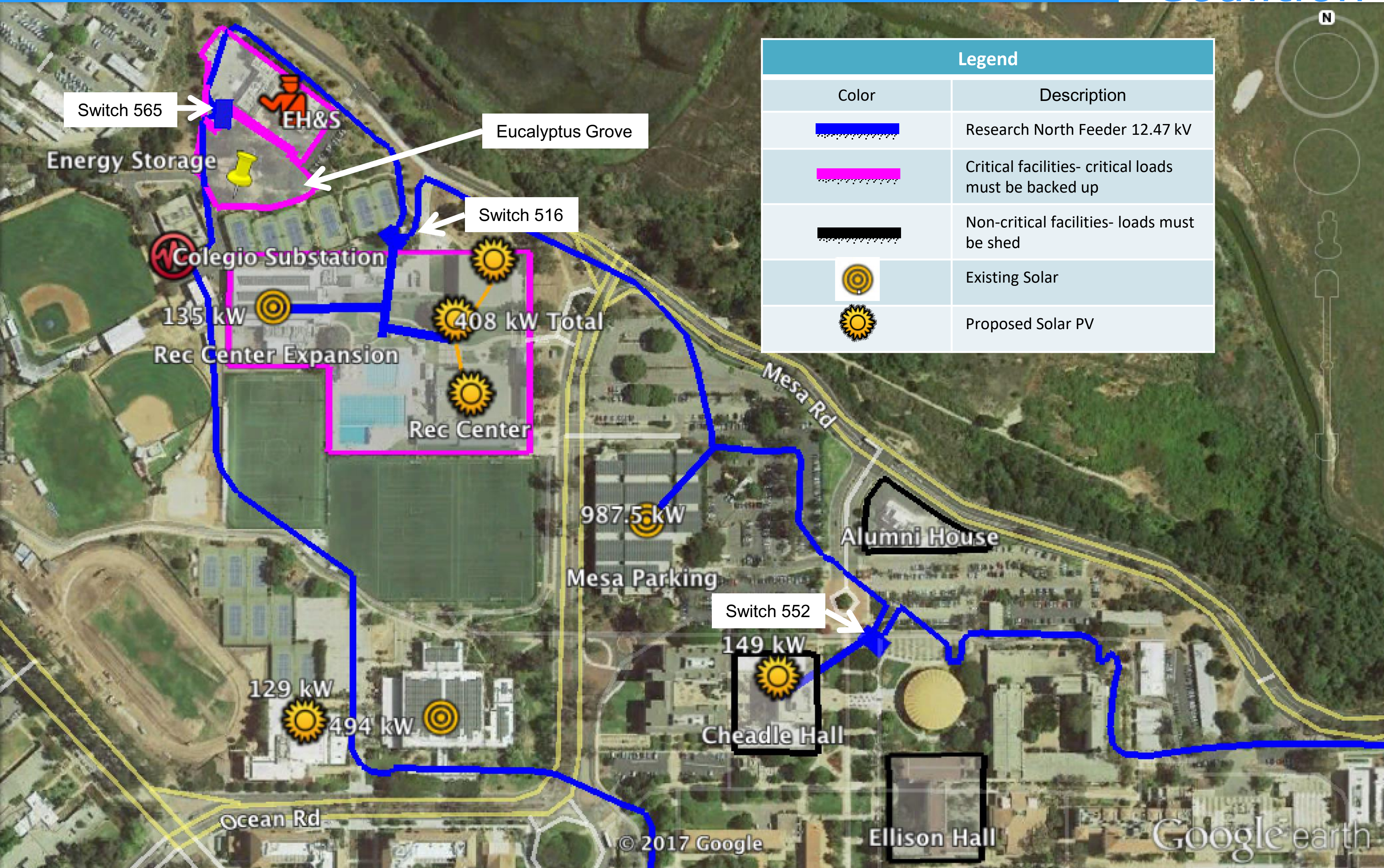
# UCSB Community Microgrid – Area Map

Clean Coalition



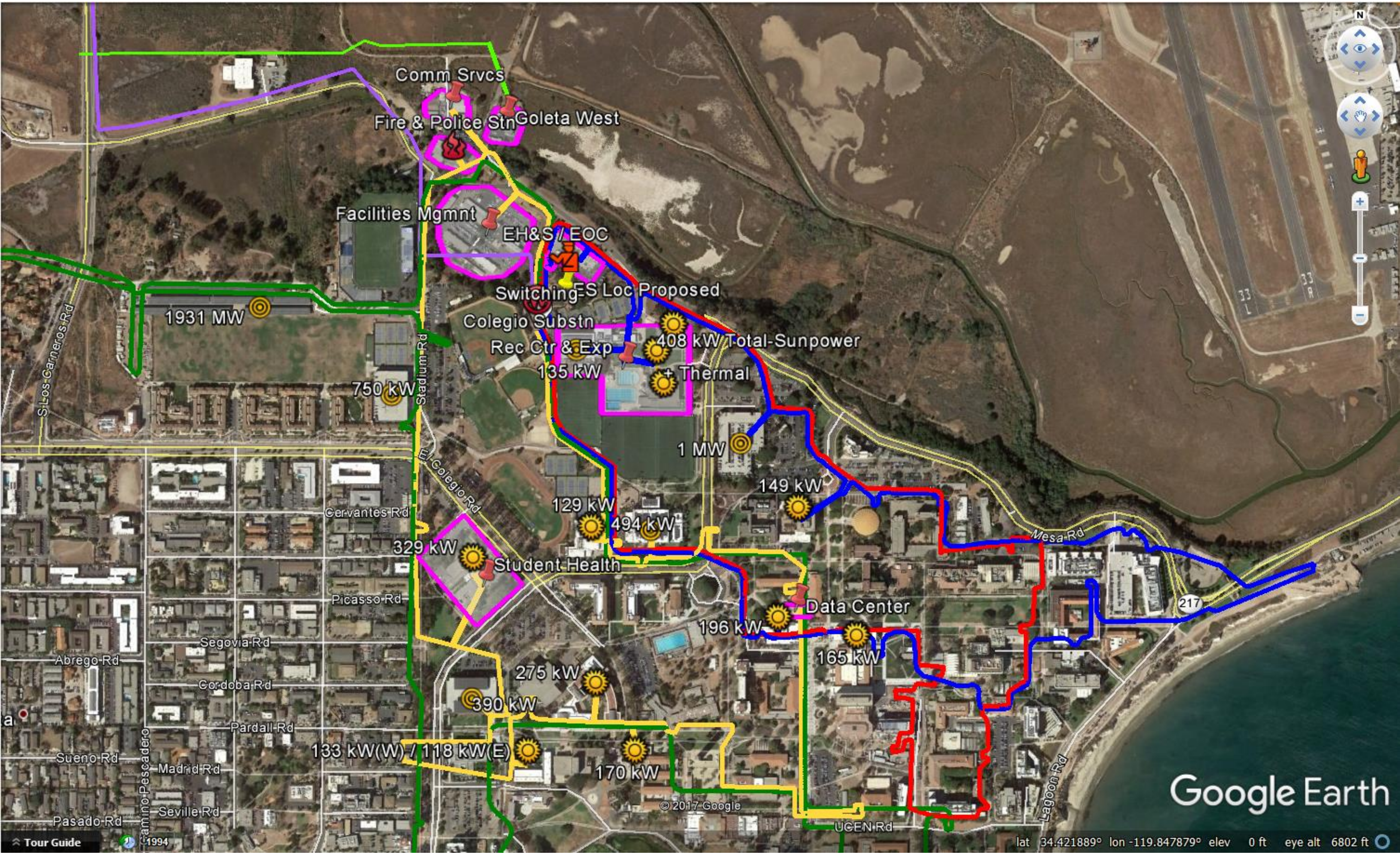
# UCSB Community Microgrid – Phase 1

Clean Coalition



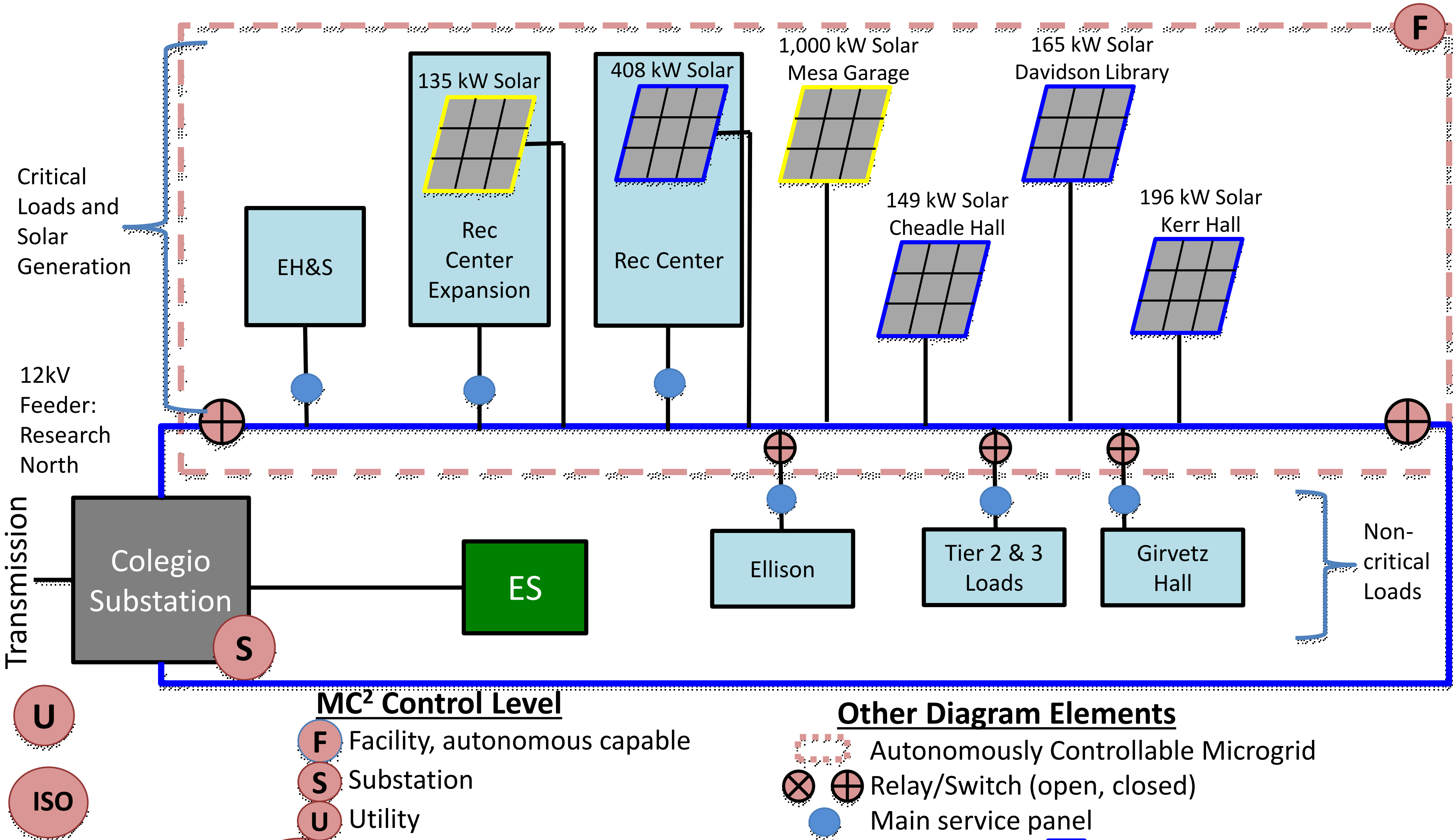
# UCSB Community Microgrid – Phase 1 + 2

Clean Coalition



# UCSB Community Microgrid – Phase 1

Clean Coalition




**MC² Control Level**

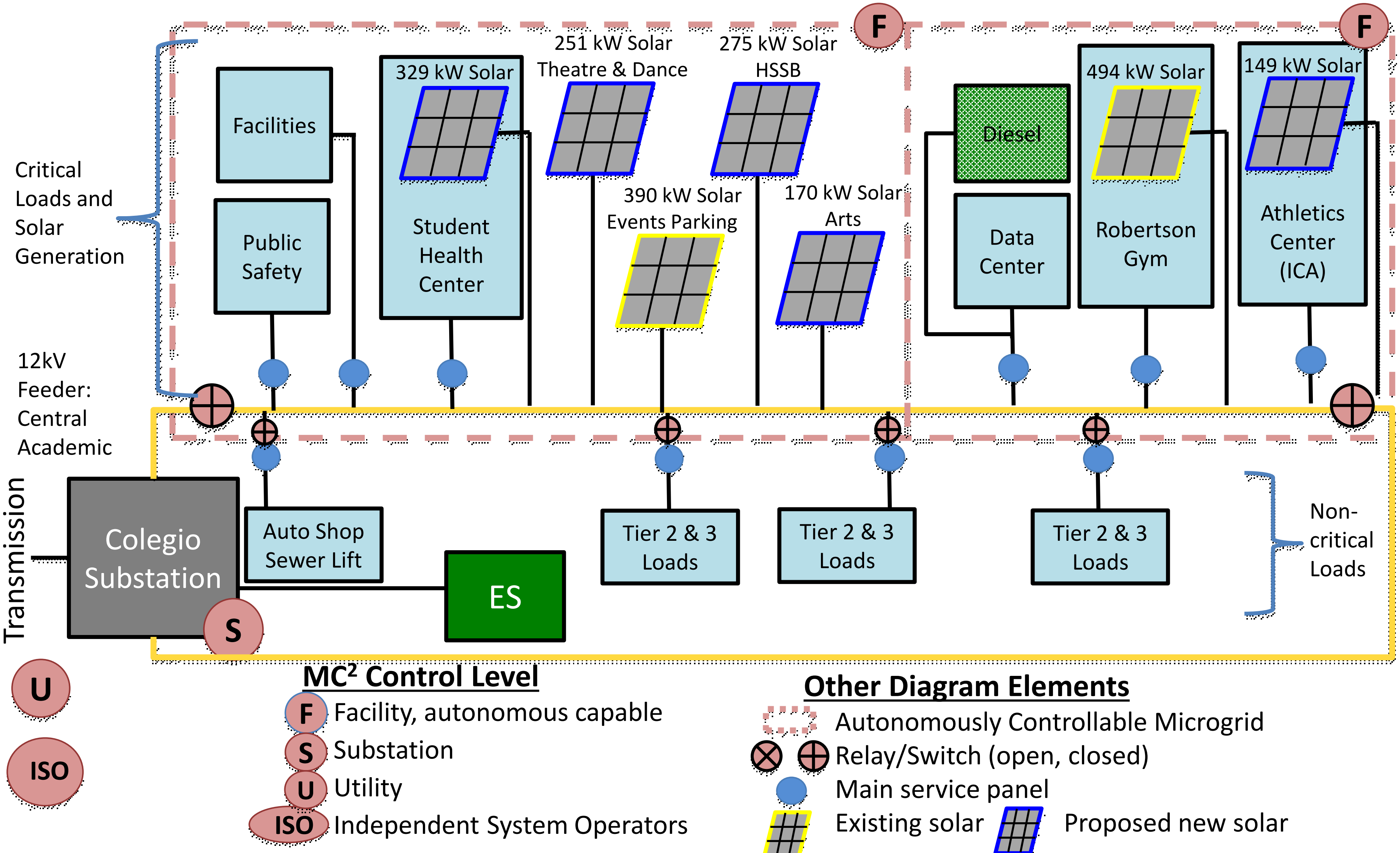
- F Facility, autonomous capable
- S Substation
- U Utility
- ISO Independent System Operators

**Other Diagram Elements**

- Autonomously Controllable Microgrid
- Relay/Switch (open, closed)
- Main service panel
- Existing solar
- Proposed new solar

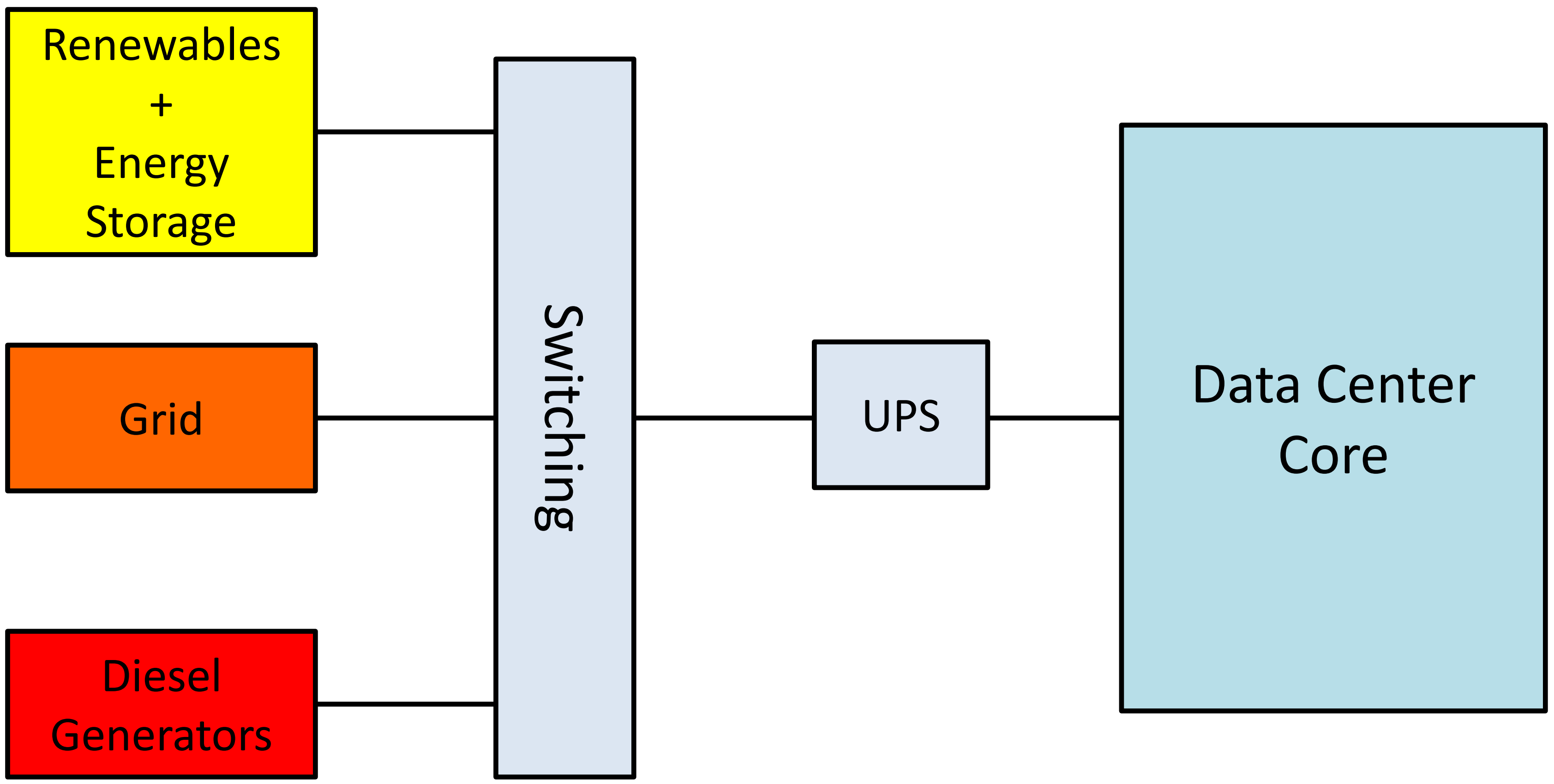
# UCSB Community Microgrid – Phase 2

Clean Coalition

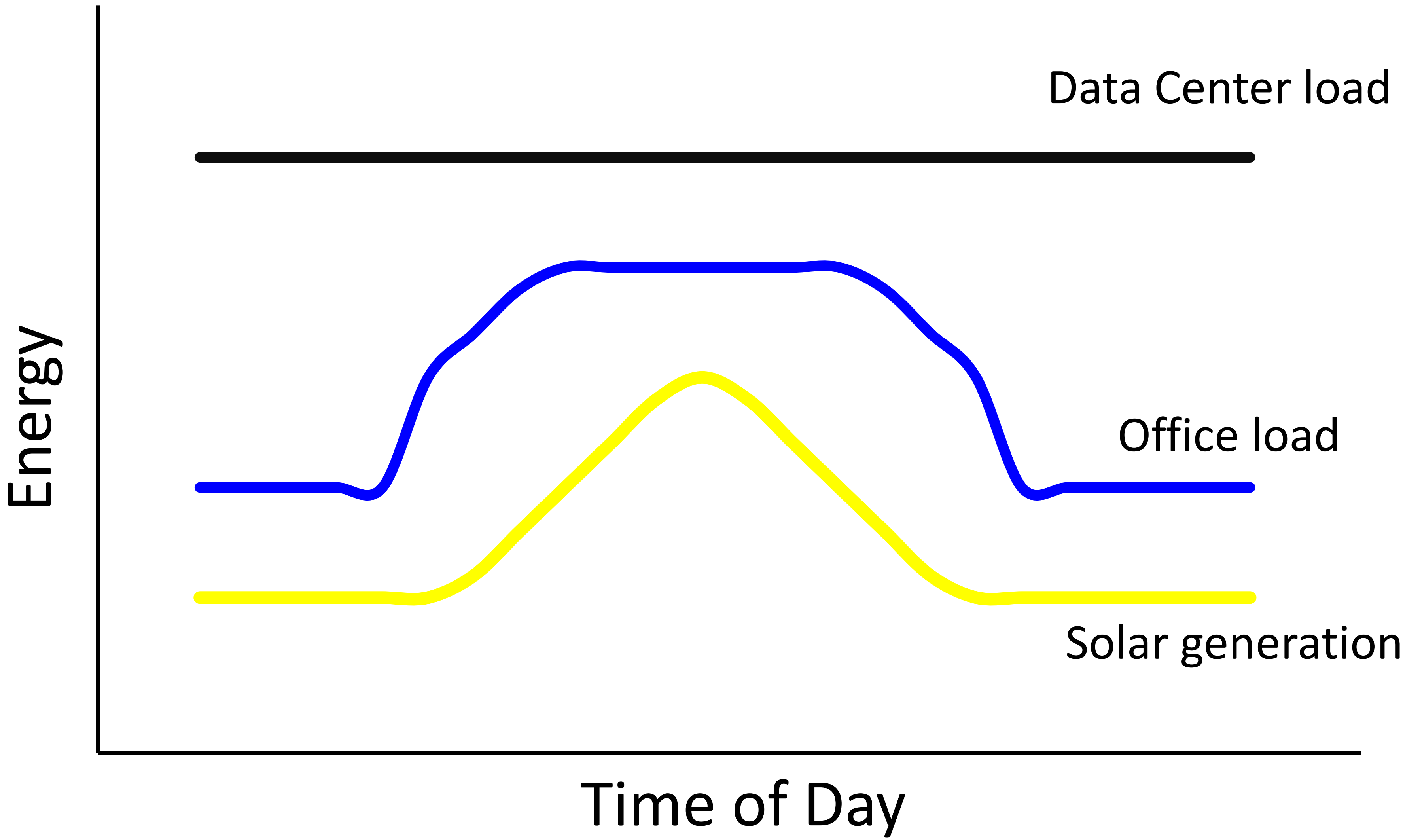


# Renewables for Data Center Energy & Resilience

Clean Coalition

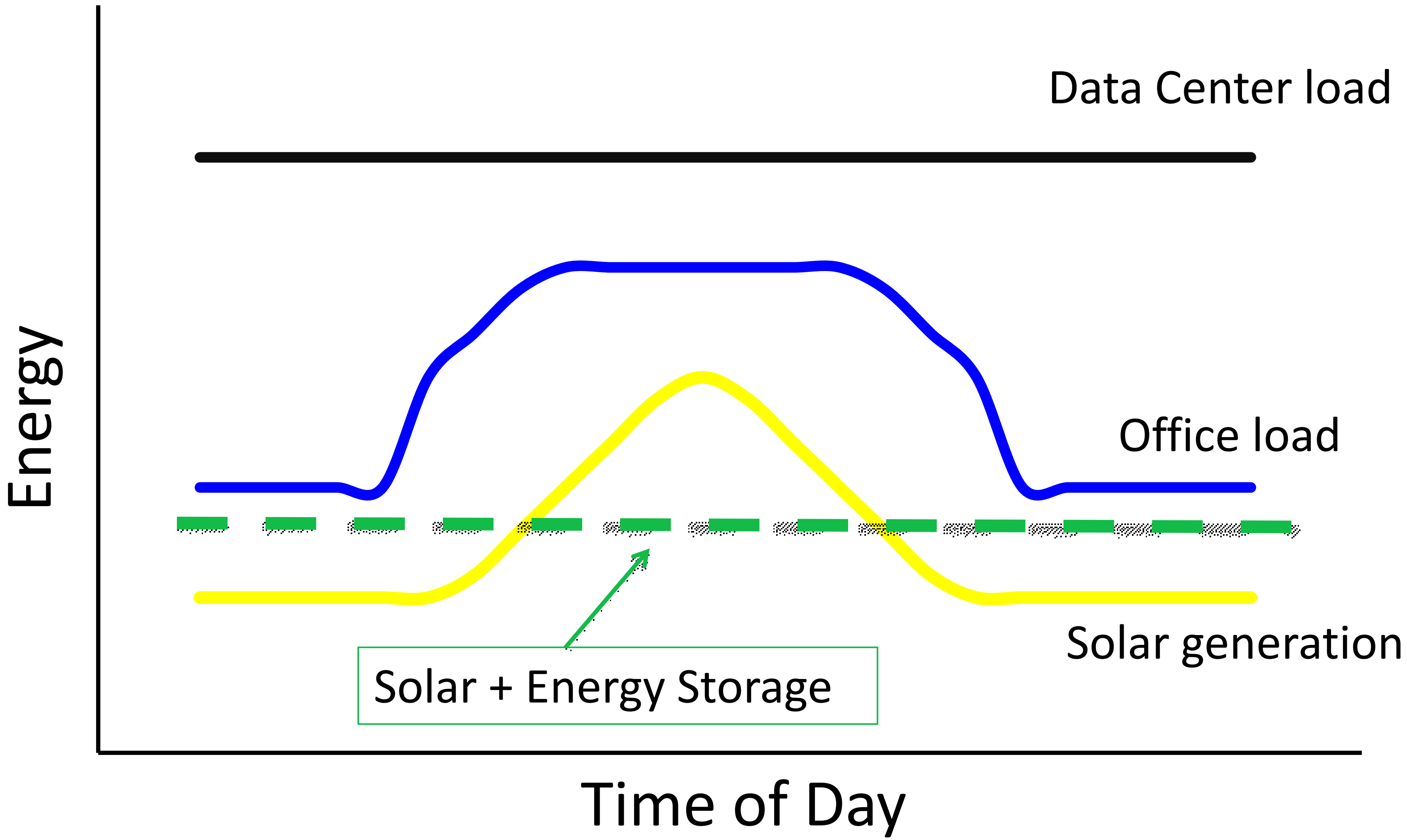


# Solar and Load Profiles – Data Center Challenge



# Local Solar + Energy Storage = Indefinite Energy

Clean Coalition



# Local Solar + Energy Storage to Replace 1MW of Diesel

Clean Coalition

- Assumptions
  - 20% solar capacity factor (typical for MW-scale solar in California)
  - Worst solar day is 10% of average (ie, 2% capacity factor)
  - 2 acres of siting required per 1 MW of solar
  - Requires 24x7x365 performance
- Calculations
  - 24 MWh of replenishment solar required daily (1 MW x 24 hr)
  - 50 MW of solar required (50 MW x .02 capacity factor x 24 hr)
  - 24 MWh of energy storage required

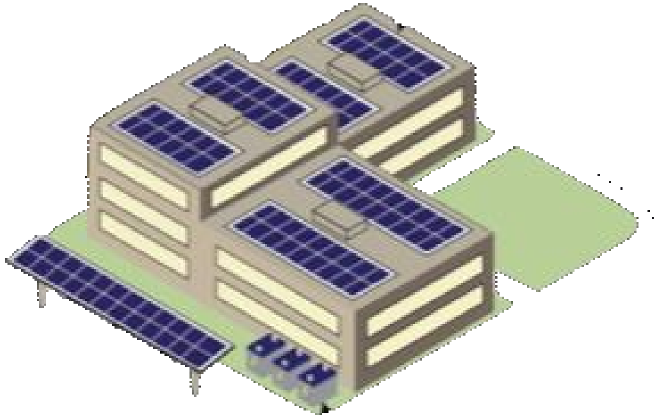
Opportunity: Local renewables + energy storage can provide indefinite backup power.

Challenge: Data centers have large flat loads; 100% solar is tough.

# Other Plays for Local Renewables + Energy Storage

Clean Coalition

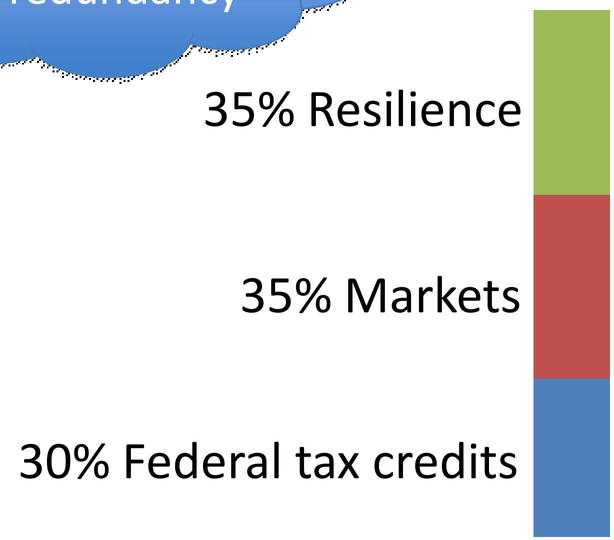
- Diversify renewables
  - Wind & solar generation profiles are highly complementary
  - One 3MW wind turbine averages 24 MWh/day



- Diversify geography
  - Demand Response (DR) combined with renewables + energy storage = big UPS
  - Fail-over strategies can allow significant reduction in energy usage

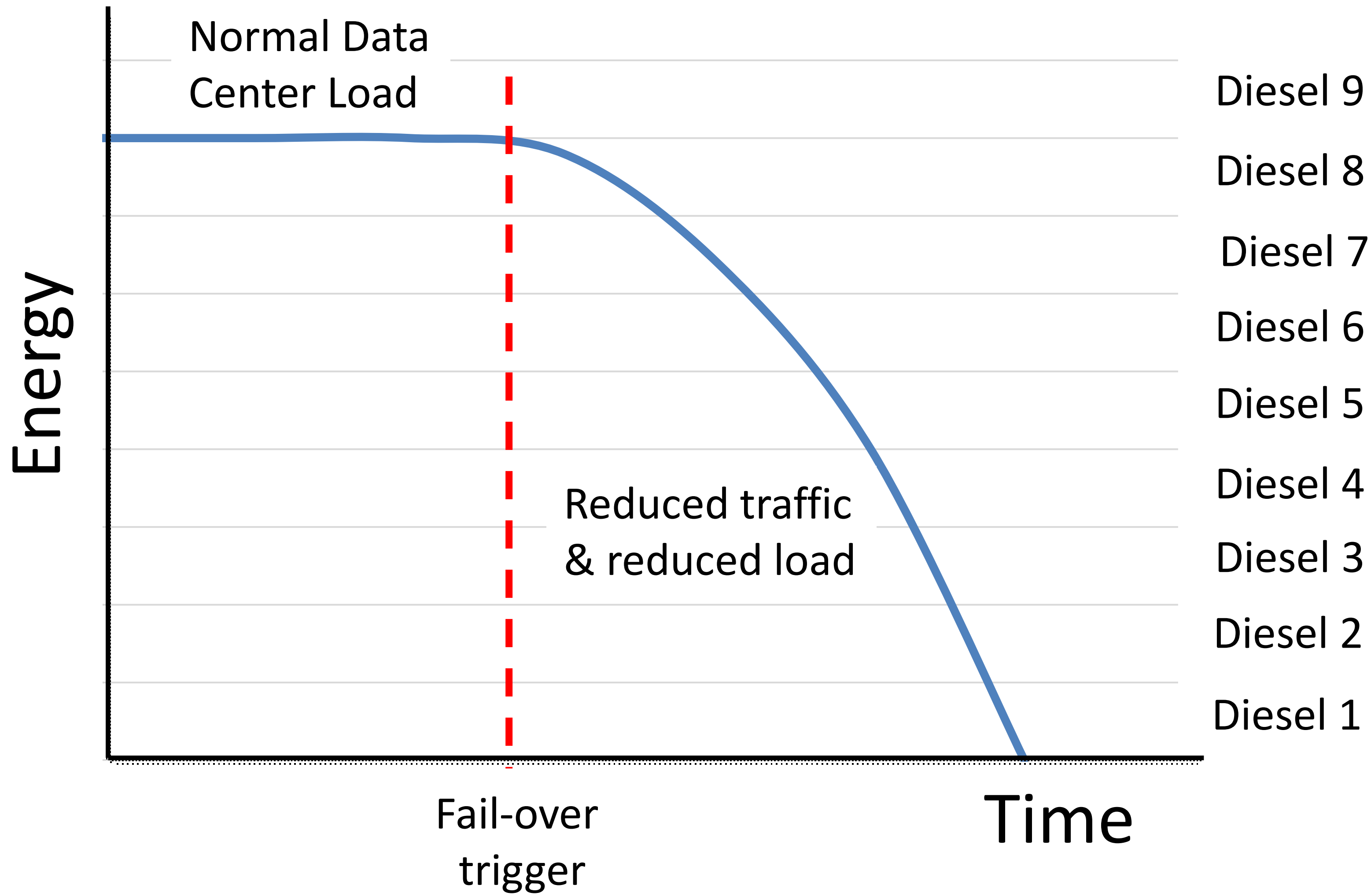
Cloud offers
geo redundancy

- Monetize energy storage in markets like DR and frequency regulation
  - Markets typically cover 35% of energy storage costs while tax credits cover another 30%



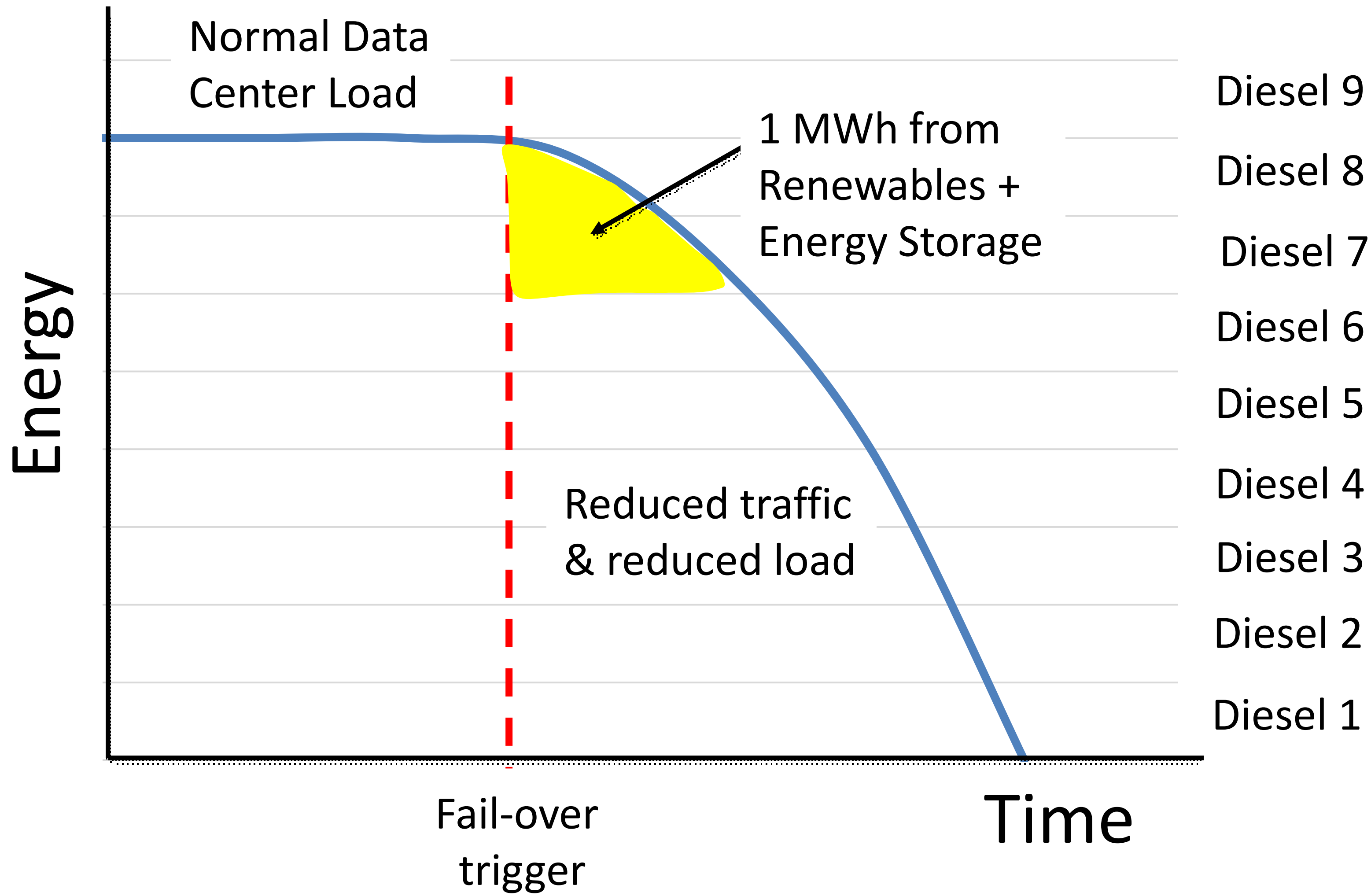
# Demand Response (DR) Opportunity

Clean Coalition



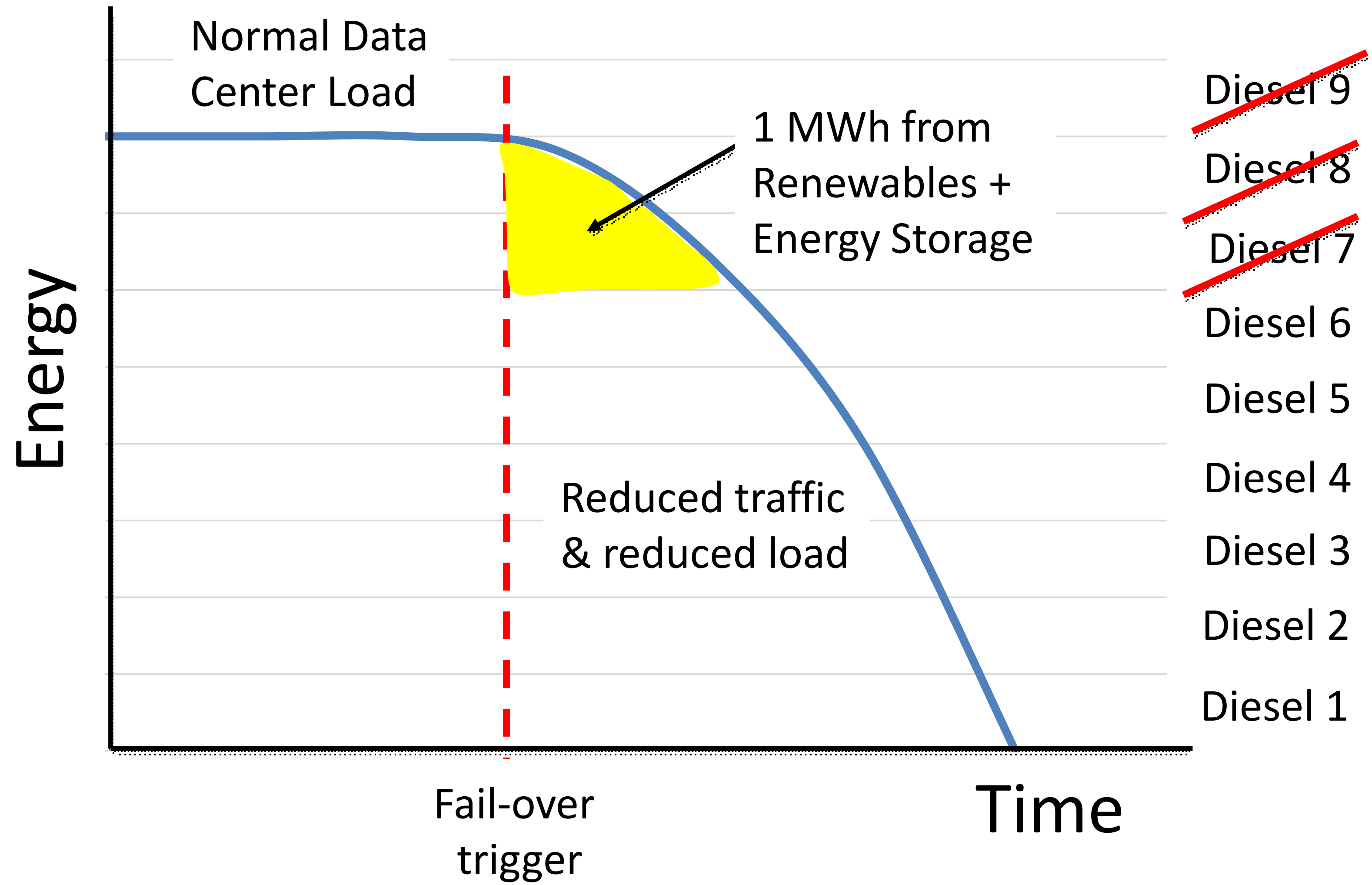
# DR + Renewables + Energy Storage = Big UPS

Clean Coalition



# DR + Renewables + Energy Storage = Success

Clean Coalition



# Multiple Pathways to Replacing 1MWh of Diesel

Clean Coalition

- 1 MWh of energy storage with small solar or other renewables
- 2 MW of solar supplies 1 MWh of energy on worst weather day in California

Replacing 1 MWh of Diesel with
local renewables + energy storage is easy

# Seeking Data Center Pioneers

Clean Coalition

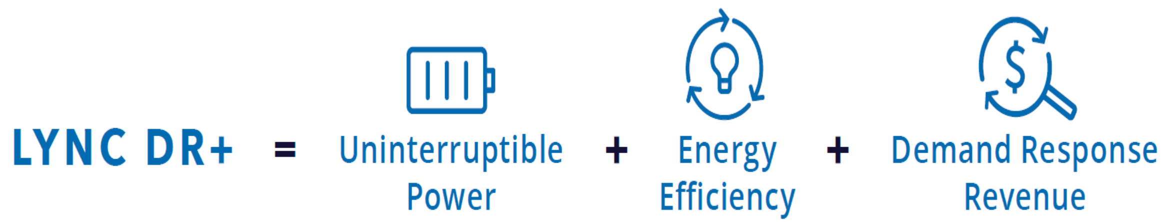
- Local renewables + energy storage is increasingly viable, including for a portion of data center requirements
- Challenges exist for data center pioneers to help overcome

**The Clean Coalition is seeking data center pioneers to conquer the next renewables frontier!**

# Backup

# LYNC DR®+: Energy Resiliency for Datacenters

- Ensures critical loads stay operating when the grid goes down
- Enables revenue from demand response and savings from peak shaving
- Reduces power penalty from traditional double conversion UPS




**Transform a cost center into a revenue-earning and cost-reducing asset**

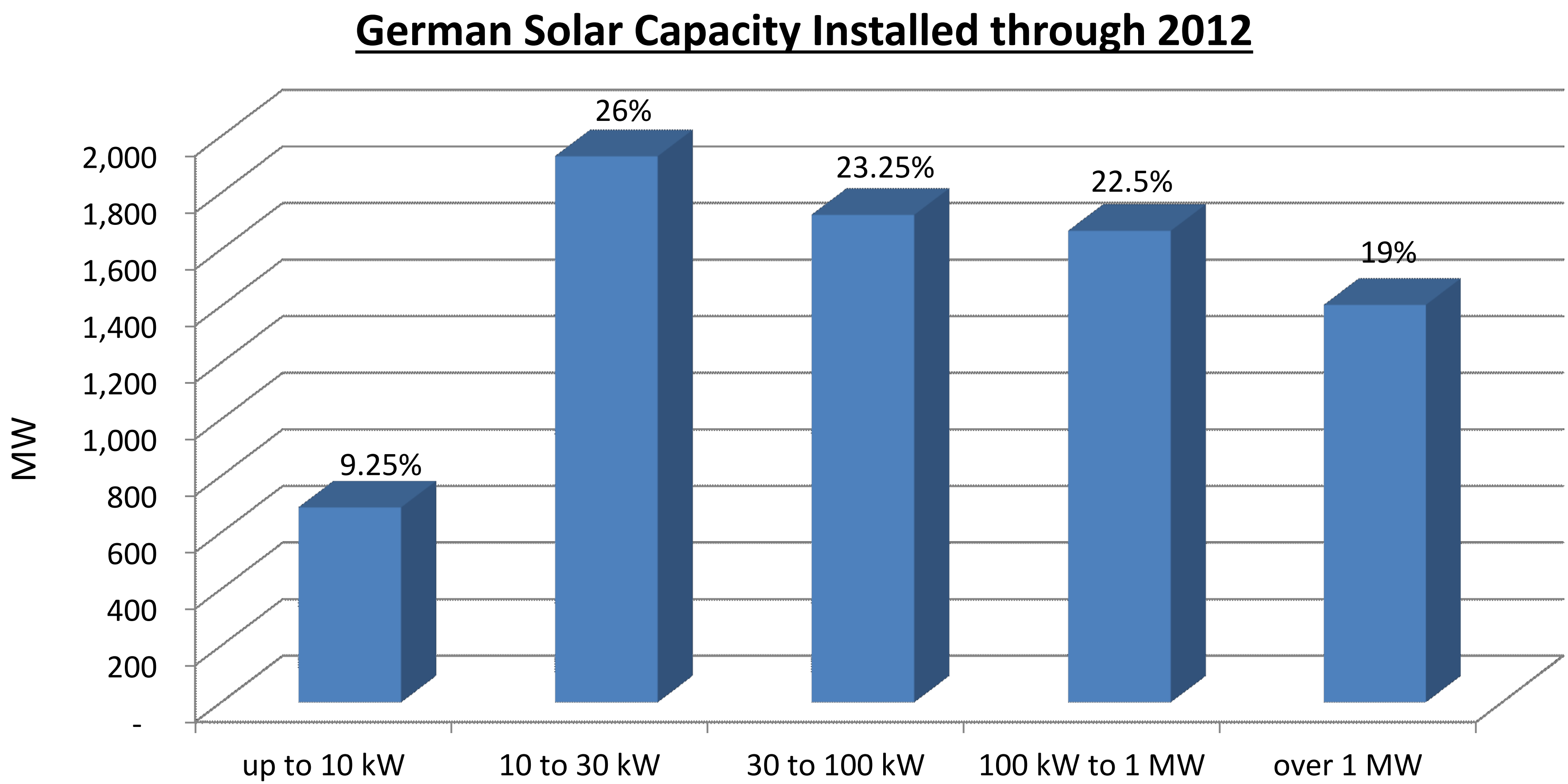
# LYNC DR®+: Energy Resiliency for Datacenters

**Example Case Study: Replacement of a 1 MW diesel generator with LYNC DR+**

- **New construction in CA**
- **1 MW / 2 MWh battery energy storage: Estimated Capex - $2,750,000**
- **Provides 1 MW of UPS power during an outage and carries load during migration of datacenter traffic to a redundant site**
- **SGIP Incentives and ITC will reduce Capex: Up to 50%**
- **When grid is operating normally, can further monetize the asset:**
  - **Utility demand response**
  - **CAISO wholesale markets**
  - **Peak shaving**

# German solar is mostly local (on rooftops)

Clean Coalition




Source: Paul Gipe, March 2011

**Germany's solar deployments are almost entirely sub-2 MW projects on built-environments and interconnected to the distribution grid (not behind-the-meter)**

# German rooftop solar is 4 to 6 cents/kWh today

Clean Coalition

| Project Size | Euros/kWh | USD/kWh | California Effective Rate $/kWh |
|---|---|---|---|
| Under 10 kW | 0.1270 | 0.1359 | 0.0628 |
| 10 kW to 40 kW | 0.1236 | 0.1323 | 0.0611 |
| 40.1 kW to 750 kW | 0.1109 | 0.1187 | 0.0548 |
| Other projects up to 750 kW* | 0.0891 | 0.0953 | 0.0440 |

- Conversion rate for Euros to Dollars is €1:$1.07
- California's effective rate is reduced 40% due to tax incentives and then an additional 33% due to the superior solar resource

**Replicating German scale and efficiencies would yield rooftop solar today at only between 4 and 6 cents/kWh to California ratepayers**

* For projects that are not sited on residential structures or sound barriers.