SAN MATEO COUNTY ENERGY WATCH

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

RICAPS

Regionally Integrated Climate Action Planning Suite

Joint Meeting: RICAPS Multi-city Working Group & Public Facilities Working Group

March 22, 2022

RICAPS technical assistance is available through the San Mateo County Energy Watch program, which is funded by California utility customers, administered by Pacific Gas and Electric Company (PG&E) under the auspices of the California Public Utilities Commission and with matching funds provided by C/CAG and additional funding provided by Peninsula Clean Energy.

Agenda

- Spotlight on Compost Awareness Week
- Public Agency Building Electrification
- Lessons Learned from Half Moon Bay
- Overview - Financing Electrification Projects
- Q&A
- Discussion - Mural exercise

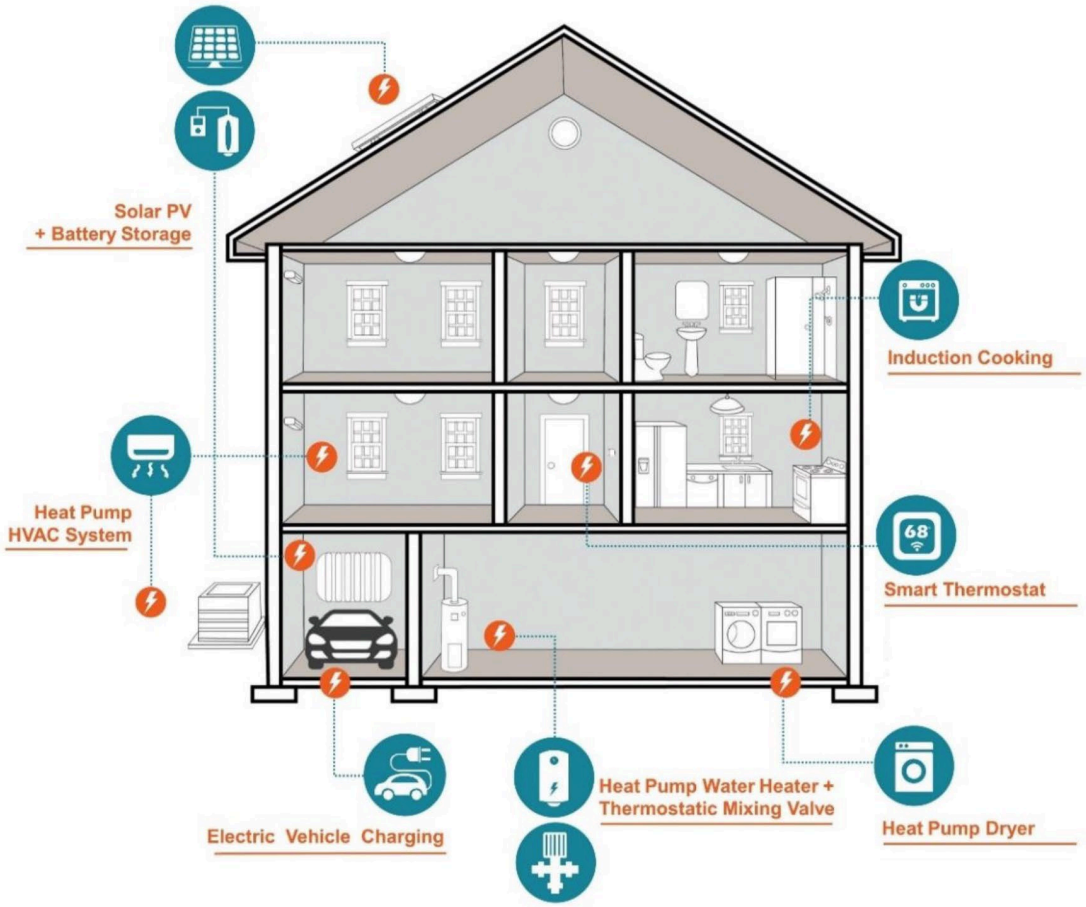
Please introduce yourself, plus if / how much you're working onsite

Jack Johnson and Jack Steinmann, County of San Mateo

SPOTLIGHT ON COMPOST AWARENESS WEEK

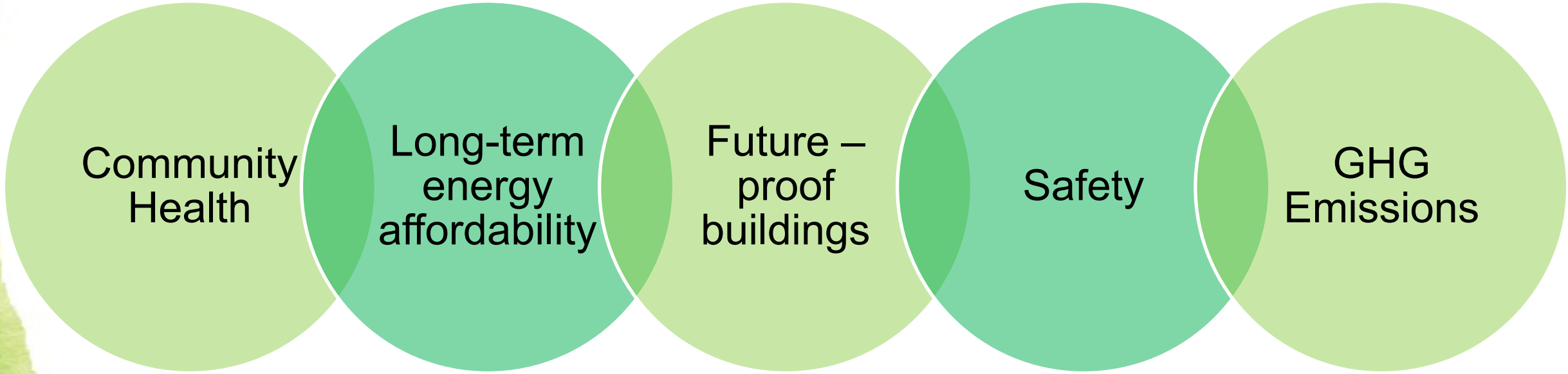
Public Agency Building Electrification Overview

San Mateo County Superior Court



Gas → Electricity for heating/cooling, other end-uses

Why Electrification?



Public Agency Building Electrification Aligns with Carbon Neutrality Goals

2025 PCE 100% 24/7 Renewable Energy

2030 40% reduction below 1990 levels (SB 32)

2045 State carbon neutrality target (EO B-55-18), latest date for jurisdictions/agencies*

**Some jurisdictions/agencies are aiming for earlier carbon neutrality targets*

Current State of Public Agency Electrification

- PG&E and PCE getting on board with funding
- Early/ proof of concept stage
- First mover jurisdictions as a model for others

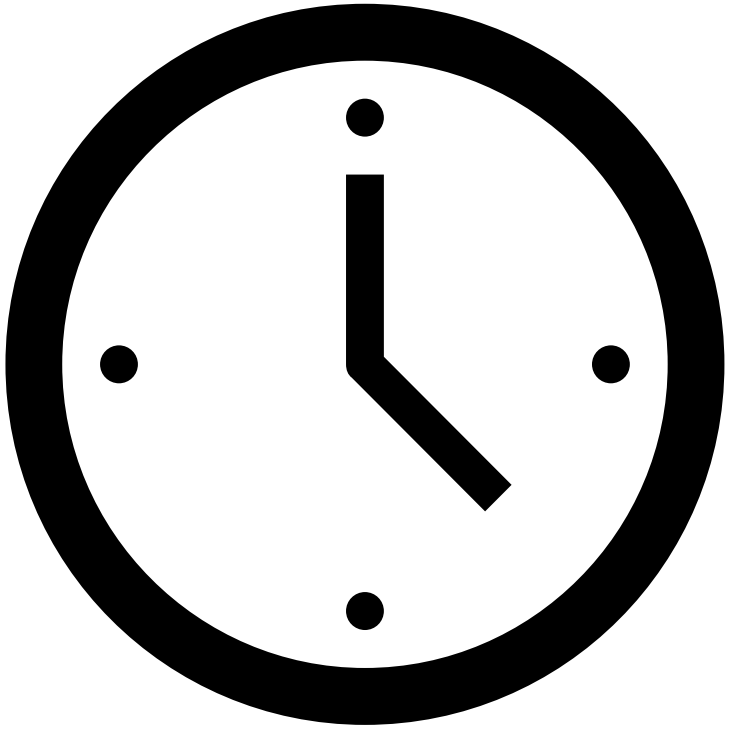
Timing Considerations for Electrification

-Carbon neutrality goal

-End of appliance life

-Funding availability

-Market availability of electrification solutions

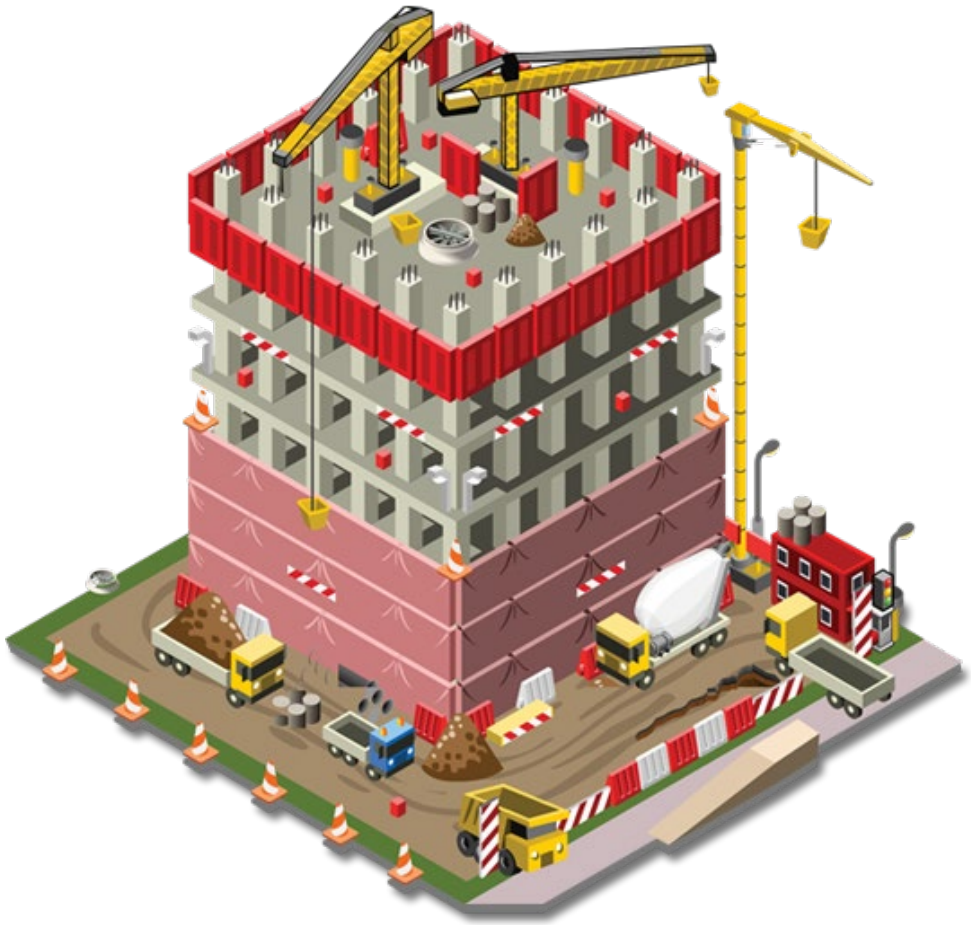


Step 1: No New Fossil Fuel Infrastructure

-If backup power is needed, focus on options with less fixed infrastructure.

- *Ex. propane tank instead of natural gas*

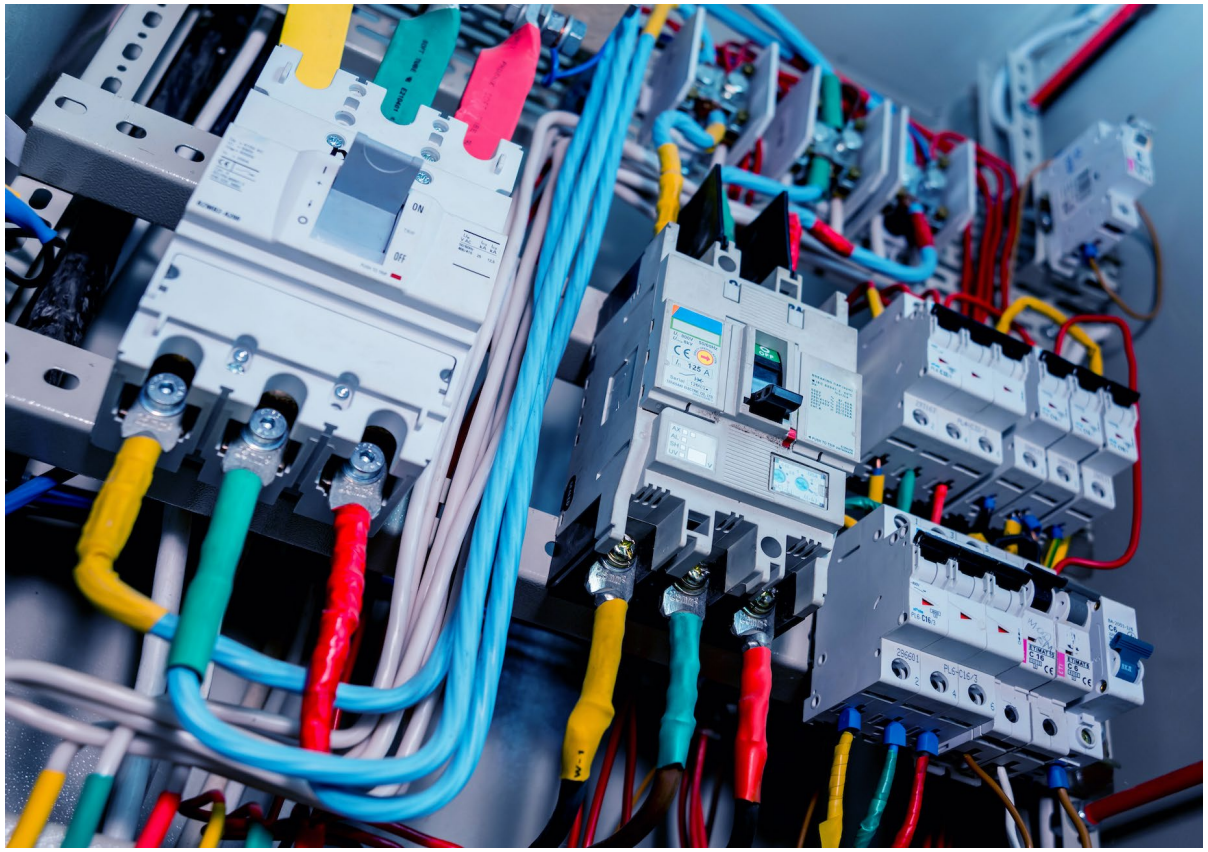
-Much more cost effective to build all-electric today than to retrofit later.



End Uses in Municipal Buildings (1)

Prioritize reducing NG load with market ready solutions

- Water heaters
- Space heaters
- Stoves

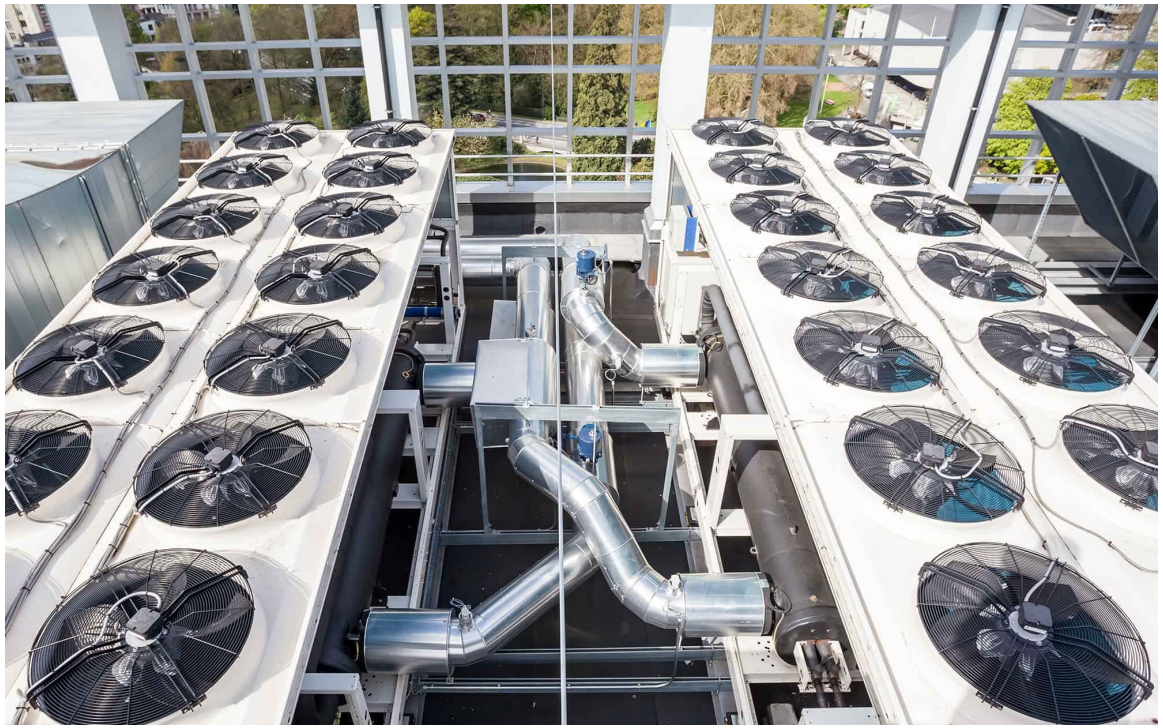


What works today: market-ready solutions

-Water heaters → heat pump water heaters

-HVAC → heat pumps

-Cooking → induction stoves



End Uses in Municipal Buildings (2)

Considerations/ potential hurdles:

Other process loads (ex. swimming pools, district heating/cooling) are more difficult to electrify now

Case Study: Stanford Energy System Innovations

Benefits: -68% emissions, -65% fossil fuel use

30 year-old natural gas co-generation plant >> **Central Energy Facility, heat-recovery process +70% more efficient; meeting 90% of campus heating demands**

+ packaged with Energy and Climate plan for existing building retrofits & energy efficient new construction, + 68-MW solar installation

End Uses Reliant on Propane/ Diesel

Challenge point:

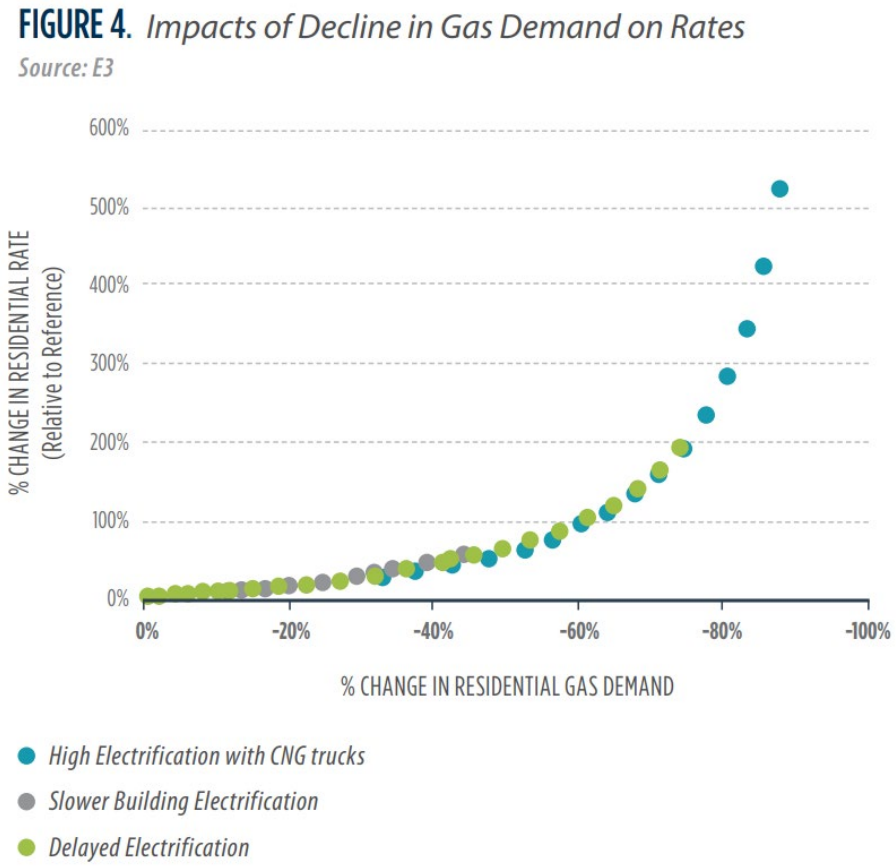
Generators and other end uses reliant on propane and diesel

-Eventual decarbonization of these, **but current focus on reducing NG load now**.

Costs: Up-front Investment

- Electrifying end-uses now will involve up-front investment
- Investment can be met through funding options
- Economics are dependent on specific project
- Financing/Incentives will play a key role

Costs: Long-term Energy Affordability



- Gas rates increase as gas demand decreases
- Gas use decreases by as much as 90%, costs rise to cover infrastructure O&M
- **3-10x increase in gas costs by 2050**

Costs: Small vs. Large-Scale Electrification

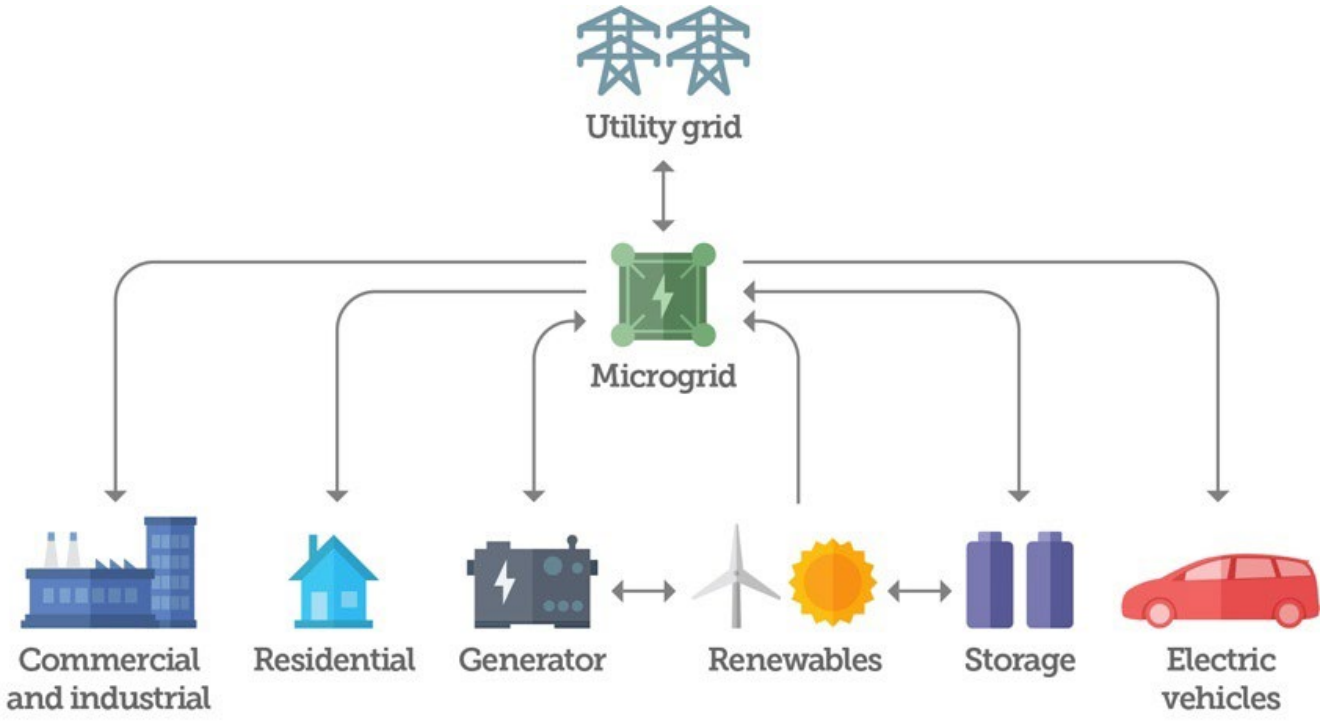
- **Small scale** = usually bill neutral

- **Large scale** = can be cost effective when packaged with other EE and grid resiliency projects (like microgrids)

Long-Term Costs of Electrification

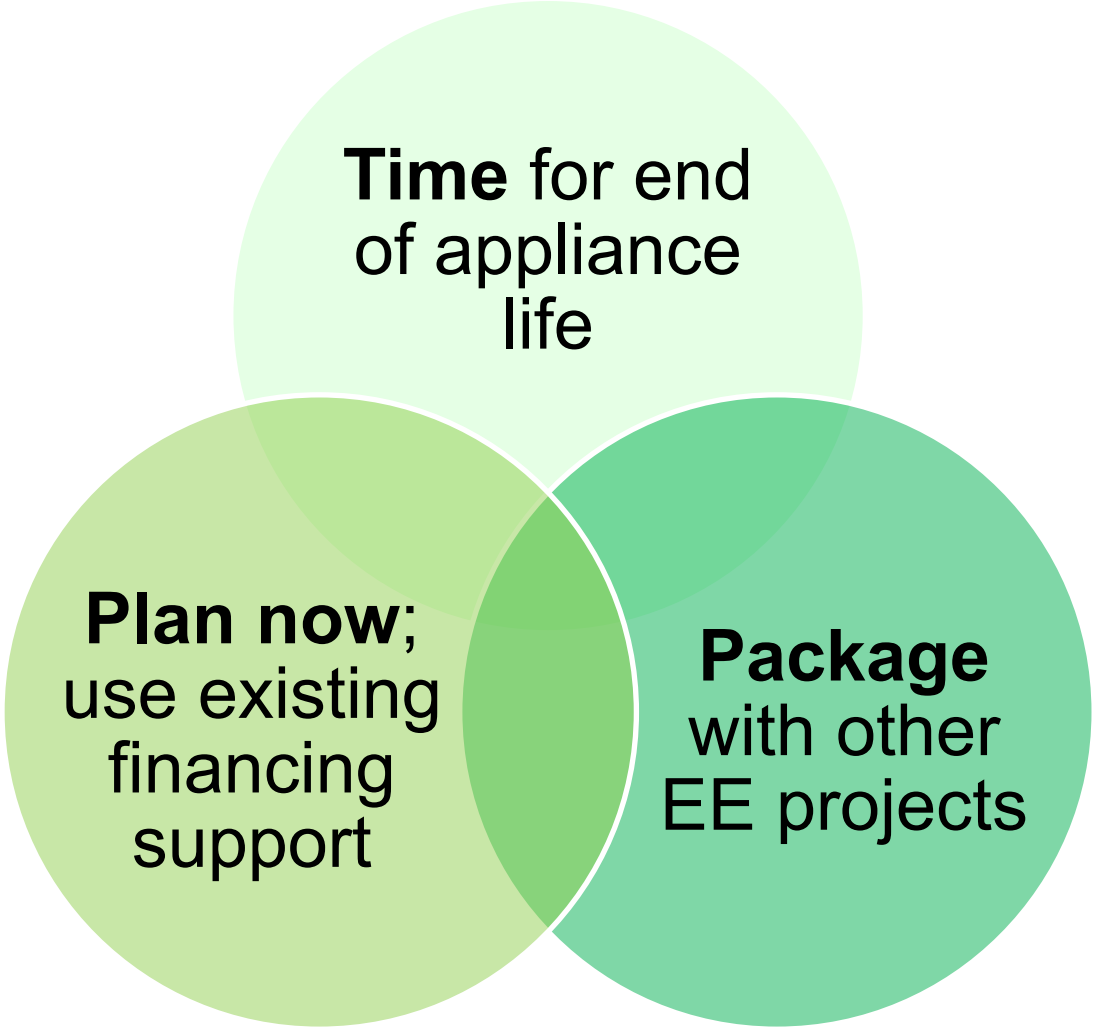
- **Electrification = best cost per carbon reduced**
  - Financing available now; technology available now
  - Avoiding electrification may mean potential reliance later on more expensive carbon capture/ sequestration technologies

Best-Case Scenarios: Large Scale Projects



Packaging large scale projects + microgrid projects

Best-Case Scenarios



Key Takeaways

-Prioritize reducing existing NG load with market-ready technologies

-Sync carbon neutrality targets with public agency electrification & funding availability for electrification

-In the early stages: look to municipal case studies as jurisdictions start to move forward

-Electrification: most cost-effective way to decarbonize

Half Moon Bay ZNE Projects

- ZNE Library - Lessons Learned
  - Engage your maintenance/facilities staff at the BEGINNING AND THROUGHOUT the project.
  - Assess your staffing needs and make staffing requests that consider the long-term maintenance and liabilities.
- ZNE Corp Yard - Current Project
  - Balance stakeholder pressures with cost-benefit.
  - Communicate early and often with other departments (sustainability, facilities, planning, etc.).

Joshua Babcock and Lance Kincaid, Willdan

OPPORTUNITIES AND FUNDING FOR PUBLIC AGENCY BUILDING ELECTRIFICATION

Electrification Options - Overview

- Most types of heating and other fossil-fuel-fired loads can be electrified
  - **Domestic Hot Water**
  - **HVAC**
  - **Food Service / Kitchens**
  - **Backup power**
  - **Larger complex process loads**

BEST FOR	NOT GREAT FOR
Medium Temperature, Steady Heating Loads	High Temperature, High Variability Process Loads (but there may be solutions)

- Most common electrification technologies are heat pumps, induction heating, and electric resistance

Electrification Options - Things to Look Out For

- **Electrical Infrastructure**: electrification adds electrical load to the building, which can impede implementation and increase costs. Things to consider:
  - How close is the system being electrified to the nearest electrical panel? Is the path to get there complex?
  - Is there spare Amp capacity at the panel?
  - Is the size of the electrified load large in relation to the whole facility? Will it require new service from Utility?

- **Heat Pump Refrigerants**: heat pumps use hydrocarbon-based refrigerants, which have global warming potential (GWP). As of 2022, the CPUC requires accounting for this for regulated energy efficiency programs
  - Accounting for added refrigerants, the net benefit is typically only reduced by ~<5% (tons of CO2e removed)
  - Low-GWP refrigerants and associated systems exist. See CARB for more information: https://ww2.arb.ca.gov/resources/documents/choosing-new-system

Electrification Options – Domestic Hot Water Systems

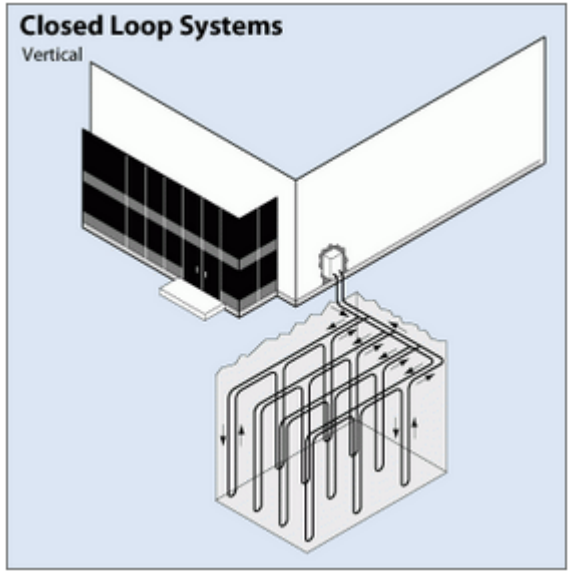
Electric Resistance Hot Water Heaters	
PROs	CONs
▪ Units are less expensive to purchase ▪ Flexible designs – can be storage type units or instantaneous ▪ Good solution for smaller unit replacements (<30 gallon) or point-of-use applications	▪ High electric draw (like a hair-dryer or toaster). Consider infrastructure costs if a large load is being served ▪ Expensive to operate (high energy costs)

Unitary Heat Pump Water Heaters (HPWHs)	
PROs	CONs
▪ **~1/3rd the energy consumption and power draw of a resistance unit.** Energy costs on par with gas-fired units ▪ Good for medium size commercial Buildings with several restrooms, mid size kitchens, locker rooms, large homes, etc.	▪ More expensive to purchase and install ▪ May need backup booster (electric resistance) when lots of heat is needed fast ▪ Only available in storage-type designs. No small, instantaneous units

Electrification Options – HVAC Space Heating

Air Source Heat Pump Package Units / Rooftop Units	
PROs	CONs
▪ Replacements for either AC units with gas heat or heating/ventilating-only units ▪ Widely available in many sizes ▪ Versatile designs with built in electric boosters and controls, or hybrid heat-pump/gas-fired units ▪ Consider Variable Refrigerant Flow (VRF) systems for maximum system efficiency	▪ Typically more expensive than similarly sized gas fired units (but no need to plumb gas lines) ▪ Slight hit to air conditioning mode efficiency

Ground Source Heat Pumps / Geothermal	
PROs	CONs
▪ Use the relatively constant temperature of the earth as a source of heat, rather than the air ▪ Higher efficiency than air source	▪ Can be several times as costly as an air-source system. ▪ Only applicable if geotechnical conditions are suitable



Electrification Options – Cooking Loads

Induction Technology	
PROs	CONs
▪ Fast heat up ▪ Precise control ▪ Minimizes kitchen HVAC loads ▪ No combustion byproducts ▪ Lowered fire risk	▪ May not work with all cookware, requiring replacement with "induction-compatible" (magnetic) ▪ End-users / kitchen staff can be resistant

- Modern electric ovens and similar appliances operate the same as old-fashioned electric ovens – electric resistance tech is the only currently available solution for these high-temperature applications.
- The Food Service Technology Center (FSTC, www.fishnick.com/itc) can offer assistance
  - Demonstrations
  - Education training
  - Induction cooktop lending program

Electrification Options – Backup Power

- Different approaches than continuous use systems. Backup power is intermittent
  - Hybrid PV Battery Systems
  - Microgrids
- Important considerations:
  - What loads need to be backed up (kW rating)?
  - How long does the facility need them backed up for?
    - What type of outage event is the main concern? Short term (e.g., hour+ blackouts) or multi-day events (e.g., PSPS)?
  - Are momentary outages (~5 minute) acceptable?
  - Is a backup generator an acceptable resource as part of the resilient system for extreme events?

ELM Microgrids
205 kWh

Eon Storage
200-250 kWh

Tesla Powerpack
230 kWh

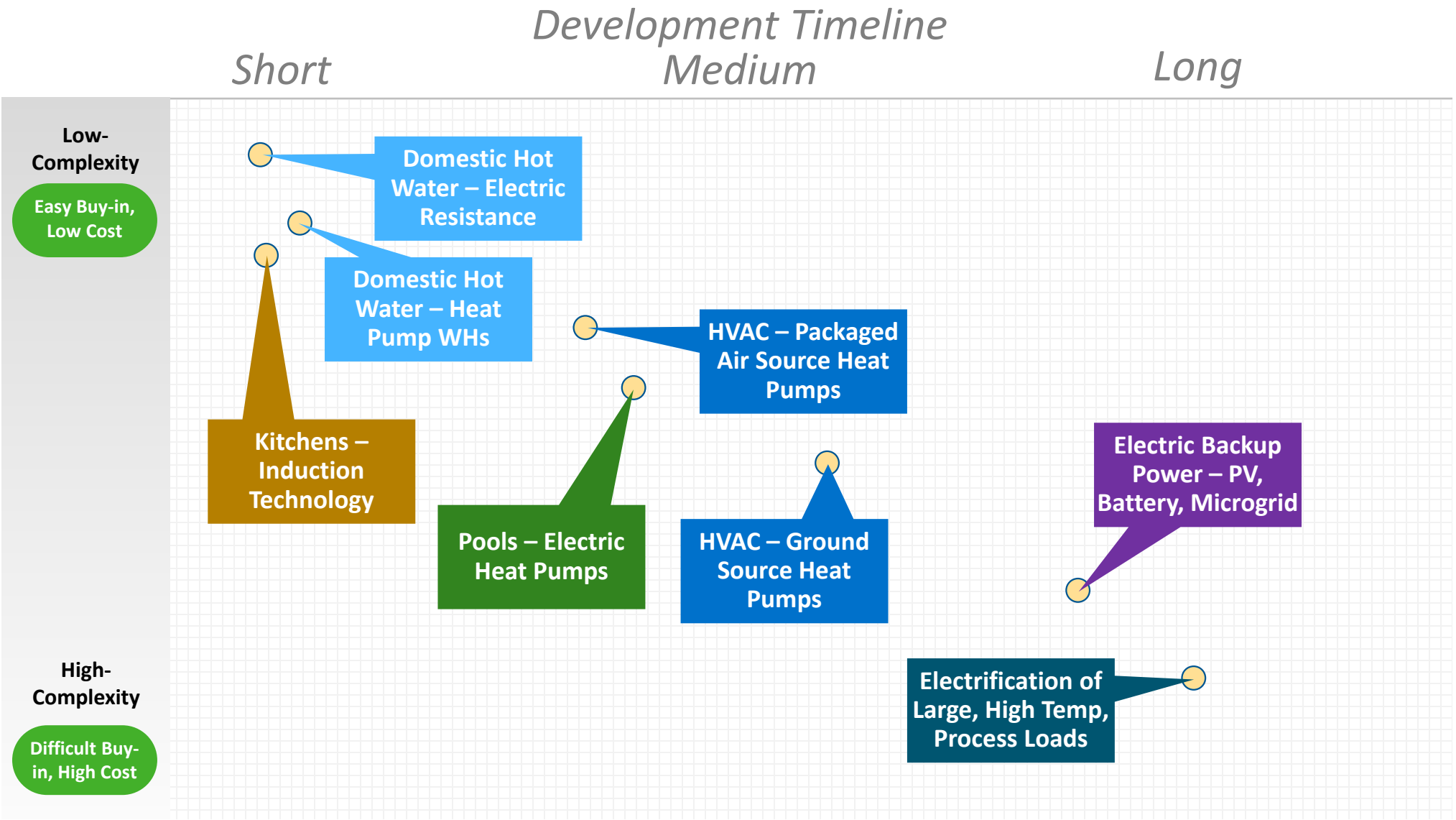
Stem (various suppliers)
250 kWh

Electrification Options – Larger, Process Loads

Electric Heat Pumps for Pools	
PROs	CONs
▪ Unitary systems available for large and small pools ▪ Larger units have high peak efficiency -> less expensive to operate than gas units ▪ Can both heat and cool pools ▪ Chemical pool covers can augment savings and performance ▪ Web-based controls	▪ Need backup heat source when outside air temperatures are low ▪ Large electrical loads typically require infrastructure upgrades ▪ Noise potential, comparable to a large air conditioner

- Other large, high temperature loads require custom designed and engineered solutions
  - Large Centralized Domestic Hot Water Systems such as multifamily or medical bldgs
  - District Heating and Cooling (e.g., Stanford's Central Energy Facility)
- Typical solutions for high temperature needs include alternative refrigerants (like CO2, R-744) or multi-stage systems
- Other process load solutions may be considered (H2, net-zero carbon fuels, other offsets)

Electrification Options - Cost Effectiveness Considerations



Funding and Support Options

Free
Utility Programs

- PG&E GK12 Program (Incentives, OBF)
- PCE, BayREN and San Mateo County Energy Watch Support

Low Cost
State Funding

- CEC Loans (ECCA 1%)
- SGIP
- iBank

Moderate Cost
Turnkey Model

- Muni Bonds, Green Bonds & Leases (Tax-Exempt & Taxable)
- PPAs, EaaS, 3P

Funding Options

PG&E GK12 Energy Efficiency Program

- Program goal is to assist public agencies with saving energy, implementing Climate Action Plans and reducing GHG emissions
- **Sub-program: Low-cost/no-cost turnkey installation of electric heat pump hot water heaters (HPHWH)**
  - Program Eligibility:
    - Active electric & gas accounts with PG&E
    - Natural gas is used for hot water heating
    - Existing unit is 30-80 gallons
    - Agree to participate in Demand Response program
  - ***Incentives and services available for limited time***

Sample Project – Redwood City

- **$42k** in total project costs, covered entirely by program
- Delivered turnkey **installation of heat pumps at 4 separate buildings**
  - Fair Oaks Community Center
  - City Hall
  - Fire Station 10
  - Public Works Building
- Primarily 50-gallon units
- **4,500** in total combined net therm savings

Funding Options

ECAA Loans

- 1% loans for energy projects: can fund 100% of project cost within a 17 yr (maximum) SPB
- Loan must be repaid from energy savings (including principal and interest) within 20 years
- Projects with proven energy or demand cost savings or both are eligible, as well as renewable generation projects, which can improve project economics for electrification measures
- Loans provided on first-come/first-served basis
- Website: https://www.energy.ca.gov/programs-and-topics/programs/energy-conservation-assistance-act/low-interest-loans

SGIP Battery Energy Storage incentives

- CPUC administered program - $41M available in PG&E territory (as of 3/7)
- $0.85/Wh incentive rate for non-residential
- Rebates are currently ~15-20% of the average battery cost
- Website: www.pge.com/sgip

California I-Bank - Two main energy related programs

- CLEEN https://ibank.ca.gov/climate-financing/cleen-programs/ direct loan that starts at $500K to $30M
- Infrastructure State Revolving Fund (ISRF) https://ibank.ca.gov/loans/infrastructure-loans/ $50K to $25M
  - Cities can apply for free, application process takes 4-6 weeks and then would need to go to Board for approval to move forward
  - Loan info
    - Interest rates would be 2.2-3.5%, typically over a 10-year term
    - $10K loan fee or a 1% loan amount (whichever is lower)
    - Also includes a reimbursement structure (if the city decides to start the project now, they can get reimbursed later)
  - Revenues & balance sheet
    - Source of repayment/pledge will either be general fund or enterprise fund. Both will be on balance sheet.
    - Benefits: faster than a commercial bank, no scoring mechanism.
    - Drawbacks: fees, including original $10K fee or 1% and an annual fee of 30 basis points (0.3%)

Funding Options

Turnkey/ESCO model

- CA Government Code 4217 – Energy Conservation Contracts allows sole sourcing of energy projects
- **$550M** available in 2022 through DOE Energy Efficiency and Conservation Block Grant program
  - Financing for energy efficiency, renewable energy, and zero-emission transportation (and associated infrastructure), capital investments, projects, and programs, including loan programs, **performance contracting programs**, and incentive programs
  - 68% to eligible units of local government

Lessons Learned

- Individual electrification measures are not likely to meet strict simple payback criteria on their own
- Primary goal of electrification should be **carbon offsets,** as opposed to cost savings

ECM 9 – Building Electrification

EXISTING CONDITIONS
- Gas and other fossil fuels used for heating at all sites

SCOPE DETAILS
- Consider proactively transitioning gas heating to electric heating

BENEFITS
- Reduce carbon footprint
- Reduce fuel costs
- Help meet California 2045 Net Zero Carbon goal

WILLDAN

Path to Carbon Neutrality ARB Report by E3: https://ww2.arb.ca.gov/sites/default/files/2020-08/e3_cn_draft_report_aug2020.pdf

Takeaway: **Brings private financing mechanisms and funding streams to energy projects**

Funding Options

Low Interest Rate & On-Balance Sheet Turnkey Options

	Municipal Bond	Green Bond	Tax-Exempt Lease Purchase	On Bill Financing
PROJECT SIZE	$3M+	$3M+	$1M+	Typically under $4M
DESCRIPTION	Debt security issued by state or local governments	Green use of bond aligned with Voluntary Green Bond Principal by International Capital Markets Association	Lease arrangement with title of equipment granted to tax exempted entity/lessee at signing of lease	Allows utility to incur the costs of the clean energy upgrade, which is then repaid on the utility bill from customer
TERM LENGTH	Up to 25 years	Up to 25 years	Up to 20 years but typically shorter than 12 years	Typically under 10 years
PROs	Fast closing, low interest rate, low risk	Lower interest rate than municipal bond, low risk	Fast closing, financing without incurring “debt”, typically does not require voter approval	Savings are paired directly with repayment on the same bill, not seen as “debt”, no interest
CONs	On balance sheet	On balance sheet, requires a climate action plan	Higher interest rate than bond, exit fee may apply, on balance sheet	Max payback restriction and strict M&V period, transferability restriction could apply

Funding Options

Off Balance Sheet Turnkey Options

	PPA/ESA	EaaS	True Lease/ Operating Lease	Public Private Partnership
PROJECT SIZE	$1M+	$250K+	$1M+	$100M+
DESCRIPTION	Electricity purchase via a long-term agreement where seller is responsible for development, construction, and operations & maintenance of project	A subscription/agreement of pay for performance of services from electrical devices owned by a service company or its financing company	Lease with lessor retaining title during lease term, and purchase option at Fair Market Value for lessee at the end of lease	Private capital financing government projects and services up-front, and then drawing operating profits from taxpayers and/or users over the course of the PPP contract
TERM LENGTH	Up to 30 years	Up to 20 years	Can be up to 10 years for initial term, may be extended for up to 5 years sometimes	Up to 30 years
PROs	No upfront costs, energy savings and net metering benefits, production guaranty, predictable price, performance risks by seller, O&M included, off balance sheet	No upfront costs, net cashflow positive typically, maintenance included usually, stay mission focused, off balance sheet	Off balance sheet, low installment payment due to tax credits available to lessor for certain assets (i.e. solar, battery) and residual value assumed by lessor	Transfer of risks, availability of private funding completion time for large scale projects, off balance sheet usually
CONs	Lower savings vs purchase & lease, Locked into long term obligation	Contracting organization must have trust in ability of contractor/service co. to plan, execute and manage properly	Tax credits are generally not available to projects if lessee is tax exempted	Complex, high transaction costs, limited control by public sector, locked into long term contracts

Next Steps

1. **Identify electrical infrastructure capacity/needs**
2. Identify sites and potential measures
3. Identify funding opportunities
4. Contract for implementation

Potential Immediate Actions

- Enroll in GK12 Heat Pump Hot Water Program offering – ***limited incentives and services available***
- Contact BayREN for free site evaluations/measure identification
- Discuss program opportunities with San Mateo County Energy Watch
- Contact Willdan if interested in exploring turnkey project delivery options

Takeaway: **Follow "No Missed Opportunities" strategy**

ANNOUNCEMENTS

RICAPS

Regionally Integrated Climate Action Planning Suite

Next Meeting (Webinar)

April 26, 1:30-3pm

Building Operator Certification Training

- BOC I & II Trainings
- Run from April – August

Cost: $995 via PG&E incentive!

BOC LEVEL I SPRING SCHEDULE

*For entire PG&E BOC Schedules, **visit www.theboc.info/ca.***
Fall Level I, Level II and Fundamentals schedules are TBD.

All classes are held online from 8:30am to 12:30 pm.	
BOC 1001-A / Energy Efficient Operation of Building HVAC Systems	4/20 & 4/21/22
BOC 1001-B / Energy Efficient Operation of Building HVAC Systems	4/27 & 4/28/22
BOC 1002 / Measuring and Benchmarking Energy Performance	5/18 & 5/19/22
BOC 1003 / Efficient Lighting Fundamentals	6/1 & 6/2/22
BOC 1004 / HVAC Controls Fundamentals	6/22 & 6/23/22
BOC 1005 / Indoor Environmental Quality	7/13 & 7/14/22
BOC 1006 / Common Opportunities for Low-Cost Operational Improvement	8/3 & 8/4/22
BOC 1013 / Smart Buildings Fundamentals	8/24 & 8/25/22

Join us at OOS!

Job opening:

Sustainability Program Manager – Climate Resilience

Applications due April 11

Thank you! See you next month…

John Allan, jallan@smcgov.org (inventories, stormwater)

Alexandria Gallizioli, agallizioli@smcgov.org (municipal, special district, and school facilities; small businesses)

Alero Moju, amoju@smcgov.org (residential programs, reach codes, codes trainings)

Sultan Henson, shenson@smcgov.org (stormwater)

Susan Wright, swright@smcgov.org (RICAPS coordination, electrification strategy)

Zoe Van Duivenbode, zvanduivenbode@smcgov.org (fleet electrification)

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO