SAMTRANS

ENERGY PROCUREMENT STRATEGY

FINAL REPORT

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GLOSSARY OF TERMS

AC	Alternating Current
AES	Advanced Energy Storage
APA	Attribute Purchase Agreement
BEB	Battery Electric Bus
BESS	Battery Energy Storage System
BEV	Battery Electric Vehicle
CA	California
CA HSR	California High Speed Rail
CAISO	California Independent System Operator
CARB	California Air Resources Board
CCA	Community Choice Aggregator
CCE	Community Choice Energy
CEC	California Energy Commission
CO_2	Carbon dioxide
COA	Comprehensive Operational Analysis
COD	Commercial Operation Date
CSP	Curtailment Service Provider
CPUC	California Public Utilities Commission
CUB	Contract Bus Fleet
DA	Direct Access
DC	Direct Current
DER(s)	Distributed Energy Resources
DRAM	Demand Response Auction Mechanism
EIR	Environmental Impact Report
ESP	Electric Service Provider
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
GRC	General Rate Case
HFTZ	High Fire Threat Zone
IOU	Investor Owned Utility(ies)
IRR	Internal rate of return
IRS	Internal Revenue Service
ITC	Investment Tax Credit
kW	Kilowatt

kWh	Kilowatt-hour
LCFS	Low Carbon Fuel Standard
LSE	Load Serving Entity
MACRS	Modified Accelerated Cost- Recovery System
MOU	Municipal Owned Utility
MW	Megawatt
MWh	Megawatt-hour
NEM	Net energy metering
NGOM	Net generation output meter
NREL	National Renewable Energy Laboratory
PCE	Peninsula Clean Energy
PCIA	Power Charge Indifference Adjustment
PG&E	Pacific Gas & Electric
PPA	Power Purchase Agreement
PSPS	Public Safety Power Shutoff
PV	Photovoltaic
REC	Renewable Energy Credit
RES-BCT	Renewable Energy Self-Generation Bill Credit Transfer
RFP	Request for Proposals
RPS	Renewable Portfolio Standard
SAID	Service Agreement ID
SGIP	Self-Generation Incentive Program
SMR	Steam methane reforming
SOP	Super-Off-Peak
TELP	Tax-exempt lease purchase
TOU	Time of Use
TV	TerraVerde Energy, LLC
UEDM	Utility expense data management
VPP	Virtual Power Plant
(v)PPA	(Virtual) Power Purchase Agreement
W	Watt
WREGIS	Western Renewable Energy Generation Information System

DEFINITIONS

Community Choice Aggregation/Energy (CCA/CCE)	CCE/CCA are programs that allow local governments to procure power (including lower carbon power) on behalf of their residents, businesses, and municipal accounts from an alternative supplier while still receiving electricity delivery (called transmission and distribution) service from their existing utility provider (PG&E). SamTrans is currently served by a CCA provider.
Demand Reduction	Decreased demand for peak power.
Direct Access Power	Direct Access (DA) is an option available to non-residential customers that would allow SamTrans to purchase their electricity directly from a third-party supplier, including products that are exposed to wholesale market pricing. Under this option, SamTrans would be granted the ability to contract directly with any Electric Service Provider (ESP).
Distributed Energy Resources (DER(s))	DERs are decentralized, electricity-producing infrastructure located close to the consumer they supply energy to, and are connected to a local distribution system or host facility. DERs can include solar panels and battery storage systems, and can be integrated into a microgrid.
Electric Service Provider (ESP)	A non-utility entity that offers electric service to customers within the service territory of an electric utility.
Eligible Renewable Energy Resource	Energy sources that are eligible to meet the State of California's Renewable Energy Portfolio Standard (RPS). The RPS is a law that sets the minimum level of renewables utilities are required to procure. Eligible renewable resources include solar and solar thermal electric; wind; certain biomass resources; geothermal electric; certain hydroelectric facilities (energy from dams); ocean wave, thermal and tidal energy; fuel cells using renewable fuels; landfill gas; and municipal solid waste conversion, not the direct combustion of municipal solid waste. Large hydroelectric generation (e.g., Hetch Hetchy) and nuclear are excluded.
Greenhouse Gas (GHG) Emissions	Gases that trap heat in the atmosphere, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases.
GHG-Free Energy	Electricity that does not emit carbon or other greenhouse gases. In California, GHG-free energy includes all eligible renewable energy sources plus large hydroelectric and nuclear energy.
Grid Services Programs	Distributed Energy Resources, such as batteries can participate in relatively new grid services programs such as the Demand Response Auction Mechanism (DRAM). Similar to traditional demand response programs (where customers are compensated for allowing the utility to

	turn off some of certain loads during certain high energy usage events), the DRAM program (as well as others) enable behind-the-meter resources to earn revenue by reducing or shifting a facility's load at specified times.
Investor Owned Utility (IOU)	Utilities owned privately by shareholders. Other types of non-IOU utilities include municipally owned utilities and community choice aggregators.
Load Serving Entity (LSE)	An organization that serves end users and has been granted authority by the state to sell electric energy to end users. Legislation would be required to allow SamTrans to become an LSE.
Low Carbon Fuel Standard (LCFS)	The LCFS is designed to encourage the use of cleaner low-carbon transportation fuels in California, encourage the production of those fuels, and therefore, reduce GHG emissions and decrease petroleum dependence in the transportation sector. SamTrans will generate LCFS credits by switching from diesel fuel to electricity in proportion to the percentage of the fleet that is operated using electricity instead of diesel. The benefits provided by the alternative fuel source (e.g., grid electricity) are compared to the standard fuel source (e.g., gasoline or diesel) and the GHG emissions associated with the complete life-cycle of each fuel is compared in order to determine the reduction in GHG emissions due to the use of the alternative fuel source. The agencies can increase the value of the LCFS credits by achieving zero-carbon electricity by either 1) using DER onsite to charge the vehicles; or 2) retiring renewable energy credits (RECs).
Microgrid	A local energy grid that can be disconnected from the traditional grid and operate autonomously, which provides resilience during a power outage. A solar-battery storage system could be designed as a microgrid.
Oversubscribed	Demand for power that exceeds supply, especially in regard to a program that has capped its participation in terms of capacity.
Peak Power	In reference to electric power, the maximum power output a load serving entity can supply to load within a defined period of time.
Peak Shaving	Strategies used to proactively reduce peak power demand.
Power Purchase Agreement (PPA)	A long-term electricity supply agreement between two parties: the power producer and the power consumer. The power producer funds, constructs, owns and operates the energy generation source (e.g., solar) and charges the consumer and agreed upon rate per kWh. The energy generation source can be located either on or off the consumer's property.

Renewable Energy	Electricity from a source that is not depleted when used, and that is not derived from fossil or nuclear fuel. In California, the term "eligible renewable" is used to indicate which renewable sources qualify for the Renewable Energy Portfolio Standard (RPS). The RPS is a law that sets the minimum level of renewable energy utilities are required to procure. Large hydroelectric sources are not eligible renewable sources because they result in other negative environmental impacts (e.g., to fish and aquatic communities). Low-impact hydroelectric sources have fewer negative environmental impacts and are considered to be eligible renewable energy resources than ineligible sources. A Power Content Label (PCL) Identifies the percentage of eligible renewable energy resources used by an energy provider.
Renewable Energy Credit (REC)	RECs are credits "created" by a renewable energy generator, like a solar array, when it produces renewable energy. A REC allows the holder to claim the environmental benefits of one unit of energy generated from a renewable source. RECs can be monetized and have financial value.
Renewable Portfolio Standard (RPS)	The RPS is a law mandating a minimum level of eligible renewable energy resource use by investor owned utilities (IOUs). The law is implemented at the state level. In this study the law will refer to California's RPS; however, other states have also adopted RPS legislation.
Retail Electricity	Retail providers (e.g., investor owned utilities like PG&E and CCAs like PCE) that sell power directly to end-use consumers. In California, end-use customers need legislative authority to bypass a retail provider and procure electricity directly on the wholesale market.
Tariff	The rates utilities charge customers, typically differentiated by customer type and level of electricity consumption.
Time-of-Use (TOU)	A rate plan in which rates vary according to the time of day, season and day of the week. Higher rates are charged during periods of higher electricity demand, or "peak" hours, and lower rates during low demand hours (called off-peak). PG&E's new TOU rates, which go into effect in 2021, shift the peak period, the higher cost period, to 4 – 7 PM year-round.
Wholesale Power	The wholesale electricity market is typically a market for generators and resellers (e.g., PG&E, CCAs and Electric Service Providers), but there are some instances where large energy users are granted access to the market (e.g., BART).

EXECUTIVE SUMMARY

As SamTrans transitions from diesel- to electric-powered buses, electricity – and the procurement thereof – will become an increasingly important component of the agency's fuel spend, environmental impacts, and participation in revenue-generating opportunities such as the Low Carbon Fuel Standard (LCFS) market. It is also critical to consider options for power resilience in the event of a sustained power outage.

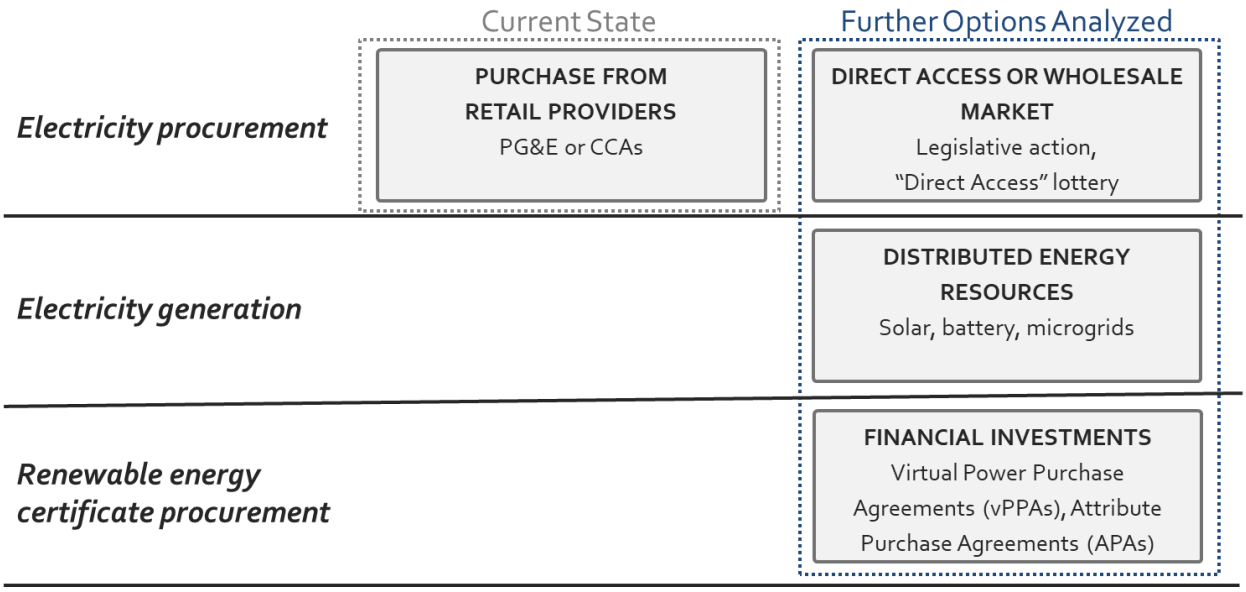
WSP and TerraVerde Energy (TerraVerde) (the "Project Team") were retained to conduct a comprehensive energy procurement study to evaluate SamTrans' short- and medium-term energy procurement options. This report provides an analysis of the electricity and technology procurement options available to SamTrans, including evaluation of the associated environmental impacts, risks, trade-offs, operational impacts and financial considerations of each option. This report also includes discussion of the potential benefits associated with jointly procuring electricity with Caltrain.

The report analyzed SamTrans' total load when its bus fleet, currently comprised of diesel buses, is fully electrified and operating the same number of BEBs. While SamTrans is planning to rollout its electrification plan in phases, overall recommendations do not change.

SamTrans currently procures 100% greenhouse gas (GHG)-free and renewable electricity through Peninsula Clean Energy (PCE), a Community Choice Aggregation/Energy (CCA/CCE). This electricity is still delivered to SamTrans through Pacific Gas & Electric's (PG&E's) transmission and distribution network. Over the short-term (1 to 4 years), SamTrans has the option to choose from two types of retail electricity providers to serve its growing load: (1) an investor-owned utility (IOU) (in this case, PG&E) or (2) a CCA (in this case, PCE). SamTrans also has the option to install onsite distributed energy resource (DER) systems (a solar photovoltaic system and/or battery energy storage system) to reduce electricity procurement needs and costs.

Over the medium- to long-term (4+ years), SamTrans can continue to remain a retail electricity customer and choose between currently available providers, or it could pursue expanded retailer choice through the Direct Access (DA) or work to have access to the wholesale electricity market, provided DA capacity is available or SamTrans is granted legislative authority to purchase through the wholesale market. DER systems could also be installed over the medium-term as additional technology options become available or existing options become more affordable. The energy procurement and technology options evaluated in this study are summarized in Figure ES-1.

Figure ES-1. Energy Procurement and Technology Options



Key findings and suggestions from the study are presented in a condensed form below. For complete discussion please see the full report.

PHASE 1: SHORT-TERM ENERGY PROCUREMENT STRATEGY SUMMARY

Both PCE and PG&E offer default rates and "greener" rates that have higher percentages of GHG-free and/or renewable energy. The short-term energy procurement strategy analysis demonstrates that PCE has more favorable standard rates compared to PG&E for SamTrans' existing and future electric load. The PG&E Solar Choice rate is less expensive compared to the CCA 100% renewable rate for SamTrans' existing load. However, the CCA 100% renewable rate is predicted to be less expensive compared to the PG&E Solar Choice rate for SamTrans' future battery electric bus (BEB) load. Table ES-1 summarizes the future annual costs associated with the new electrical services for full bus electrification at the North and South Operations and Maintenance (O&M) facilities.

SamTrans can also earn LCFS credits for switching from diesel buses to BEBs, which can offset a large portion of SamTrans' electricity costs[1]. The LCFS Program allows for the sale of Renewable Energy Credits (RECs) generated when low carbon fuel displaces fossil fuel use. SamTrans can sell the credits its BEB fleet generates for revenue in a statewide REC market. The potential financial benefits from the LCFS program are factored into the table, based on the use of

[1] SamTrans must register with the LCFS program and participate to receive revenues.

grid electricity and assuming full electrification. LCFS benefits scale in proportion to the amount of the fleet SamTrans has electrified and is operating.

As shown in Table ES-1, the CCA default option provides savings of approximately $137,780 over the PG&E standard rates. The PG&E Solar Choice battery electric vehicle (BEV) rates were not released at the time of this study. Therefore, the Project Team is unable to calculate the savings between the CCA 100% green option and the PG&E Solar Choice rates. However, based on a comparison of the non-BEV rates, it is expected that the CCA 100% green option will provide cost savings over the PG&E Solar Choice rate.

Table ES-1. Future Rate Analysis Summary[2]

Costs/Savings	Annual Electricity Cost (BEV Rate)	Total Electricity Costs with Grid Electricity LCFS Credit ($/YR)
PG&E Default Costs	$4,210,172	$344,508
PG&E Solar Choice Costs[3]	Unknown	Unknown
CCA Default Costs	$4,072,392	$206,728
CCA 100% Green Costs	$4,356,148	$490,484
CCA Savings (default)	**$137,780**	
CCA Savings (100% Green)	**Unknown**	

LCFS credits can increase in value if the fuel displacing fossil fuel is zero-carbon electricity. There are two pathways to achieving zero-carbon electricity for LCFS purposes: (1) through onsite renewable energy sources used to directly power the vehicles; or (2) by purchasing other qualifying RECs from zero-carbon sources such as solar photovoltaic (PV), wind, renewable portfolio standard (RPS)-eligible hydroelectric generation, ocean wave, ocean thermal or tidal current sources. Pathway 2 is financially viable as long as revenue generated by the LCFS program from zero-carbon electricity exceeds the cost of the RECs. Table ES-2 summarizes the estimated difference in the value of LCFS credits generated through grid electricity versus zero-carbon electricity. Achieving zero-carbon electricity provides a projected additional LCFS credit benefit of approximately $751,846 annually.

[2] Power demand reflects fully electrified fleet.
[3] The PG&E Solar Choice BEV rate was not available at the time of this study. The Solar Choice tariff has been updated with BEV rates as of March 5, 2021. A new analysis would need to be conducted to compare the cost of the Solar Choice rate and the CCA 100% Green rate.

Table ES-2. Low Carbon Fuel Standard Benefits Summary[4]

Transformer	Consumption (kWh/ YR)	LCFS Using Grid Electricity ($/kWh)	LCFS Using Zero Carbon Electricity ($/kWh)	LCFS Using Grid Electricity ($/YR)	LCFS Using Zero Carbon Electricity ($/YR)
North Base	15,624,203	$0.1362	$0.1627	$2,128,522	$2,542,505
South Base	12,751,320			$1,737,142	$2,075,005
TOTALS:	**28,375,523523**			**$3,865,664**	**$4,617,510**

The Project Team analyzed the feasibility of installing solar PV and/or battery energy storage (BESS) DER systems at North and South bases. Based on the analysis, a solar PV plus BESS system appears to be viable at both facilities and would yield greater economic benefits compared to solar-only. A cash purchase scenario, where SamTrans owns the solar PV and BESS infrastructure, is projected to yield greater savings compared to third-party ownership (see Table ES-3). A solar PV-only system would also be viable.

Table ES-3. Solar PV plus BESS Projected Utility Cost Impacts[5]

Site/ Scenario	Est. Capital Cost ($)/ PPA Rate ($/KWh)	SGIP[6] Incentive ($)	Cumulative Cash Position (Yr 25) ($)
North and South base 3rd Party Ownership	$0.1650 PPA + 70% shared savings BESS	TO PROVIDER	$2,231,833
North and South base Cash Purchase	$14,521,992	$2,130,800	$6,485,506

The projected solar PV production would only cover approximately 16 percent of SamTrans' estimated BEB electricity consumption. If the solar PV systems directly provide electricity to the BEB chargers, this would count as zero-carbon electricity under the LCFS program and increase SamTrans' LCFS revenue. Therefore, SamTrans would need to purchase RECs to achieve the

[4] Assumes the LCFS credit price is $100 per ton CO^2 equivalent. The LCFS credit price varies over time. The value used is conservative based on the past two years of history showing that the lowest LCFS credit price was $150 per ton CO^2 equivalent in April of 2018 and the highest LCFS credit price was $218 per ton CO^2 equivalent in February of 2020. The LCFS value shown uses projected carbon content values from CARB for 2022 grid electricity, solar electricity and diesel.

[5] The pro formas are based on a 22 percent ITC rate. The 26 percent ITC rate was recently extended. Therefore, the third-party ownership structure would yield even greater savings if constructed were to commence in 2022.

[6] The SGIP incentive assumes the Large-Scale Storage budget based on Step 3 incentives adjusted as required by SGIP rules.

zero-carbon electricity LCFS value for its entire projected electricity consumption. As shown in Table ES-4, if SamTrans were to pursue zero-carbon LCFS credits, onsite solar PV production would reduce SamTrans' annual REC costs by approximately $89,512.

Table ES-4. Solar Production and REC Summary

Transformer	Consumption (kWh/YR)	Projected Solar PV Production (kWh/YR)	REC Cost[7] without Solar PV System ($)	REC Cost with Solar PV System ($)	Annual Reduction in REC Cost ($)
North Base	15,624,203	2,718,291	$312,484	$258,118	$54,366
South Base	12,751,320	1,757,286	$255,026	$219,881	$35,146
TOTALS:	**28,375,523**	**4,475,577**	**$567,510**	**$477,999**	**$89,512**

Short-term energy procurement findings and suggestions include:

- **The new BEB transformers should use the BEV rate Tariff.** PG&E introduced BEV rates, which can be used by SamTrans instead of the standard B-20-P rate. The BEV rate tariff provides cost savings over the B-20-P rate.
- **Consider setting up future electric accounts that will serve large loads as primary voltage service.** Receiving service on primary voltages generally provides additional bill savings. However, the physical changes to the electric service required to achieve the annual bill savings alone do not justify the cost to complete the transition from secondary voltage service to primary voltage service for existing meters. Therefore, this should only be evaluated when infrastructure changes are already being considered for a specific site. It would be beneficial for SamTrans to review the option of setting up future electric accounts that have large loads on the highest voltage level service that makes sense, as is the case for the new electric services being installed at transmission level for the purposes of bus electrification.
- **Continue to procure electricity through regional CCA**. PCE, like most CCA providers, currently provide more cost effective rates compared to the PG&E equivalent rates. The PCE default rate is the most cost effective option available to SamTrans based on our analysis.
- **An onsite solar PV plus BESS at North and South bases will provide financial savings.** Based on current conditions and incentives, cash purchase of a solar PV and BESS system at North and South bases would provide approximately $6,485,506 savings over the lifespan of the systems. The financial benefit of a third-party ownership structure is heavily dependent on the status of the federal solar investment tax credit (ITC) at the time of

[7] Assumes the market cost is $20/REC.

construction. At the time of this study, the ITC was 26 percent and set to reduce to 22 percent in 2021 and 10 percent in 2022. The Project Team prepared pro-formas based on the 22 percent and 10 percent ITC rates. Under the 22 percent rate, third-party ownership provides approximately $2,231,833 in financial savings over the lifespan of the systems. However, at 10 percent, the third-party ownership structure does not yield financial benefits. In December 2020, Congress extended the 26 percent ITC rate through the end of 2022. The rate will step down to 22 percent in 2023 and 10 percent in 2024. Therefore, if SamTrans were to contract with a third-party and start construction by the end of 2022, the total savings would be greater than identified in the financial analysis conducted as part of this study.

- **Cash purchase of the DER systems would likely not comport with SamTrans' balance sheet.** For both the solar plus DER and solar-only options, the initial project cost would corresponds to a considerable portion of unrestricted cash reserves and total operating revenues in FY 2019, even before the large financial impact of the COVID-19 pandemic. Loans, grants or specialized bonds or third-party ownership, are likely better options for SamTrans. See Section 3.36, 4.2.3, and Appendix E for more information.

- **SamTrans should consider leveraging a tax-exempt lease purchase (TELP) structure for onsite solar and/or battery systems.** This structure allows a municipality that wants to own a project, but needs to finance the purchase, to do so without the complication of issuing bonds. A TELP is essentially an installment sale of a project to a municipality. It is set up in form to look like the sponsor is leasing the project to the municipality, but the municipality has an option to purchase the project at the end of the lease term for a nominal price. The 'tax-exempt' qualification to this financing method is associated with the federal income tax exemption recognized by the lessor on the interest earnings they receive through the repayment schedule. Because the lessor does not pay federal income tax on the interest earned, the tax-exempt lease carries a much lower interest rate than other types of leases and installment loans. This significantly lowers the cost of financing to the borrower.

  While not offering direct ownership from "year 0," this option should be evaluated by SamTrans, as it allows to leverage certain incentives such as the Federal ITC described in Section 2.1.1. Under this scenario, a "tax-sponsor" (an entity other than the agency and subject to taxes) would own the project, or a portion of it, for a period of time before passing ownership to the agency, and would be able to leverage the ITC benefits which are realized in the year the solar project begins commercial operations. The duration of this initial time is normally at least five tax years, corresponding to six contract years, during which the asset vests to the owner, because, according to the "clawback" provision, the Internal Revenue Service (IRS) will recapture any unvested portion of the credit if the project owner sells it before the end of the fifth year of commercial operations. After six years the agency can buy out the unowned portion of the solar project at a depreciated fair market value. See Section 4.2.3 for more information.

- **SamTrans could also consider financing onsite solar and/or battery systems through other federal, state or local incentive programs or by issuing green bonds.** As discussed in Section 4.2.3, the U.S. Department of Energy and the California Energy Commission each offer different financing and loan programs for renewable energy projects. SamTrans could also consider issuing a green bond to finance onsite DER systems. Green bonds are discussed in more detail in Section 4.2.3.
- **Pairing a BESS with onsite solar yields additional financial and resilience benefits.** When paired with an onsite solar PV system, a BESS can further reduce demand and provide savings value that is not available to a stand-alone battery energy storage system or solar PV system. Integrating energy storage systems with solar PV systems provides a holistic approach to renewable energy generation and financial savings. A solar PV system by itself provides per-kWh utility bill savings and some peak demand reduction but is subject to intermittency based on weather conditions and therefore plays an unreliable role in ensuring that demand charges can be effectively managed. In cases where the customer has high demand charges, solar PV and energy storage can be controlled together to provide the optimal overall bill and peak demand savings through charge/discharge management software capable of making decisions that allow for optimized financial savings based on the actual operating profile on a real time basis. This includes the ability to decide when to charge the battery system with energy provided by the solar PV system, ensuring that the battery is always charged and available for use to make up for a period of low production from the PV system. Batteries charged by solar PV also have the potential of providing "energy arbitrage," i.e., charging the batteries from the solar PV during low bill credit periods and exporting energy from the batteries during high bill credit periods. In addition, a combined solar PV and energy storage system can be configured to have the added benefit of providing an alternative source of power and resiliency in times when the grid is either unreliable or not available.
- **Consider purchasing RECs to increase the value of SamTrans' LCFS credits.** Achieving zero-carbon electricity provides a projected additional LCFS credit benefit of approximately $751,846, assuming a price of $20 per REC. SamTrans can reduce the amount of RECs needed if onsite solar is used to charge the BEBs. Based on the estimated value of the LCSF benefits and the costs for procuring energy, SamTrans has the potential to cover the majority of the costs of their utility bills once the fleet is fully electrified.
- **Consider implementing two energy efficiency recommendations.** SamTrans would realize minor energy and cost savings by implementing the two recommended energy efficiency improvements (upgrade belt-driven fan systems with synchronous belts and implement a chilled water supply temperature reset strategy) identified in Section 3.4.
- **Investing in a utility expense data management (UEDM) solution will streamline electricity data collection and payment and reduce costs.** UEDM offers companies an end-to-end solution that centralizes utility information (cost and consumption), improves

data accuracy, reduces costs (direct and indirect expenses), and provides for timely and insightful reporting all within a single cloud-based platform. However, a UEDM may only produce savings for SamTrans if pursued jointly with Caltrain.

PHASE 2: MEDIUM-TERM ENERGY PROCUREMENT STRATEGY SUMMARY

The medium-term energy procurement strategy analysis demonstrated that there are potential financial and sustainability benefits to procuring electricity through DA or wholesale markets. Neither option is currently available to SamTrans, but the agency can take steps now to position for future opportunities. Table ES-5 summarizes the estimated savings associated with DA or wholesale procurement.

Table ES-5. Estimated annual savings from DA or wholesale procurement versus retail

Estimated Electricity Consumption When Fully Electrified (MWh)	36,000
Percent Electrified at Plan	100%
Year Plan is Met	2032
Average Blended Rate from Task 3 Report ($/MWh)	$195
Estimated Annual Spend in Year Plan is Met (2020 dollars and rates)	$7,000,000
Estimated 10% Annual Savings Wholesale v. Retail Electricity[8]	$700,000

The emergency power review conducted as part of Phase 2 compared the various fuel sources, costs and availability of diesel, natural gas and hydrogen fuel cell emergency backup generators. Diesel emergency generators currently have the fewest barriers to entry from a capital and operational cost perspective and could be rented or shared between North and South bases. While cleaner burning, a natural gas-powered generator would require significant investment, particularly if there isn't a suitable natural gas line located adjacent to each base. Moreover, jurisdictions in the Bay Area have started to enact regulations prohibiting certain uses of natural gas. Hydrogen fuel cell emergency power generators have the lowest emissions. However, the technology is nascent, and therefore, expensive, particularly if SamTrans does not intend to purchase fuel cell vehicles. Based on SamTrans' 2020 Innovative Clean Technology (ICT) plan, SamTrans will not need significant backup power for the BEB fleet for several years. Therefore, SamTrans should monitor industry trends and reconsider hydrogen emergency power backup in the future as the technology matures.

Medium-term energy procurement findings and suggestions include:

- **SamTrans should engage the regional CCA relative to any products that would provide electricity and LCFS-compliant RECs.** PCE does not currently offer a product that meets

[8] Annual savings are <$0.5 million until 2029.

the California Air Resource Board's (CARB's) requirements for zero-carbon fuel sources (which increase the value of LCFS credits). However, PCE could provide bundled product (i.e., electricity plus the associated RECs) that would be compliant in the LCFS program thereby leading to increased LCFS revenue.

- **SamTrans should continue to monitor the Direct Access market and consider participation.** The DA market is a market in California that allows energy buyers to have expanded choice in their service provider. For example, if a buyer is granted the ability to enter the DA market, they can choose a different electricity service provider than their current options of PG&E and CCAs, the current electricity retail providers for the agencies. DA procurement is likely to result in savings for SamTrans, regardless of whether or not it pursues jointly with Caltrain. However, SamTrans' savings may be even higher if it does jointly procure with Caltrain. DA is only available via a lottery system and the program is currently at capacity. Additional capacity may become available in 2024, but the amount, timing, and process to apply for capacity are all in question. If sufficient capacity is added that could serve SamTrans' anticipated load, it may be worth applying.
- **SamTrans should partner with other California transit agencies (such as California High Speed Rail) to pursue legislation that would enable access to the wholesale market and conjunctive billing.** Though BART was able to gain access to the wholesale market through legislation, the process was very specific to BART's unique circumstances and took many years to finalize. Other California transit agencies have interest in gaining access to the wholesale market as well and have taken steps towards this goal. It will be important to ensure that the legislation is inclusive of (1) existing modes of transit and (2) non-rail transit. By pursuing legislation, SamTrans will have the option to switch to wholesale procurement in the future if desired.
- **SamTrans should participate in CPUC, CAISO and PG&E regulatory processes that would affect future electric vehicle rates and access to Direct Access and wholesale energy markets.** The California energy market is complex and dynamic. SamTrans would benefit by actively engaging in the rulemaking process. This is another opportunity to partner with other California transit agencies, particularly those in the Bay Area, who may have similar goals.
- **SamTrans should not pursue wholesale market participation without addressing its significant risks.** Wholesale electricity prices are subject to greater variability over time as the market reacts to real-time supply and demand needs, but on the whole are lower than retail electricity prices since they are also competitive. The estimated savings from wholesale procurement will be somewhat offset by the need to engage an entity that will effectively operate as your Electric Service Provider (ESP) or to take management of the wholesale market electricity efforts in-house. Either management route will have both real costs, likely including consulting, legal fees, and ESP management fees or additional staff headcount plus it will have a material impact on internal staff time regardless of whether or

not the management is out- or in-sourced. It is important to weigh the benefits of access to the wholesale market with these costs.

- **SamTrans would benefit from jointly procuring energy with Caltrain.** If SamTrans elects to pursue onsite DER, unique CCA products, DA, or wholesale market strategies, it would benefit from procuring energy together to reduce costs and streamline management.
    - **If SamTrans does not procure jointly with Caltrain, it is likely not going to be financially beneficial to pursue wholesale electricity on its own, at least until full fleet electrification is reached.** SamTrans will have a much smaller load compared to Caltrain. In addition, the fleet will not be fully electrified until 2038.
- **Diesel-powered and battery electric system emergency power backup is more cost effective in the short-term.** SamTrans already has diesel infrastructure in-place and an onsite diesel-powered emergency generator. Based on the 2020 ICT Plan, the fleet will continue to need diesel fuel for another seventeen years. Therefore, it may be prudent to use traditional emergency generators initially until a larger portion of the fleet has been electrified. SamTrans could consider renting diesel generators to reduce cost and avoid investment in technology that may become obsolete in the future. In addition, if SamTrans installs a BESS at either base, the BESS system can provide backup power for a portion of the fleet.
- **SamTrans should monitor developments in hydrogen fuel cell emergency backup power technology.** The technology is currently nascent but is expected to become financially competitive in the future.
- **SamTrans should consider combining the solar PV and BESS system into a microgrid.** Installing a microgrid controller to enable the system to island from the grid would require minimal additional cost.

OPPORTUNITIES, RISKS AND TRADEOFFS

Each energy procurement decision is associated with different opportunities and risks and may have implications on other decisions. Tables ES-6 and ES-7 present the primary risks, trade-offs and other considerations for each of the options evaluated in this study. Figure ES-2 illustrates the energy procurement options in a decision tree format and Figure ES-3 provides a high-level timeline of near-term decisions.

Table ES-6. Energy Procurement Opportunity Matrix

OPPORTUNITY	TIME HORIZON	LEVEL OF EFFORT	FINANCIAL IMPACTS	ENVIRONMENTAL BENEFIT	LOCAL ECONOMIC BENEFIT	EMERGENCY POWER POTENTIAL
Retail Electricity Options						
PG&E Default	Near-term	Low	$$	🍃		
PG&E 100% Renewable	Near-term	Low	$$$	🍃🍃🍃		
CCA Default	Near-term	Low	$	🍃🍃	✓	
CCA 100% Renewable	Near-term	Low	$$$	🍃🍃🍃	✓	
Direct Access (DA)	Medium-term	High	$-$	🍃🍃🍃	✓	
Purchasing Wholesale Electricity						
Procuring Power on the Wholesale Market	Long-term	High	$-$	🍃🍃		
Wholesale Power Purchase Agreements (PPA)	Long-term	High	$-$	🍃🍃🍃		
On-Site Energy Resources						
Solar PV	Medium-term	Medium	$$$	🍃🍃🍃🍃	✓	✓
Battery Energy Storage	Medium-term	Medium	$$	🍃🍃🍃	✓	✓
Hydrogen	Long-term	High	$$$$	🍃🍃	✓	✓
Other Opportunities						
Renewable Energy Credits (REC)	Near-term	Medium	$	🍃		
Low Carbon Fuel Standard (LCFS) Credits	Near-term	Medium	$$$$	🍃🍃		
Grid Services Programs	Medium-term	Medium	$	🍃		

Table ES-7. Risk Analysis and Trade-off Matrix

Option	Primary Risks	Trade-offs	Impact on Other Options: how decisions effect acting on other options	Additional Considerations
Current State	Overpaying relative to other options, not maximizing LCFS revenue.	Ease; minimal effort to maintain current contracting.	DA, legislative action, and current state are mutually exclusive options.	Potential new products that create more LCFS revenue; would need comparative cost analysis.
DER: Solar PV, Batteries, & Microgrids	Regulatory changes and/or changes in energy usage at project locations could impact the savings performance from these systems.	Cost savings from avoided electricity costs and avoided costs from REC purchases, revenues earned through emerging grid services programs.	Distributed projects would pair well with each of these additional options.	With the step-down of the ITC and the fast-paced incentive funding draw down for SGIP, procurement of these projects should be prioritized.
Direct Access	Transactional costs with minimal payback; difficult negotiating for LCFS-qualifying RECs.	Ability to potentially spur new renewable energy generation; cost savings v. retail; potentially more lucrative LCFS credit generation.	DA, legislative action, and current state are all relatively mutually exclusive options.	The program is at capacity; seeking capacity at this stage may not be worth the effort; wait until it reopens.
Wholesale market	Significant effort with no guarantee of success; risks associated with being exposed to wholesale trading.	Potential cost savings.	DA, legislative action, and current state are all relatively mutually exclusive options.	This process and the results for BART are complex; encourage a debrief with BART before exploring deeply.
Financial investment: vPPA	Expensive and risk financial position relative to only receiving RECs.	Long term REC position with potentially more lucrative LCFS credit generation.	All other options, specifically relative to their REC generation impact this option.	Only should be implemented if other sources of potential LCFS revenue are unsuccessful.
Financial investment: APA	Overpaying for RECs in the long term.	Long term REC position with potentially more lucrative LCFS credit generation.	All other options, specifically relative to their REC generation impact this option.	This is a potentially good alternative to buying spot-market RECs for use in the LCFS program.

Figure ES-2. Energy Procurement Decision Tree

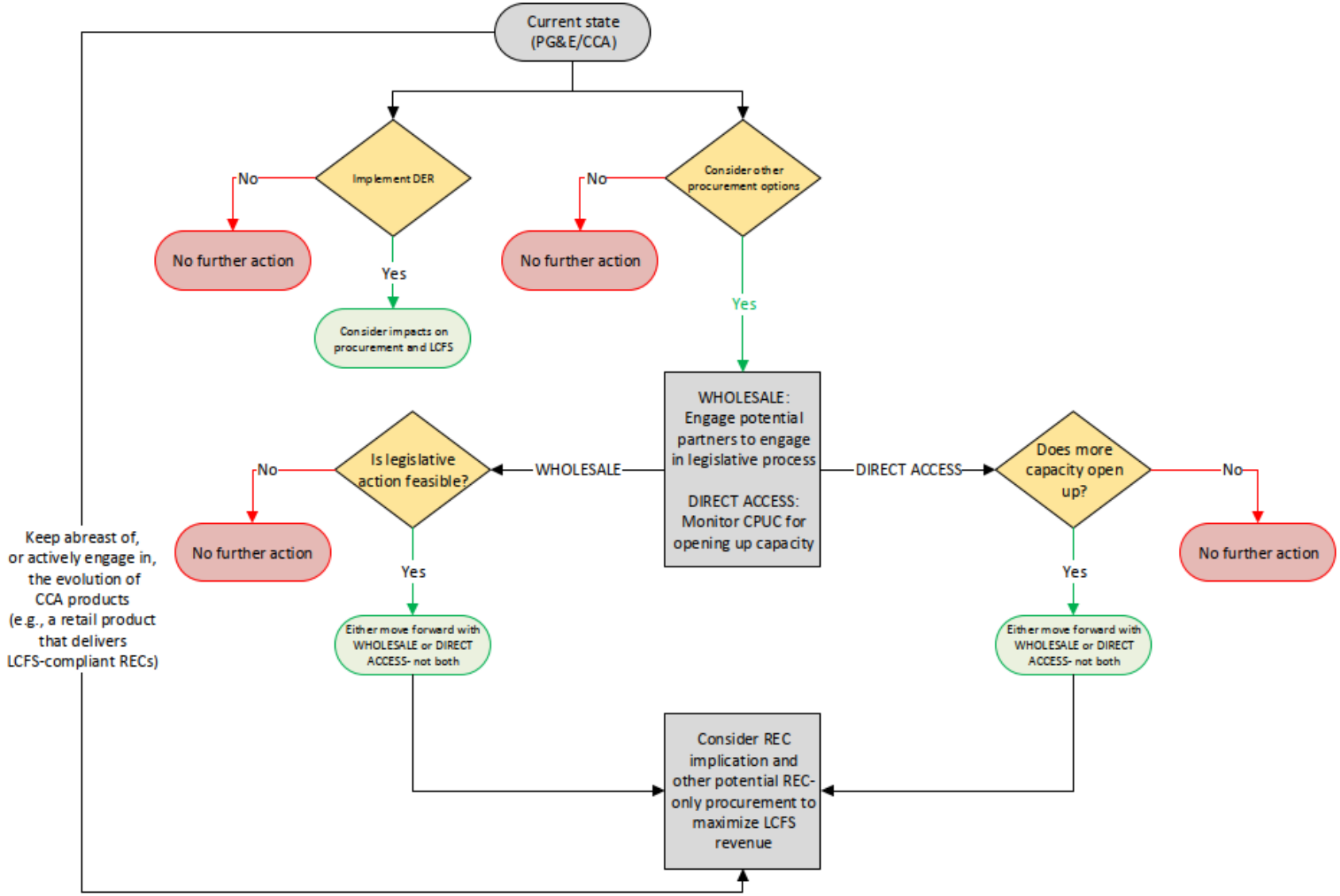
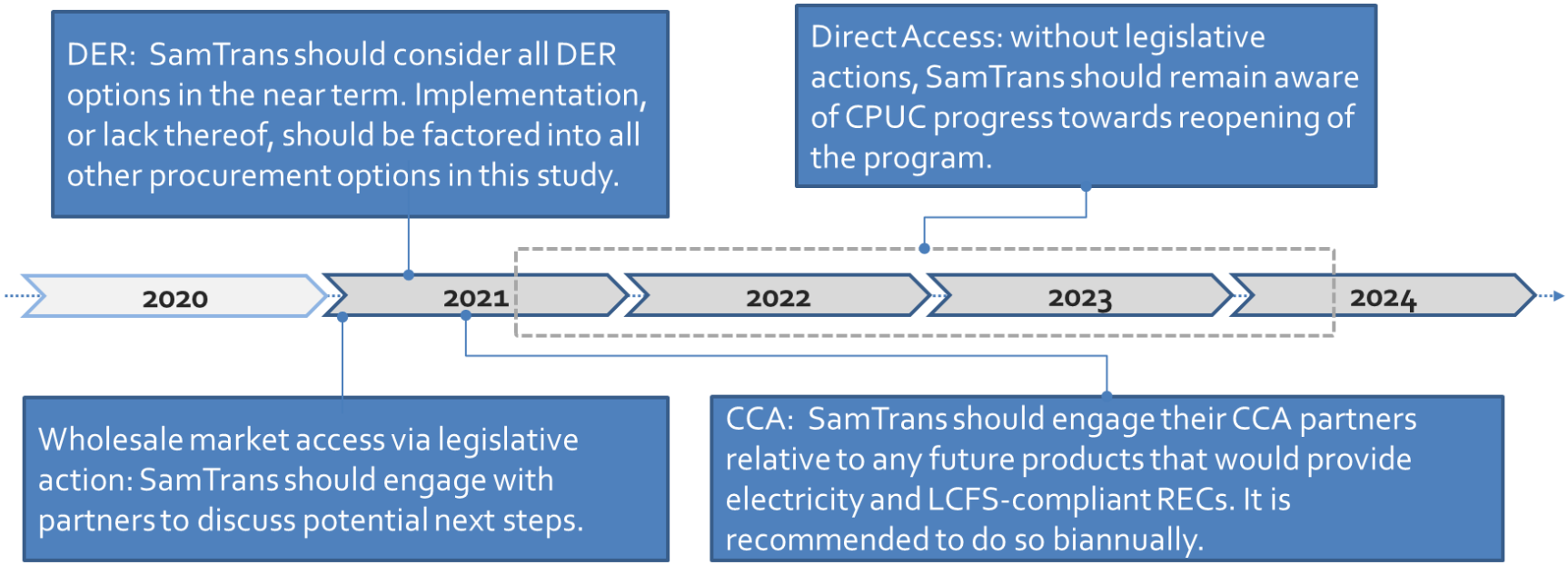


Figure ES-3. Time Horizon



** Consideration of renewable energy certificate procurement should be considered throughout in relation to electricity procurement decisions*