Technical Conference
Innovative Technology Projects (STEP)
Docket No. 16-035-36
April 2, 2019






ROCKY MOUNTAIN POWER
POWERING YOUR GREATNESS

Agenda

- 1:00 – 1:15 Introductions
- 1:15 – 1:30 STEP Funding Request
- 1:30 – 2:30 Battery Demand Response Project
- 2:30 – 2:45 Break
- 2:45 – 3:15 Advanced Resiliency Management System Project
- 3:15 – 3:50 Intermodal Hub Project
- 3:50 – 4:00 Wrap Up

STEP Funding Request

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STEP Budget

- Total funds requested = **$21.8 million**
  - Other Innovative Technology Funds
    - Intermodal Hub $2.0 million
    - Battery Demand Response $3.27 million
  - Conservation, Efficiency and Other New Technology Programs
    - ARMS $16.52 million

Utah Solar Incentive Program (USIP) Funds

- The original STEP filing included all remaining USIP project applications that had received (or were expected to receive) conditional approvals but had not yet qualified for incentive payments.
- Since the time of the original filing an estimated $14.2 million of approved project incentives have expired and are no longer incentive-eligible. The following table details the change in projected incentive payouts:

Original Filing: 2016-2023	Current Forecast: 2016-2023	Variance: Increase/(Decrease)
$33.6 million	$19.4 million	($14.2 million)

- Due to the high level of expired projects the USIP account has sufficient funds to cover all incentive payouts without the use of any of the $50 million in STEP Pilot funds.
- Use of any excess USIP funds (Schedule No. 107 revenues) will be determined in a later proceeding.

Battery Demand Response Project

Bill Comeau

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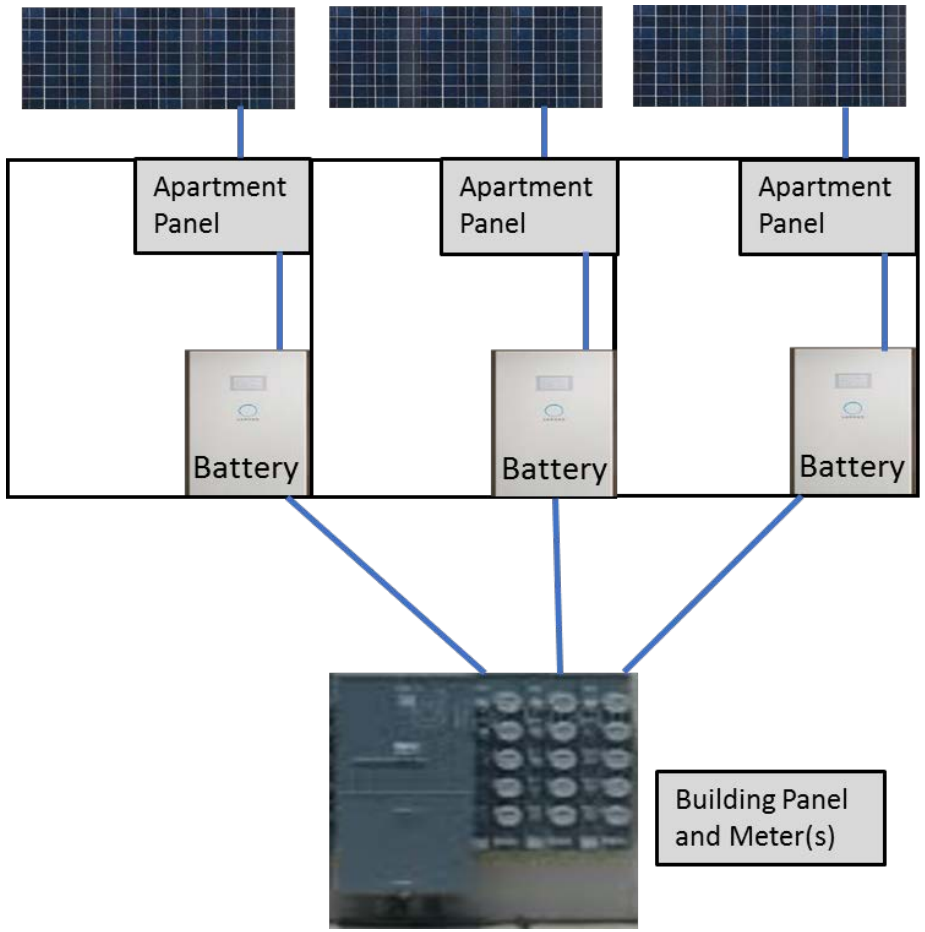
Project Overview

- The Soleil community is located in Herriman, Utah
  - 600 apartments for rent with options for one, two and three bedrooms
  - 5.2 MW solar, ~5 MW batteries
- Building and carport plan review – Reference Handout
  - Solar installed on buildings and carports
- Installation of the batteries in first building scheduled for August 2019
  - All buildings expected to be complete with batteries installed by the end of 2020
- Soleil will own and maintain the solar and batteries
  - RMP will control and dispatch the batteries

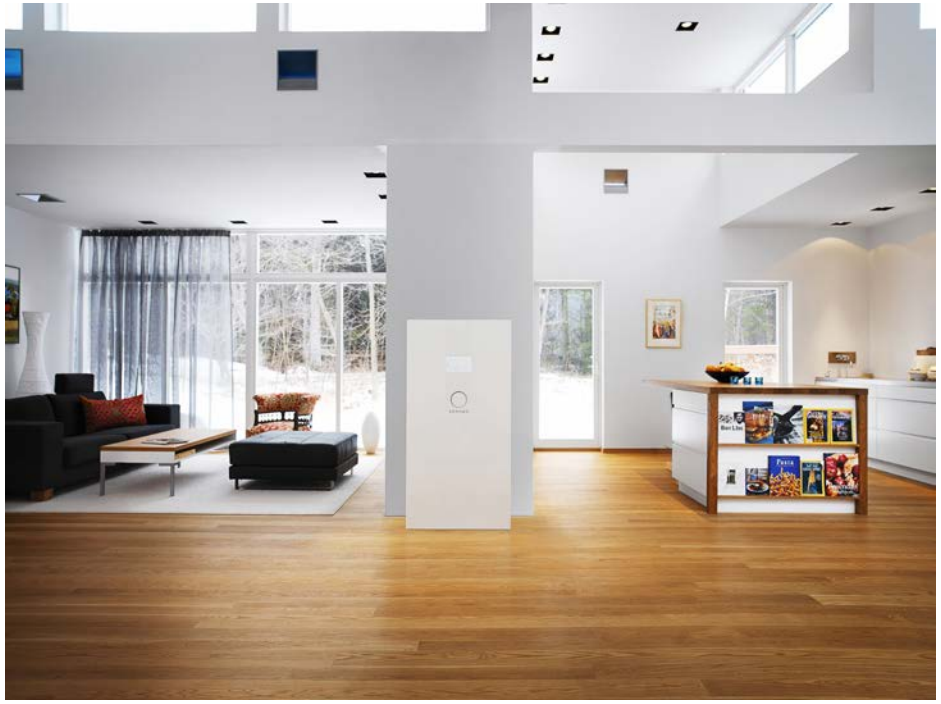
Battery/Solar Configuration

- Batteries and solar are independent systems per each apartment and common area
  - Review of floor plan and one-line - Reference handout
  - Solar wired to each battery and apartment
  - Battery unit meters usage and solar production
  - Battery inverters are IEEE 1547 compliant
  - Solar panels will not be DC coupled due to product availability, will consider in 2020 when product is available
  - The intent is to charge the batteries from only solar, although it is anticipated the data may indicate a benefit to charge from the grid, such as in the winter when cloudy to offset peaks
  - Initial use is not expected to have the batteries exporting energy back to the grid, part of project is to develop and implement a safe and sustainable way to dispatch battery capacity to the grid
  - Individual apartments can function like a micro-grid only during periods when the solar output is greater than usage
  - Batteries will provide apartments with backup for outages



Battery/Solar Configuration (Cont.)

- Each apartment will be on schedule 136 – Customer Generator
  - During sunny and low load days (spring and fall) it is anticipated there will be excess energy from the solar
  - Data will help inform future rate designs for battery systems
- The partnership with Soleil allows for behind-the-meter solar and batteries to be controlled by Rocky Mountain Power through a utility application for ability to:
  - Dispatch for traditional demand response (offsetting customer loads)
  - Inform how to best optimize the grid by utilizing batteries
  - Monitor and control both batteries individually and also in aggregated groups



Battery/Solar Configuration (Cont.)

- The Sonnen battery was the only product that met all the needs for the project
  - Ability to daily cycle for over 25 years (capable of over 20,000 cycles)
  - Advanced software for daily load cycling, frequency response, aggregate batteries, etc.
  - Battery chemistry safe for indoor use
  - Ability to develop a utility application to dispatch and control the batteries
- Soleil evaluated use of large single batteries for each building
  - Existing products did not have all the functionality needed
  - Size and aesthetics were not complementary to the community
- Evaluation will inform uses of any battery
  - Functionality to utilize for price signals, demand response, load shaping, customer outages and cost-effectiveness

Battery/Solar Configuration (Cont.)

- The project has been in development for over a year
  - Technical items with battery manufacturer have been resolved
  - Auric Solar has become certified to install the batteries
  - City of Herriman and fire department has provided requirements for the battery install and has provided preliminary approval, final approval expected within a month
  - Installed an emergency shut-off switch near the outside service panel that is connected to all batteries
  - Unless unknown issues come up the project is on-track to complete as planned
- The software platform allows for robust data gathering
  - The Company intends to either use one of its pre-qualified vendors for evaluation services, or establish a new contract for these services through a competitive RFP
  - The data will be shared publicly in a report and may help inform cost-effectiveness approaches for utility scale battery demand response solutions

Project Costs and Other Benefits

- The total cost of the solar and battery solution is approximately $34.3 million
  - $22.3 million for the solar panels, inverters, wiring, materials for mounting and labor
  - $12 million for the batteries, the battery component is not economic for the developer without tax incentives and funding from STEP
- The 5 MW capacity of the batteries will not be large enough for meaningful reductions on the overall system, but will provide a foundation to build a battery demand response program to help with managing the system
  - Due to the uncertainty of the performance of the project the local infrastructure was sized to serve the development without the batteries. Existing infrastructure and capacity existed near the site.
  - Frequency response functionality will be part of the design to inform how to scale for system management of increasing levels of variable generation (renewables)
  - Although the project is small from a utility perspective it will allow the Company to learn how to implement a larger solution
- Residents of Soleil are expected to have lower overall energy costs and other benefits
  - Backup power in the event of an outage
  - Living in a community that is minimizing impact on air quality and utilizing new technology
- Inform future rate design for batteries
  - Look at daily load shaping, peak impacts etc.

ARMS Project

Rohit Nair

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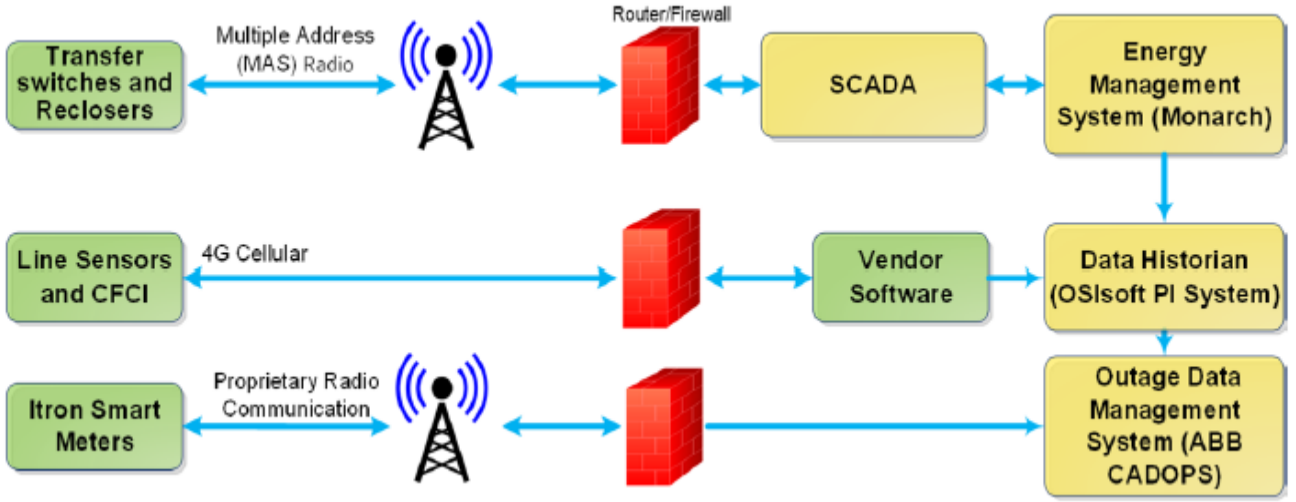
Project Overview

- Deploy advanced line sensor technology on select distribution circuits
- Install and test communication hardware devices on strategic field equipment to enable remote monitoring, operation and control capability
- Install and operate ERT Gateways to extend AMI network to 764,000 AMR meters
  - *ERT Gateways captures outage information and aggregates meter reads into hourly interval data from AMR meters*
- Integrate field equipment data into the Company's control center operations to provide for faster outage response, shorter restoration times and improved reliability

Project Benefits

- Improves customer service by providing faster outage restoration
- Enhances visibility into field operating conditions (e.g. outage reporting)
- Delivers cost savings
- Provides customers with timely interval energy usage data
- Reduces CO_2 emissions via fewer vehicles on the road
- Provides a platform for future Smart Grid applications



Intermodal Hubs Project

James Campbell

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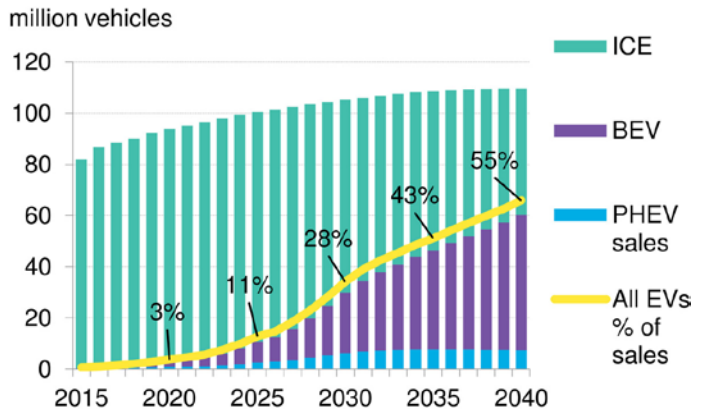
Why Intermodal Hub



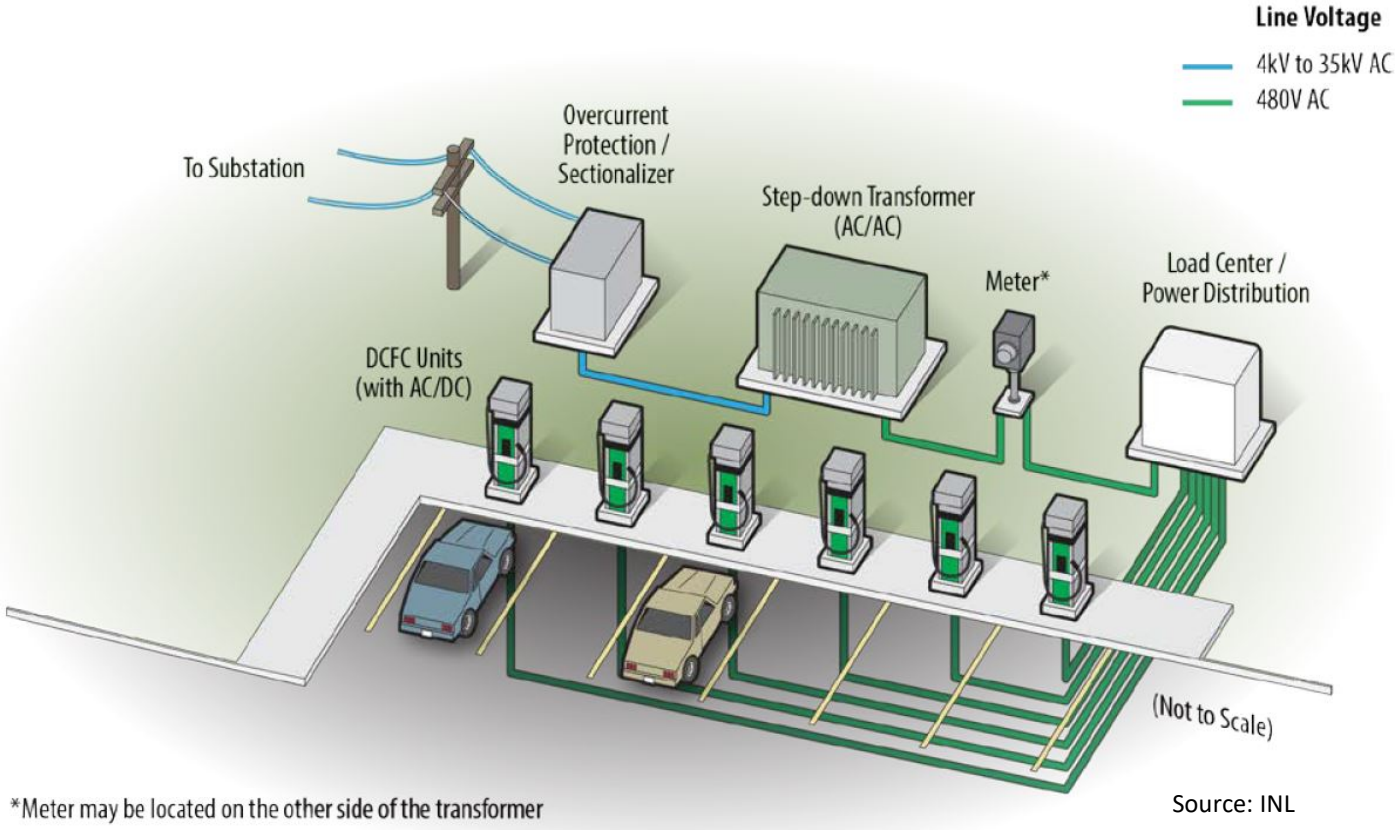
Source: Bloomberg New Energy Finance

<u>Growth for e-buses will be faster by 2030 86% of global sales will be electric</u>

"If consumers purchase EVs at the expected rates in the next five to ten years, a lack of charging infrastructure could become an obstacle". *Engel et al 2018*

1-450 KW charger requires 450 KW of Infrastructure

6-450 KW chargers require 2700 KW of Infrastructure

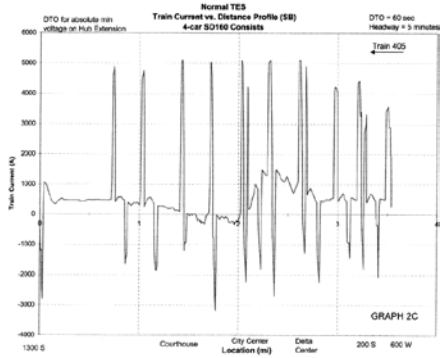


Source: INL

State of the art chargers
450 KW overhead bus
150 KW-350 KW passenger cars

Stacking of loads "worst case" particularly for low utilization

Intermodal Hub Pilot Project



TRAX line, predictable MW-level pulsed load

Intermodal Hub facility variable demand

Intermodal Hub Site-level Energy Management System

Project does not impact substations or feeder circuits

- **Develop control system tools**
  - **Increase utilization**
- **Evaluate potential for utility demand response program or other solutions**
- **Conduct cost benefit evaluation**

2x actively controlled 450 kW overhead bus chargers

- Currently 3 e-buses (Hub to U of U)
- Add 2 e-buses (Hub to PC)
- Potential to add 27 more e-buses

3x actively controlled 100 kW bus depot chargers

(TBD) actively controlled public DC fast and L2 EV chargers

- Expand Hub to include trucking and ride hailing
- Take advantage of infrastructure
- Increase utilization

Energy management system tools

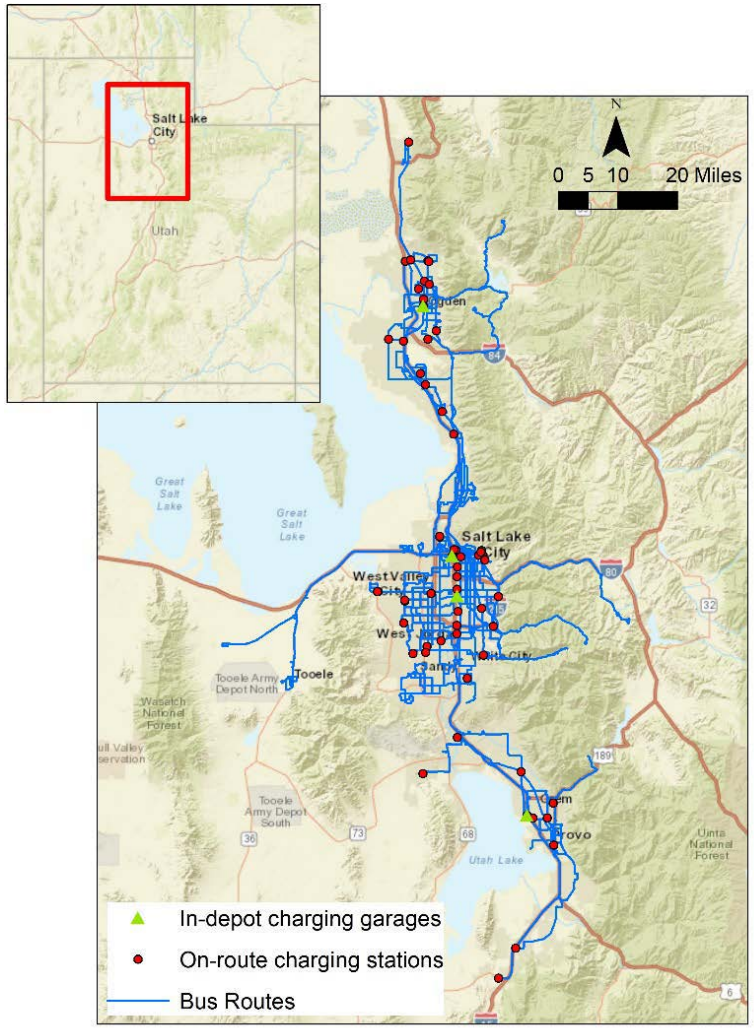
Compile-time (planning) optimization tools

- Route & schedule optimization
- Statistical and agent-based demand modeling
  - Train, bus, and passenger vehicle models
- Leverages historical data, growth models, planned upgrades
  - Historical data from trains and bus fleets, utility, chargers, and passenger vehicle participants
- Algorithms developed by USU team, ported to commercial server systems
- Outputs
  - Recommended fleet management, route schedules, overhead and overnight charger queuing schedules
  - Forward looking projections, anticipated limits, future impacts on schedules
  - Proposed schedule for system upgrades
  - Algorithm updates for run-time optimization tools

Run-time optimization tools

- Adaptive and learning control algorithms predict demand in presence of changing conditions
- Optimize real-time charger power levels and queuing to minimize impact on prioritized loads
- Communicates with UTA fleet management and public vehicle participants (via phone apps)
- Real-time data monitoring
  - Connected into the UTA back office
  - Communicate to all on-site chargers through secure UTA network via open charging protocol (OCPP)
  - Back office access to remote 10-second location and battery status data via on-board AT&T broadband cards, breadcrumb historical data via WIFI at the Hub
  - Utility data via bridge to phone equipment
  - Public vehicle participant data via cell phone apps
- Hosted by the UTA IT team, supported by the USU team

Roadmap for Future



Source: 2018 UTA study on e-buses

Olympic Exploratory Committee report calls for “zero emission transportation system”

If technology is proven then opportunity to deploy:

- UTA study identified 70 potential charging locations
- In addition 50 light rail substation upgrades needed
- Other transit possibilities
  - Park City
  - Zion National Park
  - Airport
- Truck and distribution centers
- Other industries?
- Company and USU will hold outreach and workshops to share findings

Photo: NREL

THANK YOU