GPG Overview of

SunShot Incubator 11 Award: Reducing Storage Cost with PV Forecasting and Load Control

Prime Recipient: EdgePower

Sub-recipients: Clean Power Research & Eguana Technologies

July 12, 2017

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Clean Power Research®

EGUANA TECHNOLOGIES

Project Team

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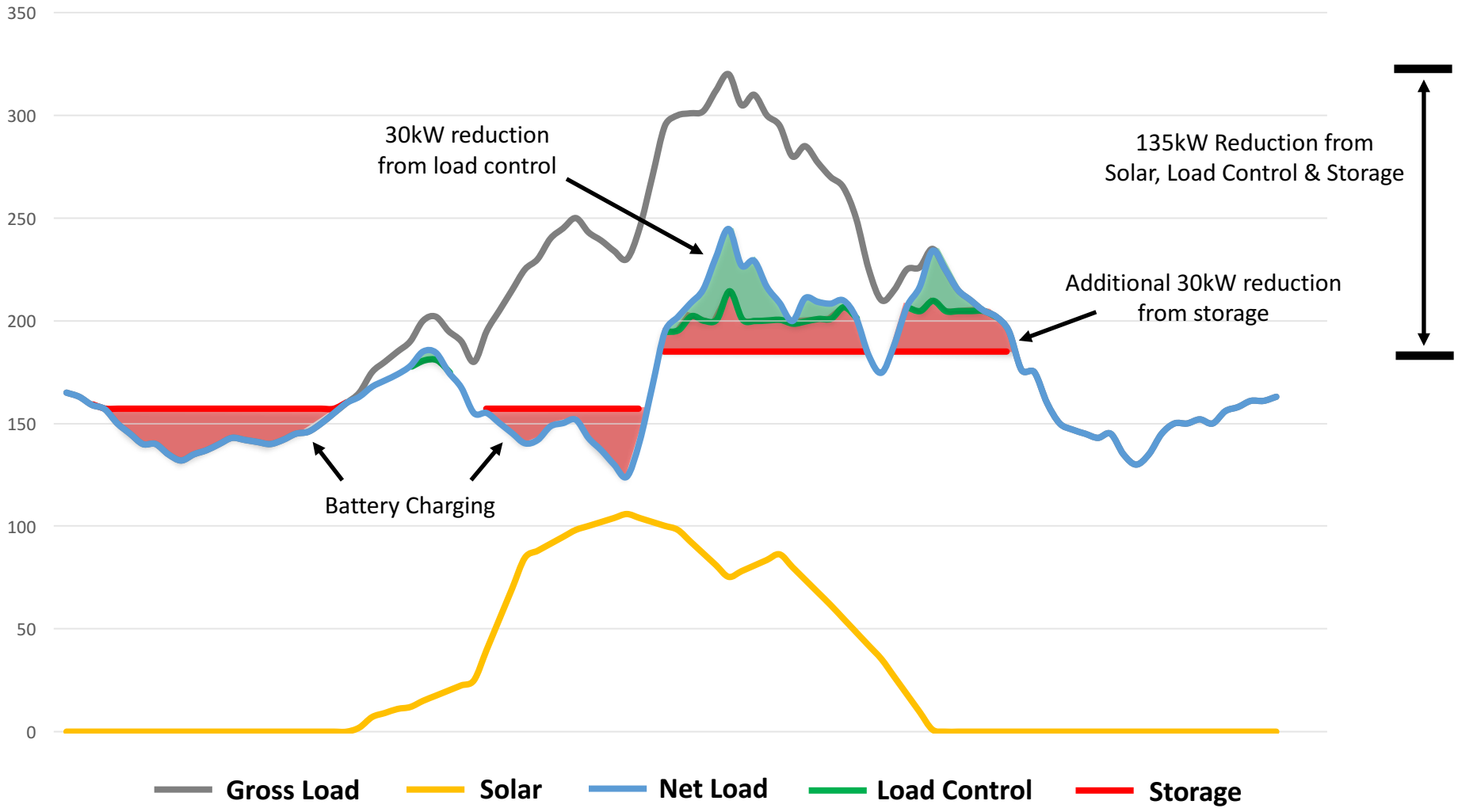
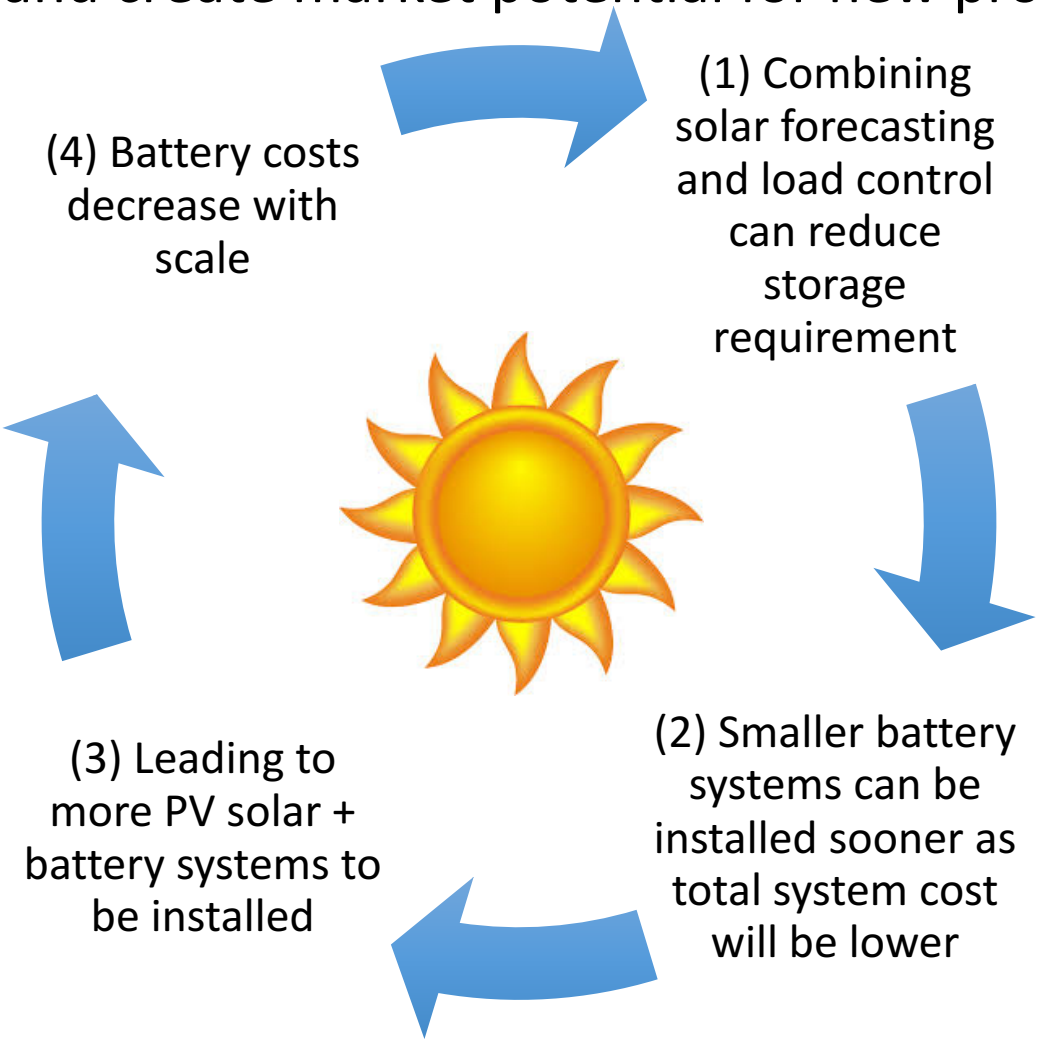
EDGEPOWER	Clean Power Research	EGUANA TECHNOLOGIES
• Founded in July 2014 • Prime awardee of SunShot Incubator Round 10 • Customers include Fortune 500 companies • Over 500 gateways deployed controlling HVAC and/or lighting (many with PV) • Offices in Aspen, CO (HQ) and Prescott, AZ	• Founded in 1998 • Prime awardee of SunShot Incubator Round 8 and Sub-recipient Round 10 (PowerClerk) • Sub-recipient to EdgePower in Incubator Round 10 • Three software product families, serving solutions in: solar prediction, energy valuation, and program optimization • Offices in CA and WA	• Founded in 2010 • Battery Energy Storage platforms for residential and commercial applications • Eguana's bi-directional power control platform deployed in thousands of solar, energy storage, and fuel cell applications around the world • Offices in Calgary, Canada and Toronto, Canada
<u>Key Personnel for Project:</u> • Nathan Glasgow, CEO • Karl Swanson, COO • Ted Belanger, Director of Product • Shawn Adams, Lead Developer	<u>Key Personnel for Project:</u> • Dr. Tom Hoff, President Research and Consulting • Dr. Richard Perez, Technical Advisor • Adam Kankiewicz, Solar Researcher • Skip Dise, Product Manager	<u>Key Personnel for Project:</u> • Brent Harris, CTO • Vishwas Ganesan, Director of Business Development

Realizing Return from PV, Load Control & Storage



Technology Adoption

How load control and solar forecasting can speed battery adoption and create market potential for new product line



Technology Overview

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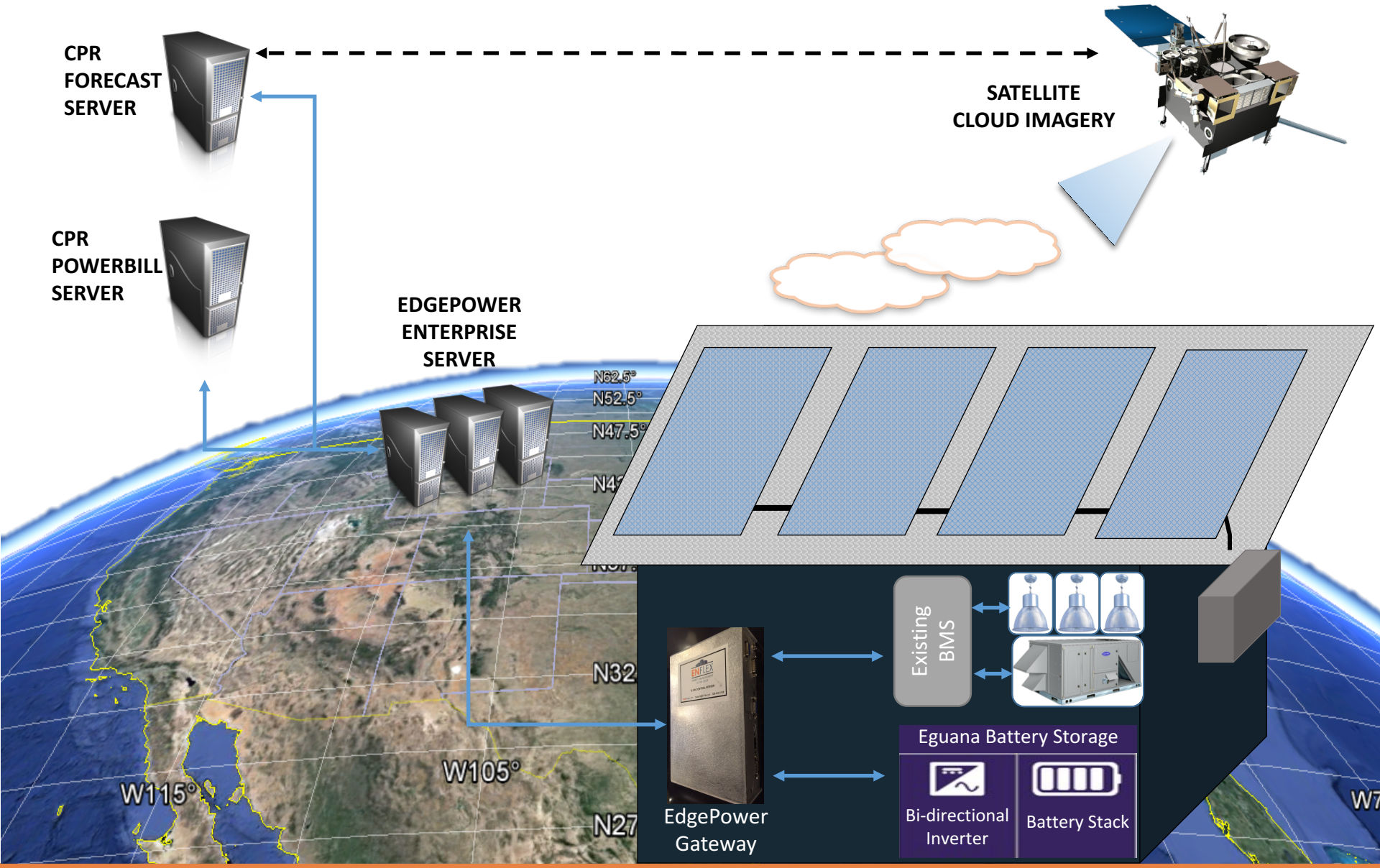
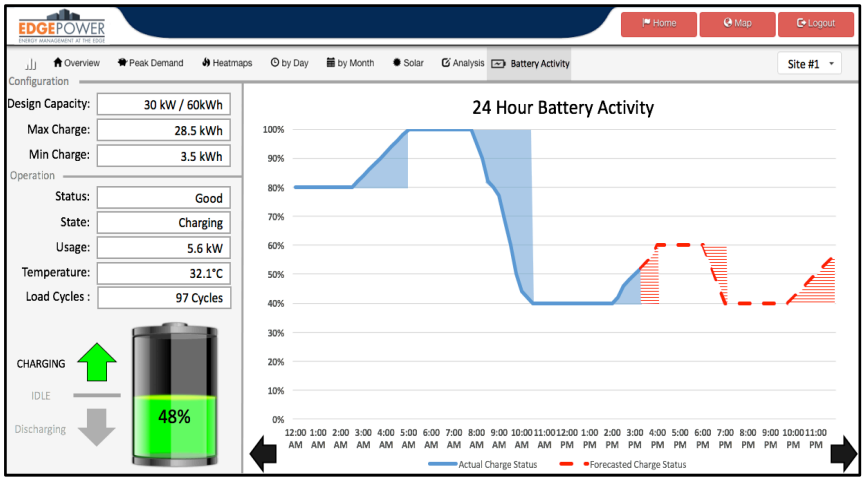


EdgePower Contributions

Firmware Development

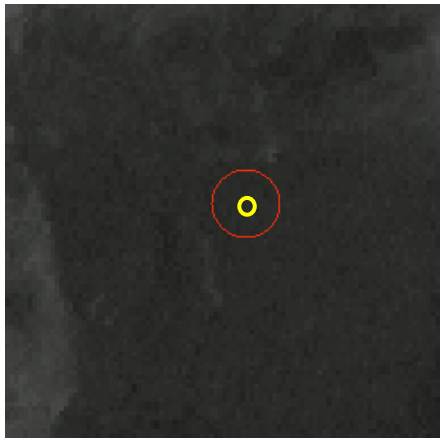
- Battery storage Demand Charge Reduction drivers and control algorithms, including charge/discharge forecasting
- Interaction with existing load control product
- Manager Interface showing potential savings vs. changes to operations
- Bi-directional integration with CPR forecasting and rate tools

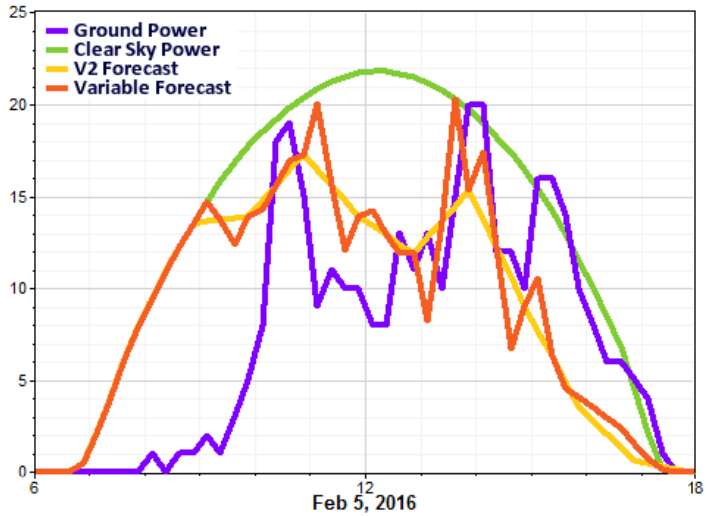


Installation, Testing, Project Management

- Host site identification, hardware specification, and installation
- Savings calculations: pre- and –post load curves run through CPR's Power Bill tool
- Commercialization plan developed and begun implementation
- Open Data Reporting and DOE documentation

CPR Contributions





- Solar forecast high resolution data
- Targeted 15-minute Variability
- 3-years of historical high resolution data
- Applied to modeling building behavior under load control and battery operation
- “Right Size” a battery system based on climatology

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Maximizing Financial Return on Commercial Building PV

- **Problem**: Solar alone does not provide reliable demand charge reduction. Batteries are still expensive. Demand charge reduction requires low-cost and reliable load shifting with storage plus load control

- **Execution**: EdgePower, CPR and Eguana have reliable technologies and a history of bringing service-based solutions to market

- **Impact**: Expansion of the available commercial PV market (by improving site economics), accelerate the electric battery storage market, interest from utility partners for grid integration services, enable higher PV penetration

Project Timeline & Deliverable Periods

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	2017											2018									
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
D1																					
D2																					
D3																					
D4																					

Deliverable Period 1

- EdgePower enterprise application performance optimization
- Modbus driver for communication between EdgePower Gateway and Eguana battery storage system developed
- 3 potential host sites for demonstration pilot identified

Deliverable Period 2

- EdgePower enterprise application capable of presenting battery storage system health and operational data
- Communication and control established between EdgePower Gateway and Eguana battery storage system in test lab
- Logic and pseudo code for load control and battery discharge/charge algorithms developed
- Initial gross building load forecast developed
- Identify host site for demonstration pilot, perform site comfort and productivity evaluation, building manager approval of installation plan

Deliverable Period 3

- Develop EdgePower enterprise webpages providing on/off switch for automated load control plus battery storage operation
- EdgePower Gateway capable of monitoring real-time building load and implementing sub 1-minute control decisions
- Pseudo code for load control and battery algorithms transitioned into enterprise and gateway code
- Implement improved gross building load forecast
- CPR building-level solar forecast developed
- Load control and battery storage system hardware installed at host site

Deliverable Period 4

- Demonstration period for automated load control plus battery storage
- NREL verified savings report and M&V report published
- Commercialization plan and technology roll-out plan developed