Final Outcome Report (Non-confidential)

MARINER PARTNERS' SHIFT ENERGY

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Project Title: Beta Testing of EOS Technology
ERA Agreement Number: 25903797.1

Name & Information of Recipient Contact: Nancy Butler
VP of Operations – Mariner Partners Inc.

Name of ERA Project Advisor: Sheila Schindal

Start date of the Project: April 06, 2017
Completion date of the Project: Dec 31, 2021

Technology Readiness Level (TRL) at Project Initiation: 6
Technology Readiness Level (TRL) at Project Completion: 9

Total ERA Funds received: 1,210,432.39

- **Received through December 31, 2021**: $1,065,316.13
- **Left to receive after final claim approved**: $145,116.26

Total actual project costs (total eligible, total ineligible)

- **Eligible -** $3,789,265.69
- **Ineligible -** $21,193.64

For Submission date: Feb 28th, 2022

Short Project Description and High-level Results:

Project Description

Mariner Partners' SHIFT (SHIFT), has developed a proprietary, patent approved software based technology, called Energy Optimization System (EOS™) to improve the operation of systems in a building and reduce the use of electricity, gas, steam, and other energy sources avoiding utility costs and reducing carbon footprints.

The project was to demonstrate six months of EOS™ operation in 16 buildings, representing each of SHIFT's target market verticals for this Project: healthcare, airports, and office towers. Demonstrate target energy reductions in all 16 buildings.

High-Level Results

The project implementation occurred over a period of 48 months where SHIFT engaged with 16 different sites across the target Markets such as Office Towers, Healthcare, Airports.

The overall range for energy savings at the individual sites was within the target range of 10% to 20%. The Avg Percentage savings for all sites improved through the project, as evidenced in the most recent site deployments during the last 18-24 months, as result of improvements SHIFT made.

New product **Automation and User Experience Tools** were developed as part of the project.

Cost and time to deploy the EOS™ service were reduced beyond the target 10% through the development & use of new tools.

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Section 1
Executive Summary

The Technology

SHIFT has developed a proprietary, patent approved, software based technology to improve the operation of systems in a building and reduce the use of electricity, natural gas, steam, and other energy sources, avoiding utility costs and reducing carbon footprints. The system, called Energy Optimization System (EOS™).

Project Implementation

The project implementation occurred over a period of 48 months where Mariner Partners' SHIFT engaged with 16 different sites across target Markets such as Office Towers, Healthcare, Airports.

The Outcome

Performance Results
The overall range for energy savings at the individual sites was within the target range of 10% to 20%. The Avg Percentage savings for all sites improved through the project, as evidenced in the most recent site deployments during the last 18-24 months, as result of improvements SHIFT made.

Deployment Effort & Duration
Deployment effort & duration continued to improve through the project period in both effort & duration by exceeding the target 10%

Product Technology Development
New product **Automation and User Experience Tools were** developed as part of the program.

Commercialization
There were customers from the project that signed contracts for extended use. SHIFT targets to have additional customer sites in Alberta, and globally.

Environmental Benefits

Over the duration of the demonstration project, it was also measured that GHG emissions were reduced

Section 2
Project Description

Introduction

Mariner Partners' SHIFT Energy has developed a proprietary, patent approved, software based technology to improve the operation of systems in a building and reduce the use of electricity, natural gas, steam, and other energy sources, avoiding utility costs and reducing carbon footprints. The system, is called Energy Optimization System (EOS™).

Background of the Project

The primary impact of EOS™ is the reduction of CO_2 due to reduced electricity and fuel use.

Demonstrated six months of EOS™ operation in 16 buildings, representing Mariner's target market verticals, for this Project: healthcare, airports, and office towers.

Through the Project, Mariner obtained data that validated the EOS™ technology for the market. Mariner developed software tools throughout the Project that will be proprietary to Mariner and will expedite the setup and configuration of EOS™ service. As well, Mariner developed additional new system integrations, third party integrations, user visualizations, and reporting capabilities.

SHIFT partnered with EllisDon and Brookfield Global Integrated Solutions (BGIS).

Performance/Success Metrics Identified in the Contribution Agreement

Demonstrate six months of EOS™ operation target energy reductions representing each of Mariner's target market verticals for this Project: healthcare, airports, and office towers.

Demonstrated successful integration into the systems of the specific building, which had minimum 1000-8000 points per site mapped.

Demonstrate target energy reductions in all 16 buildings. Target energy savings were 10-20% on each site for an average of **15%** across all sites within the Project.

Reduce the cost and time to deploy the EOS™ service through the use of new tools, planning, and partnerships. The target for labor reduction will be a minimum of 10%. Targeted reductions were measured across specific similar size sites within the same vertical markets at the end of the Project.

Plan, design, develop, test and launch Monitoring and Control Tools and Operator Control and Management tools.

Section 3
Project Workspace

Deployment Methodology and Commissioning

The work at each site was broken into six checkpoints.

Integration: All required read data is coming back from the building and is confirmed accurate. All write points have been tested to verify that they actuate the correct apparatus in the building.

Engineering Solution: EllisDon and BGIS have provided an engineering assessment for each site indicating what optimizations are recommended. They have provided a written report for each site that describes the optimization opportunities.

M&V (mechanical and ventilation) Baseline: M&V Plan has been published and approved. All M&V data collection is working. M&V Baseline model has been constructed and verified. A report of the M&V models is published.

EOS™ Engineering: All optimizations have been designed, built, and tested live in the building. This requires collection of info such as nameplate data, drawings, schedules, etc.

Post Support and Training: Mariner provides on-site training and appropriate documentation for each site to hand off the operation to the normal site team.

M&V Reporting: Written reports are produced documenting the results per the approved M&V Plan.

Technology Development

The new Product **Automation and User Experience Tools** developed as part of the program are:

- **Building Qualification and Automation Tools:**
- **Control and Management User Interface Tools**:
- **Demand Management Tools**:

Project Achievements Relative to Stated Objective and Performance Metrics, Including Analysis of Results

Demonstrate six months of EOS™ operation in 16 buildings,

The 16 Building sites consisted of Office towers, Healthcare, and Airport

- NOTE: Five (5) of the sites were based in Alberta

Demonstrated successful integration into the systems of the specific building, which had minimum 1000-8000 points per site mapped

All 16 sites satisfied the criteria of 1000-8000 points.

Demonstrate target energy reductions in all 16 buildings.
High-lights of the target energy reductions are as follows:

- Overall Performance
  - The overall range for energy savings at the individual sites was within the target range of 10% to 20%. The Avg Percentage savings for all sites improved through the project, as evidenced in the most recent site deployments during the last 18-24 months, as result of improvements SHIFT made. During the last 18-24 months the Avg percentage savings increased by 5% at the Alberta Sites
  - Specific to the Alberta sites; The Avg Percentage savings for the Alberta sites was also within the target

Other observations associated with the performance results are as follows:

- Seasonal
  - Higher electricity monthly savings were observed during summer season
  - Higher natural gas monthly savings were observed during winter season

- Building Type
  - Amount of energy savings was higher in facilities that have much longer operation hours and tighter space conditions to maintain, resulting high energy intensity and more opportunities for energy savings.

Plan, design, develop, test and launch Demand Management Monitoring

New Demand Management Monitoring and Control Tools and Operator Control and Management tools were successfully deployed to all eligible sites

Reduce the cost and time to deploy the EOS™ service
Deployment costs continued to improve through the project period in both effort & duration by more than the target 10%.

Product Technology Development
New product Automation and User Experience Tools were developed as part of the program.

Section 4
Commercialization

Mariner Partners' SHIFT Energy will continue to invest in the evolution of the solution with a strong focus on two main market opportunities within Energy Management.

1) Demand Management
2) Carbon reduction along with Energy efficiency as part of ESG (Environment, Social, Governance)

Section 5
Lessons Learned

Obstacles, Delays Encountered

Obstacles

- Connectivity – Sites having ability to communicate via required protocols
- Site Renovations – A site instructed SHIFT to stop deployment activities which resulted in EOS being turned off, due to site renovations being performed on-site.
- Due to March 2020 COVID; Occupancy levels in buildings affected the opportunity for energy savings

Delays

- Due to March 2020 COVID;
    - Site performance monitoring for 2 sites that were in-progress was paused
    - Ability to identify and start the last 2 sites as part of the project were delayed

Lessons Learned

Building Type

- Facilities that have much longer operation hours and tighter space conditions to maintain (e.g., Hospitals), results in high energy intensity and more opportunities for energy savings.

COVID impact:

- Energy Efficiency programs were postponed
- SHIFT's Adjacent Period Measurement capability was become instrumental in providing a viable alternative for calculating energy savings because of Pre-COVID versus COVID conditions

Section 6
Environmental Benefits

Over duration of the demonstration project, GHG emissions were reduced by approximately 2,808 t-CO2e

Over a ten-year period of 2020- 2029 it is expected that the resulting annual GHG emission reductions, within Alberta will be approximately 35,760 t-CO2e per year by 2029.

Over the same period, resulting in GHG emission reductions, within other parts of Canada, will be approximately 55,925 t-CO2e per year by 2029. and other parts of the world will be approximately 94,037 t-CO2e per year.

Section 7
Economic & Social Impacts

Economic Impact in Alberta

Over the ten-year period of 2020- 2029, the cumulative number of installed EOS™ units within Alberta is expected to increase each year,

As part of SHIFT's Go-to-Market strategy, SHIFT will be developing Partnerships with companies that are doing business in Alberta.

Social Impact in Alberta

Healthy Buildings and tenant comfort are a key aspect of SHIFT's Go-to-Market strategy.

Section 8
Scientific Achievements

Granted US Patents

Region: United States

Identify No. : 11,061,376 B2
Description: METHODS AND SYSTEM FOR REDUCING ENERGY USE IN BUILDINGS (Granted 20210713)

Status: Granted

Granted CA Patents

Region: Canada

Identify No. : 2,986,922
Description: METHODS AND SYSTEM FOR REDUCING ENERGY USE IN BUILDINGS (Granted 20211019)

Status: Granted

Section 9
Overall Conclusions

Project Outcomes

The project confirmed that the target range of 10-20% energy reduction is achievable and that buildings with facilities that have much longer operation hours and tighter space conditions to maintain, resulting in high energy intensity and more opportunities for energy savings.

- The results from the Alberta sites as part of the project also confirmed that the target range of 10-20% energy reduction is achievable.

GHG Emissions

GHG Emission – CO2 reduction is becoming a key focus for companies that are embarking on a corporate ESG (Environment, Social, Governance) initiative.

The cumulative GHG reductions over the next ten-year period are expected to be approximately 320 kt-CO2e.

Section 10
Next Steps

Next Steps for the Technology/Process/Innovation

SHIFT will continue to respond to RFPs.

SHIFT will continue to invest in the evolution of the solution with a strong focus on two main market opportunities within Energy Management.

1) Demand Management
2) Carbon reduction & Energy efficiency as part of ESG (Environment, Social, Governance)

Potential Partnerships Under Development

SHIFT's Go-to Market strategy involves further establishing Channel Partner type relationships with different players in the Energy Management Ecosystem, that are regionally and globally focused.

Section 11
Communications Plan

Communications Activities

Regular monthly check-ins occurred with both SDTC & ERA representatives for monitoring progress through-out each year.

There were Milestone progress update reports provided to SDTC/ERA annually.

Internally within SHIFT, there were regular updates provided to the Mariner Partners senior management / leadership team.

Section 12
Literature Reviewed

White Papers

Several published white papers were referenced and reviewed by the SHIFT R&D team as part of our efforts with Optimization algorithms improvements.

SHIFT

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EMISSIONS REDUCTION ALBERTA	Project Emissions Reductions	ID: F0160035
Recipient Organization	Mariner Partners Inc.	
Title	Beta Testing of EOS Technology	

GHG Emission Reductions (ERs): 2011–2050	
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0
2017	0
2018	0
2019	0
2020	0
2021	899
2022	0
2023	0
2024	0
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0
2034	0
2035	0
2036	0
2037	0
2038	0
2039	0
2040	0
2041	0
2042	0
2043	0
2044	0
2045	0
2046	0
2047	0
2048	0
2049	0
2050	0

Please Refer to ERA's Website For the Quantification Methodologies
https://www.eralberta.ca/calculating-ghg-emissions-reduction/