# MIS 6349.002: Group 4 (Watt Explorers) - Project Proposal

**Attention: Dear client, please note that this is not a legally binding document. This is just an iterative document that can always change, based on the judgment and approval of Dr. Ray Aria, the instructor of MIS6349 course.**

**Client Name:** Commodit Edge LLC

## 1. Statement of Group Contribution

**Prepared by:** Jatin Gopisetty

| **Group Member** | **Role** | **Level of Contribution** 0=No Contribution 1=Weak Contribution 2=Equal Contribution 3=Strong Contribution | **Statement of Work** |
|---|---|---|---|
| Vaishnavi Gawali | • Business/Project Analyst<br>• Data Analyst | 3 | • Identified steps and plan to conduct market research and feasibility study of single-phase chargers and EVs in the Canadian market |
| Suresh Gopalakrishnan | • System Architect<br>• Project Manager (2nd in Command) | 3 | • Overall system architecture<br>• Budget and finance<br>• Project management |
| Jatin Gopisetty | • Project Manager | 3 | • Designed Gantt Chart<br>• Communicated between the client and the team<br>• Assigned tasks to team<br>• Performed stake holder analysis |
| Tarun Latchireddi | • Data Analyst<br>• Project Manager<br>• System Architect | 3 | • Performed the full examination of the Single-phase EV chargers |

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| | | | and identified the requirements for the system<br>• Explored the future considerations for the Single-Phase EV chargers in the Canadian market<br>• Described the data collection process and briefly explained how data regarding the Single –Phase EV chargers will be collected, stored, processed, and secured as per the requirements of the business |
| Aleen Le | • Developer<br>• Research/Market Analyst<br>• Data Analyst | 3 | • Identified how to acquire and analyze competition in the EV charger market<br>• Identified possible risks involved and strategies to manage these issues<br>• Conducted brief research on the current EV market to gauge future sustainability and growth |
| Saurabh Nair | • Product Manager<br>• Project Manager (3rd in Command)<br>• System Architect<br>• Developer | 3 | • Led the development of the project overview, objectives, and business question, laying the foundation for the proposal<br>• Created the implementation plan outlining key steps and milestones, ensuring project clarity and feasibility<br>Collaborated with the team to define and document project deliverables, guaranteeing all essential aspects are covered.<br>• Co-created the Work Breakdown Structure |

| | | | |
|---|---|---|---|
| | | | (WBS) with valuable team input, providing a detailed project roadmap<br>• Facilitated both team calls, setting direction, assigning tasks, and taking ownership of progress updates and maintaining all internal communications |
| Yash Shiyani | • Developer<br>• Research/Market Analyst<br>• Business/Project Analyst | 3 | • Researched Canadian government regulation, schemes and rebate program on EV chargers<br>• Compiled data on current electric vehicle market in Canada<br>• Found solution based on analyzed data |
| Sowmya Yella | • Business/Project Analyst<br>• Data Analyst<br>• Research/Market Analyst | 3 | • Crafted an executive summary highlighting the significance of single-phase EV chargers in Canada, stressing workplace and public area uses<br>• Addressed ethics and privacy concerns, assuring data security and ethical behavior throughout the project |

# 2. Project Overview

### 2.1 Executive Summary

***Author:*** Sowmya Yella ***Editors:*** Saurabh Nair

**Executive Summary**

The Canadian single-phase electric car charger industry is expanding rapidly, driven by the growing popularity of electric vehicles. To leverage on this trend, businesses should segment the market based on vehicle type and charging requirements. Identifying market gaps and meeting potential and unmet requirements in workplaces and public areas will be critical for establishing an overview of the project.

The primary focus is on single-phase electric vehicle (EV) chargers that operate between 110 and 220 volts. Recognizing the changing environment of electric vehicle uptake, the project intentionally broadens its scope to investigate uses for single-phase EV chargers outside of domestic settings. This covers workplaces and public areas, recognizing their importance in defining the future of EV charging infrastructure and contributes to the transformation of the Canadian energy landscape, fostering efficiency and functionality in varied contexts and accelerating the adoption of electric vehicles across the nation.

**Client and Objectives**

Our client, a leading player in the energy solutions business, is looking for strategic insights into the Canadian electric vehicle charging market. The purpose is to better understand industry dynamics, identify market trends, and assess development potential, particularly in the single-phase EV charger space.

**Key areas of concentration include the following:**

1. **Market Dynamics**: A comprehensive analysis of the Canadian energy market, with a focus on the need for electric car chargers, regional differences, and emerging trends
2. **Regulatory Landscape**: A complete analysis of the legislation that governs single-phase EV charger installations to ensure that all legal and compliance criteria are met
3. **Competitive Landscape**: Identifying and evaluating key players in the single-phase EV charger market, including market share, product offerings, and strategic positioning
4. **Technology Trends**: An inquiry into technological developments that influence single-phase EV charger design and performance, with recommendations for remaining ahead of the curve
5. **Market entry strategies**: Recommendations for entering the market, such as potential alliances, financial possibilities, and product differentiation strategies to gain a competitive advantage

**Market dynamics**

In our market strategy, segmentation is critical since we divide the target market based on vehicle type, charging requirements, and geographic region. This nuanced methodology enables us to identify market gaps by studying charging infrastructure, examining existing single-phase charger problems, and comprehending different vehicle specifications and client segments.

**Market Research Data Forms**

Comprehensive market research necessitates obtaining a variety of data, including:

1. **Demographics**: Understand the demographics of electric vehicle owners, such as age, income, and location
2. **Charging Habits**: Observe patterns such as peak charging times, average charging times, and preferred charging locations
3. **Mapping the Infrastructure**: Determine the locations of existing chargers and gaps

**Evaluation Strategy:**

1. **Target Market Analysis**: Analyze market categories to identify needs and preferences depending on vehicle type and charging needs
2. **Gap Analysis**: Evaluate the market's existing offerings and find areas where current solutions fall short. This involves establishing if single-phase chargers are compatible with various electric vehicle kinds

3. **Potential Analysis**: Explore the untapped potential in workplaces and public areas, taking into account the unique challenges and opportunities provided by these environments

**Value Proposition**

This report intends to provide our customer with actionable knowledge, allowing them to capitalize on possibilities in the changing Canadian energy market. Emphasizing single-phase chargers allows for more informed judgments about market entry, product development, and strategic partnerships, as well as alignment with market demand and regulations.

**End-User Perspective**

This analysis takes into account a wide range of end-users, including individual electric vehicle owners, businesses investing in charging infrastructure, municipalities establishing charging networks, and utility providers responding to shifting energy consumption patterns. It is critical to tailor products and services to meet these various needs.

**Conclusion**

This report acts as a complete reference for our client, helping them navigate the Canadian energy industry, particularly the rising market for single-phase electric vehicle chargers. Understanding market dynamics, laws, competition, and technology developments enables the client to make well-informed decisions that are aligned with business objectives, producing long-term value for both the organization and end-users in Canada's changing energy landscape.

## 2.2 Project Overview and Objectives

***Author:*** Saurabh Nair ***Editors:*** Jatin Gopisetty

### 2.2.1 Overview

A rapid rise has been noticed in the electric vehicles (EVs) sales in Canada. This presents a significant opportunity for innovation within the energy sector of Canada . By performing a detailed market research on existing solutions, we may be able to draw some very interesting insights on the unmeet requirements of the evolving market. With this project we aims to bridge the gap by conducting a comprehensive market analysis of the Canadian single-phase EV charging market, identifying unmet needs, and proposing a tailored solution to enhance efficiency, reliability, and functionality by introducing a innovative solution.

### 2.2.2 Objectives

The primary objective of this project is to develop an innovative solution that addresses specific, unmet needs within the Canadian single-phase EV charging market by following a six-step approach:

1. **In-depth Market and Industry Analysis**: Gain a comprehensive understanding of the Canadian energy market, focusing on market size, growth trends, customer demographics, and regulatory factors specific to single phase EV chargers, and other industrial charging systems.

2. **Evaluation of Market Players**: Analyze both Canadian and global players active in the Canadian market, assessing their product offerings, technological capabilities, service models, and market strategies along with any upcoming competitors.

3. **Identification of Market Needs**: Identifying gaps and unmet needs within the Canadian Ev market, particularly areas where innovative Information Systems (IS) or non-IS solutions can add more value.

4. **Solution Development**: Propose an innovative and practical solution, either IS-based or non-IS, to address the identified needs and enhance efficiency, reliability, and functionality within the market.

5. **Solution Design Document Creation**: Develop a detailed solution design document outlining feasibility analysis, system architecture, process flow design, user interface, and an implementation roadmap.

6. **Impact Assessment and Startup Plan**: Evaluate the potential impact of the proposed solution on the market, considering scalability, cost-effectiveness, environmental impact, and user adoption. Additionally, create a well-researched plan for establishing a startup based on the proposed solution, covering legal formation, market analysis integration, solution development, team assembly, funding strategies, prototype development, regulatory compliance, and networking/partnerships.

### 2.2.3 Business Question/Problem

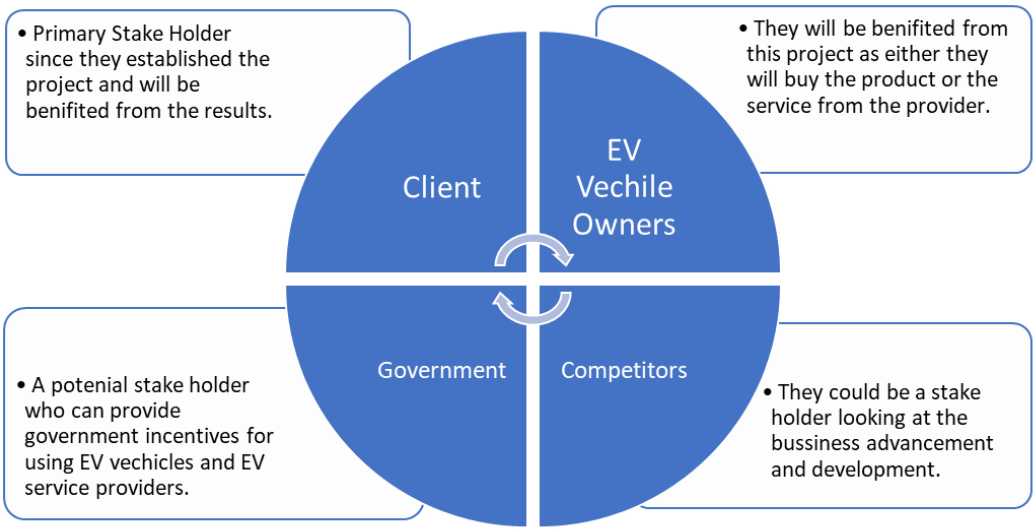
The growing demand for single-phase EV charging in Canada highlights the need for innovative solutions that address current market limitations and also try to identify any growth opportunity. This project focuses on the following business question:

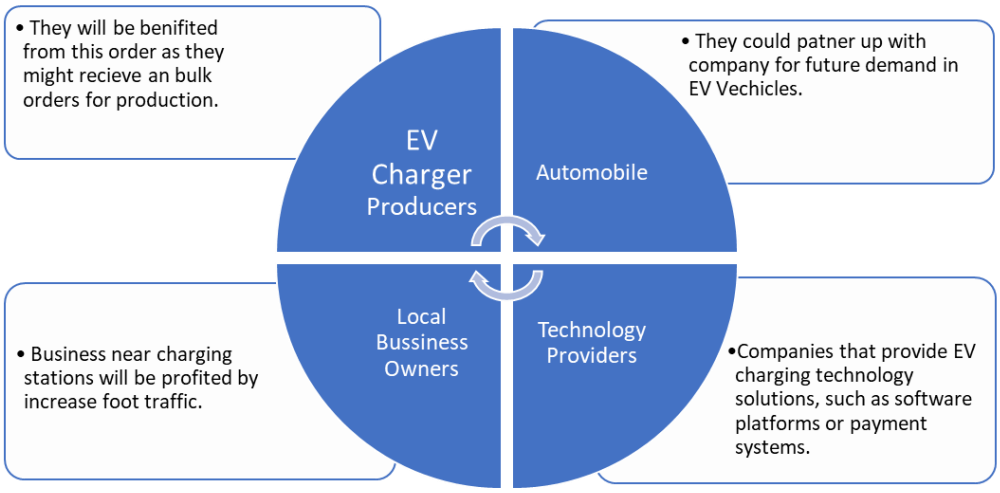
What specific, unmet needs exist within the Canadian single-phase EV charging market, and how can a tailored solution enhance efficiency, reliability, and functionality for stakeholders?

By answering this question, we aim to develop a solution that creates significant value for the market and positions us for success in the evolving EV landscape.

## 2.3 Stakeholder Analysis

***Author:*** Jatin Gopisetty ***Editors:*** Sowmya Yella, Aleen Le




## 2.4 Current Status Analysis

***Author:*** Tarun Latchireddi

***Editors:*** Yash Shiyani, Saurabh Nair, Jatin Gopisetty, Aleen Le

After performing the complete examination of the single-phase EV chargers in Canada, the following points were produced below.

**Charging Network Distribution**: We really need to investigate the distribution of single-phase electric vehicle chargers in Canada's various regions, including the suburban areas, rural areas, and metropolitan cities which would give us an idea on how well the Charging network has been scattered across the country.

**Charging Speed**: We also need to evaluate the charging speed of a single-phase EV chargers which is usually normally between 3.3 and 7.2 kW, and check whether it is sufficient to meet the demands of electric vehicle owners both the commercial and the retailers.

**Types of Connectors:** We must ascertain whether the most popular connector types in Canada—Type 1 (SAE J1772) or Type 2 (IEC 62196)—are compatible with the present range of EV vehicles.

**Availability of Charging Stations:** We must determine the chargers' accessibility in retail spaces, offices, public parking lots, and residential locations.

**Payment Systems**: We also must consider how convenient and compatible chargers are by looking at the many payment methods they accept, including credit cards, smartphone apps, RFID cards, and subscription services.

**Policies and Incentives by the Government**: Examine how laws, subsidies, and other policies, such as funding initiatives for the development of additional charging infrastructure, may affect the use and deployment of EV chargers.

**Connectivity and Mobility**: Evaluate roaming agreements and charging network compatibility to facilitate smooth charging experiences for electric vehicle drivers traversing several provinces and regions.

**Charging Station Utilization**: Examine single-phase charger utilization rates to find places where the network of charging stations could be improved or expanded.

**Requirements for the Single-Phase EV Chargers:**

**Enhanced Charging Speed**: To meet the increasing need for quicker charging, use chargers that can provide more power, including Level 2 chargers that can give 7.2 kW or more.

**Extension of Charging Infrastructure**: To increase coverage and accessibility, particularly in rural and isolated locations, identify underserved areas and give priority to the implementation of single-phase chargers.

**Securing Connector Type Standardization**: To improve compatibility and expedite EV charging experiences, charging networks should be encouraged to adopt standardized connector types.

**Improved Payment Options**: To increase EV drivers' convenience, incorporate a variety of payment methods and expedite the payment process. This can include interoperable payment solutions that are accepted by various charging networks.

**Integration with Renewable Energy Sources**: To encourage environmentally friendly charging methods and lessen the impact on the environment, look into ways to integrate single-phase chargers with renewable energy sources, including solar panels.

Implement load control, dynamic pricing, and demand response capabilities, among other smart charging features, to maximize power resource utilization and maintain system stability.

Establish a common platform for data monitoring and analytics from charging stations to learn about usage trends, user behavior, and infrastructure performance. This will allow for data-driven optimization and decision-making.

**Inclusivity and Accessibility**: By following accessibility guidelines and offering suitable facilities at charging stations, charging infrastructure can be made accessible to all users, including those with impairments.

**Future Considerations:**

**Transportation Electrification:** Plan for the extension and modernization of infrastructure necessary for charging electric vehicles to meet the expected rise in demand.

**Integration with Smart Grids**: To assist grid modernization programs, enable demand response, and promote vehicle-to-grid (V2G) interactions, investigate options for connecting EV chargers with smart grid technology.

**Cooperation & Joint Ventures**: Encourage cooperation between stakeholders to create unified plans for increasing EV adoption and infrastructure deployment. These stakeholders include utilities, government agencies, automakers, and charging infrastructure providers.

**User Education and Awareness**: Start educational programs and public awareness campaigns to encourage the use of electric vehicles, dispel myths about the availability of charging infrastructure, and allay anxieties about owning an electric car.

## 2.5 Market Research and Feasibility Study

***Author:*** Vaishnavi Gawali ***Editors:*** Saurabh Nair, Aleen Le

**Market Research**:

1. Market Research Goals:

Understand the requirements proposed by the client and complete the market research to align with the client's needs. Market research may include understanding the product (single-phase charger) position in the market and the competitors manufacturing and supplying the product, studying if the current and potential consumers prefer single-phase chargers over any other type of charger, and analysis of consumer needs.

2. Consumer Market Segmentation:

Conduct a thorough study about the market size of current consumers of EVs and their preference of charger type with reasons to use a particular type of charger. A similar study can be conducted for potential consumers using government and public websites. Research on the consumer market can be segmented as current consumer, potential consumer, type of charger used by current or potential consumer and their preference to charge at home or EV station.

3. Collection of data to analyze trends:

For data collection, public and government websites, surveys, questionnaires, and statistical analysis can be used, and these trends can be analyzed using these data. For finding insights from the collected data, we may use AWS services for data analytic sand visualization tools like Tableau. AWS services would be used to data storage, ETL transactions, building, training, and deploying machine learning models.

4. Conducting Survey (Optional):

A survey can be conducted to get more details about the use of electric vehicles over other vehicles, how consumers prefer to charge EVs (at home or charging stations), and how these consumers prefer single-phase chargers.

5. Market Trends and Growth in Canadian EV Market:

Perform a thorough study of the current market situation of electric vehicles and charging infrastructure. Refer to government websites, international research papers, and public websites to identify potential growth.

6. Feedback from stakeholders:

Share the research report with the stakeholders in a timely manner and use the feedback to determine if the research aligns with the client's needs.

7. Cost and Competitive Analysis:

Determine which competitors are presently producing or supplying single-phase chargers in the Canadian market, perform a SWOT analysis, and study their pricing policies. Research of potential new startups and their strategies can help the client to set up its business. Client's current focus is single-phase charger related to EVs, but a thorough analysis can be performed about other types of chargers and market demand, then can come up with a suggestion if client should proceed with single-phase charger or another charger type.

Conduct a detailed study of information accessible on public websites for competitor analysis and suggest to the client the cost they could keep for a single-phase charger.

**Feasibility Study:**

1. Economic Considerations:
    - Study about the growth of EV market in Canada and are consumers opting for of single-phase chargers.
    - Come up with a pricing plan for the Canadian market by analyzing the prices of the current single-phase chargers and present it to the client.
2. Technical Considerations:

- Study the characteristics of single-phase chargers and how they are beneficial to the consumers in terms of speed of charging, safety and efficiency and the environmental impact it has.
- Understand Canada's current electrical infrastructure and inform client if there are any challenges to the production, sales or installation of single-phase chargers.

3. Legal Considerations:
    - Understand the process of getting permission from the government for bringing a single-phase charger in the market or installing an EV charging station.
    - Study and find if there are any regulations imposed in Canada related to electric vehicle charging stations in Canada and single-phase charger as a product
4. Scheduling Considerations:
    - Design a detailed project timeline that includes project management, competitor analysis, solution development, solution design and impact analysis along with resource allocation.
    - Impact Assessment: Dedicated sprint is assigned for impact assessment where we will share the team's research and consider and work on any changes required. As a team, we will have backup strategies if we must change the direction of the research to meet the goals set by the client. During other sprints, we plan to use the slack time to rework on any part of the research if needed so that the project timeline is not disturbed and delays in the schedule are reduced.

### 2.6 Competition Research

***Author:*** Aleen Le ***Editors:*** Saurabh Nair

To determine the competitive market landscape for single-phase EV chargers in Canada, the following needs to be done:

- Use data from market research
- Analyze data from top Canadian EV charger producers
- Analyze data from global producers/sellers
- Compare pricing model and efficiency of competitor products with proposed solution
- Perform a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis on each major competitor to identify an opportunity to break into the market

### 2.7 Technology and Infrastructure

***Author:*** Suresh Gopalakrishnan ***Editors:*** Jatin Gopisetty

The technological platform and infrastructure are critical components for the project focusing on the Canadian energy market. The proposed system will leverage public cloud computing solutions and advanced data analytics services offered by them to ingest, clean, load, and analyze market data efficiently to identify critical components for the client. Using cloud solutions offers several advantages.

1. **Scalability** – on-demand resource scalability to facilitate large-scale market analysis without huge cap expense.
2. **Cost Effective** – pay-as-you-go model for most of the services and spot instances for computing will have significant cost savings (up to 60%) as our project will have fluctuating workloads.
3. **Data Analytics and Machine Learning Services** – Amazon Web Services (AWS) offers a wide range of data analytics and machine learning services, such as
    - Amazon S3 for data storage
    - Glue for ETL
    - Amazon Athena for data querying
    - Dynamo DB for Unstructured Data
    - Amazon SageMaker for building, training, and deploying machine learning models
    - Native connectivity with Tableau to visualize data
4. **Security and Compliance** – Comprehensive security features
5. **Availability** – Global data centers will allow us to deploy and transfer data around the world with high-performance and secure

The technology stack will include:

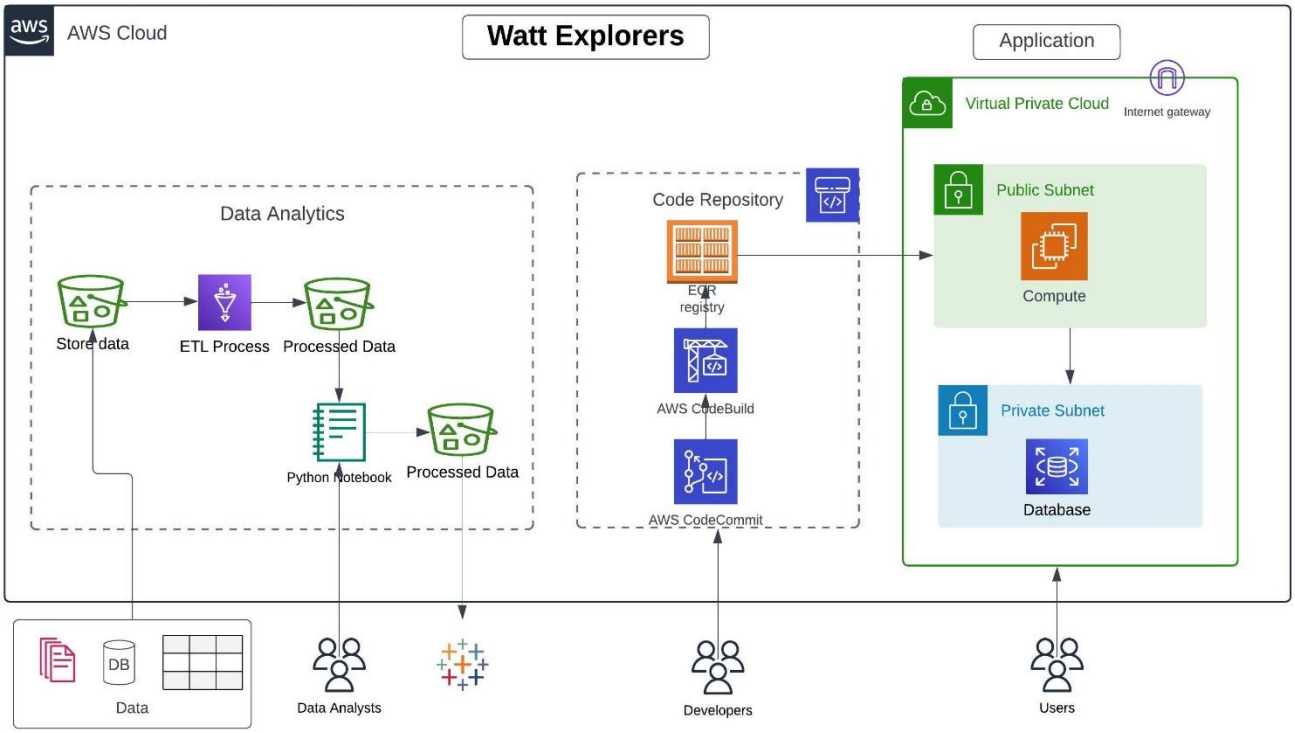
1. **Cloud Services** – Amazon Web Services cloud offering for applications, databases, computing resources, data storage, and analytics services
2. **Data Analysis tools** – Python, SQL, and Tableau for data manipulation, analysis, and visualization
3. **Machine Learning** — Amazon Sagemaker
4. **Container Services** – Amazon Elastic Kubernetes Service (EKS)
5. **Database/Servers** – Amazon Relational Database Services(RDS) & Amazon Elastic Compute Cloud(EC2)

### 2.8 System Design and Architecture

***Author:*** Suresh Gopalakrishnan ***Editors:*** Jatin Gopisetty

1. **Data Collection Module**: Automates ingestion and processing of market data collection, regulations, and trends from Data analysts
2. **Analysis Engine**: Process and manipulate data using Python and machine learning models to predict market trends and identify new opportunities
3. **Solution Development Framework**: Facilitates the design and simulation of EV charging solutions
4. **User Interface (UI)**: A dashboard for stakeholders to interact with the system, view insights, and manage the solution development process

High-level cloud architecture




**NOTE:** Complete architecture will be updated once the team completes the market analysis and client recommendations on SI architecture.

## 2.9 Data Collection

***Author:*** Tarun Latchireddi ***Editors:*** Aleen Le

Data gathering techniques could include the following, depending on the goals and scope of the project:

**Direct Observation:** To gather information on charger types, availability, utilization rates, and any noticeable problems or anomalies, field technicians or researchers might personally visit charging facilities.

**Remote Monitoring**: Gathering data in real-time on charging sessions, energy usage, connectivity status, and operational performance through the use of remote monitoring systems mounted on chargers. This may entail using already-existing communication protocols, like the Open Charge Point Protocol (OCPP), to retrieve data.

**Questionnaires and Surveys**: Interviewing and surveying EV drivers, charging network operators, and other relevant parties to learn more about user preferences, levels of satisfaction, and suggestions for enhancements.

**Data Sharing Agreements**: Working together with utilities, government agencies, charging network operators, and other organizations to ensure compliance with privacy legislation and data sharing agreements while gaining access to aggregated charging data for analysis purposes.

**Accessing Publicly Available Databases**: Find out about charger locations, specs, and usage trends by gaining access to publicly available datasets, such as government databases or charging network directories.

Following collection, the data must be properly processed, stored, and secured:

**Data Storage**: Considering variables like data volume, preservation requirements, and accessibility for analysis, the gathered data should be kept in safe, scalable databases or repositories. For managing big datasets, cloud-based storage systems can provide dependability and flexibility.

**Data processing**: To extract valuable insights and spot patterns or trends, data processing entails cleaning, transforming, and analyzing the gathered data. To guarantee data quality and accuracy, this may entail statistical analytic tools, outlier detection, and data normalization.

**Data Security**: Ensuring the privacy, availability, and integrity of the gathered data is essential. Sensitive data can be protected from breaches and unwanted access by putting authentication procedures, access controls, and encryption measures in place. To protect data privacy and comply with rules, adherence to pertinent privacy laws is necessary. Examples of these laws include the General Data Protection Regulation (GDPR) and the Personal Information Protection and Electronic Documents Act (PIPEDA).

**Anonymization and aggregation**: Depending on privacy concerns, personal information gathered from EV drivers or charging transactions may require anonymization or aggregation in order to preserve individual privacy and enable insightful analysis at the population level.

**Data Governance**: To control the gathering, storing, and usage of EV charger data, precise regulations and processes must be established. This entails creating regulations for data retention, specifying roles and duties, and making sure that data management procedures are transparent and accountable.

## 2.10 Testing and Validation

***Author:*** Yash Shiyani ***Editors:*** Aleen Le

**Objective:**

The testing and validation step ensures the operation, performance, and security of the single-phase EV charging system. This section describes a detailed testing method for each system component to ensure dependability, efficiency, and compatibility with security standards.

**Critical Components of Testing and Validation:**

1. **Functionality Testing**: This phase assesses all aspects of the single-phase EV charging system. This involves evaluating UIs (User Interface), charging mechanisms, and communication between components.
   - Methodology: Functional testing will include unit and integration testing, system testing, and user acceptability testing (UAT).
   - Tools and Resources: Use automated testing tools to increase productivity and accuracy. In addition, manual testing will be performed to mimic user interactions and real-world scenarios.
2. **Performance Testing**: Testing will be done to guarantee the best performance in different scenarios. This involves assessing the charging speed, load management, and system responsiveness.
   - Methodology: Performance testing will include load, stress, and scalability tests. Real-world simulations will determine the system's responsiveness during high usage.
   - Tools and Resources: Use performance testing and monitoring tools to assess the system's behavior under various load conditions.
3. **Security Testing**: Security is a concern. During this phase, possible system weak points are identified and prevented, as well as user data, transactions, and communication are ensured to be secure.
   - Methodology: Security testing will consist of penetration testing, vulnerability scanning, and code reviews. Compatibility with industry security standards and laws will be thoroughly reviewed.
   - Tools and Resources: Use specialized security testing tools, security specialists.
4. **Usability and User Experience Testing**: Assessing the UI's ease of use and overall experience is critical for increasing client acceptance. This includes evaluating accessibility, user feedback techniques, and visual design.
   - Methodology: During usability testing, actual users will interact with the system, provide feedback via surveys, and analyze user behavior.
   - Tools and Resources: Implement user-testing platforms, feedback-gathering tools, and usability-testing labs.

**Test and Validation Documentation**:

1. **Test Plans**: Detailed documentation of scope, objectives, and procedures of each testing phase

2. **Test Cases and Scenarios**: Defined scenarios for performance, functionality, security, and usability testing

3. **Testing Environment Setup**: Documentation for configuring testing environments, including h/w, s/w, and network settings

4. **Testing Results and Reports**: Detailed reports on each testing phase, including detected issues, resolutions, and system performance indicators

5. **Analyze user comments from usability testing** to identify areas for improving the UI and overall experience

Validation and Sign-Off: After testing and validation, a report will summarize the results, address any issues, and ensure the single-phase EV charger system meets predefined functionality, performance, and security standards. Before moving further with the project, the validation report will be reviewed and approved by the client.[1]

## 2.11 Evaluation Metrics

***Author:*** Jatin Gopisetty ***Editors:*** Aleen Le

**Popularity in Charging Stations**: Based on the location and demand we can evaluate that the stations at these places are successful and we have change increase the number of stations at these locations to reduce the long queues.

**Total Number of Stations**: With this, we will be able to identify the progress being made on the new stations that are being built and to what extent can they be expanded in the future.

**Customer Feedback**: The Feedback about the service or product where an increase in satisfaction rate shows how happy and loyal our customers will be.

**Government Regulatory**: Ensuring that proper regulations to avoid penalties.

**Environmental Impact**: One of the Metrics is the reduction in greenhouse emission gas, natural resources that are used for fuel, this will have a great impact on customer growth and significantly a high increase customer.

## 2.12 Risk Analysis

**Author:** Aleen Le **Editors:** Yash Shiyani

There are several possible risks involved when starting a new business. Potential risks and strategies to manage them include:

- **Financial risks**
  - Sustainability
    - Research demand for EV chargers in Canada
    - Research EV vehicle production supply
    - To manage: Analyze data to project market trend. Ensure that supply can meet demand for at least five years
  - Profitability
    - Research cost to manufacture EV charger, if possible
    - To manage: Ensure quality of product, have a unique marketing position, and create and monitor proper budget
- **Market risks**
  - Market size
    - Research size of current EV market in Canada
    - To manage: Consistently assess market conditions for EV chargers and vehicles
  - Competition
    - Research key player sales in Canada
    - To manage: Seek customer feedback to ensure product(s) is competitive. Evaluate market penetration
  - Location
    - Research EV market saturation by province
    - To manage: Identify competitors' market saturation by location
- **Technology risks**
  - Startup time (outdated product before launch)
    - To manage risk: keep an eye on the market, if market appears to be trending down significantly, then would have to liquidate current assets/convert to another product (further research required)
- **Execution risks**
  - Poor management involving startup plan
    - To manage: hire team of legal experts
  - Product failure
    - To manage: Test product before launch[2]

## 2.13 Ethics and Privacy

***Author:*** Sowmya Yella ***Editors:*** Vaishnavi Gawali

Ethics and privacy considerations when analyzing the infrastructure for charging electric vehicles in Canada.

**Concerns about privacy**:

Privacy must be given first priority in the energy industry due to the possible sensitivity of data. Our commitment is to:

1. **Data Anonymization**: All gathered data, including personal data, will be anonymized in order to protect people's privacy. It won't be feasible to identify particular people or companies since personally identifying information (PII) will be removed or combined.

2. **Legal Compliance**: We promise to follow all applicable Canadian privacy laws and rules. This involves making ensuring that our practices for collecting, storing, and analyzing data comply with the law as well as following all applicable federal, state, and local privacy regulations.

3. **Explicit Consent**: Explicit and informed consent must be obtained whenever the analysis calls for conducting surveys or gathering data from people or organizations. The goal of gathering data, the intended use of the data, and the privacy protection measures will all be explained to participants.

**Ethical considerations**:

It is essential to the endeavor that we uphold ethical standards, and we pledge to:

1. **Transparency**: We shall keep our customer, participants, and the general public informed about the purpose, techniques, and possible results of our analysis at all times throughout the project.

2. **Impartiality**: To guarantee that the conclusions are based only on factual information, our analysis will be impartial. Since conflicts of interest could taint the objectivity of our recommendations, we will make an effort to present a fair and impartial analysis.

3. **Responsibly Using the Results**: We will responsibly apply the knowledge we have gathered from our investigation, emphasizing the development of ecologically friendly and sustainable solutions. We are devoted to making a constructive contribution to the change, even if we are aware of the potential social effects of our efforts.

**Security Precautions:**

For the purpose of safeguarding any data collected or assessed throughout the project, we will put the following procedures in place:

1. **Data encryption**: All sensitive data that is sent or kept will be encrypted to thwart unauthorized access.

2. **Safe Storage**: Only individuals with permission will be able to access the data, which will be stored safely. There will be frequent security audits to find and fix any possible vulnerabilities.

3. **Data Retention Policy**: Following the conclusion that data is no longer needed for analysis, we will establish a precise data retention policy outlining how long data will be kept and how securely it will be disposed of.

**Team Confidentiality (NDA):** As members of a team, we are subject to stringent secrecy agreements, or NDAs. Our staff will maintain absolute confidentiality regarding any proprietary or sensitive information that is gained throughout this assignment. We are dedicated to upholding the interests of our clients and building trust as part of our ethical behavior.

In conclusion, we stress the importance of privacy and ethics in our work. By putting in place robust privacy protections, upholding ethical standards, and placing a premium on data security, we want to conduct a responsible and courteous study that satisfies both legal requirements and societal expectations.

# 3. Project and Task Analysis

## 3.1 Task Analyses

***Author:*** Jatin Gopisetty

***Editors:*** Vaishnavi Gawali, Suresh Gopalakrishnan, Jatin Gopisetty, Tarun Latchireddi, Aleen Le, Saurabh Nair, Yash Shiyani, Sowmya Yella

| Task | Duration |
|---|---|
| Project Management | 1 Week |
| Project Planning and Scheduling | 3 Days |
| Define project scope | 2 Days |
| Develop project schedule | 2 Days |
| Assign tasks to team members | 2 Days |
| Risk Management and Communication | 3 Days |
| Identify potential risks | 2 Days |
| Develop risk mitigation strategies | 2 Days |
| Implement communication plan | 2 Days |
| Deliverable Tracking and Reporting | 1 Day |
| Establish tracking system (running) | 1 Day |
| Monitor project progress (running) | 1 Day |
| Prepare and distribute status reports (running) | 1 Day |
| Market and Competitor Analysis | 3 weeks |
| Identify Data Sources and Data Collection (Includes Market, Competitors, Sales, etc) | 16 days |
| Conducting Market Survey(optional) | 2 days |
| Regulatory Research | 3 days |
| Data Collection Report | 2 days |
| Analysis and Solution Development | 4 Week |
| Data Cleaning | 4 Days |
| Analyze user feedback | 1 Day |
| Visualizing the data | 3 Days |
| Analyzing the data (identifying the trends, growth, and sales, market) | 14 Days |
| Perform SWOT analysis | 1 Day |
| Brainstorming solutions | 4 days |

| | |
|---|---|
| Compile and review the report | 2 days |
| Impact Assessment and Communication | 2 weeks |
| Assess solution's effectiveness | 6 days |
| Prepare operational plan | 2 days |
| Presentation Materials and Reports | 1 week |
| Create presentation materials | 5 days |
| Compile final project report | 5 days |

List of deliverables to be provided to the client throughout the project lifecycle.

1. Project Management Deliverables:
   - Project Plan and Schedule
   - Communication Plan
   - Project Progress Reports
   - Status Reports
2. Market and Competitor Analysis Deliverables:
   - Data Collection Report Includes:
     - Market Data Collection Report
     - Market Trend Analysis Report
     - Regulatory Research Report
     - Competitor Information Report
     - SWOT Analysis Report
     - Pricing Strategy Recommendations
     - Competitor Analysis Report
3. Analysis and Solution Development Deliverables:
   - Compiling Data and Review Report Includes:
     - Visualizations
     - Analysis reports
     - Solutions reports
4. Impact Assessment and Communication Deliverables:
   - Final Project Report

### 3.2 Implementation Plan

***Author:*** Saurabh Nair ***Editors:*** Jatin Gopisetty

**Phase 1: Market & Competitor Analysis (2 weeks)**
**Activities:**

1. Conduct comprehensive market research using publicly available data (government reports, industry associations, research studies, news articles)
2. Analyze market size, growth trends, customer demographics, and regulations specific to single-phase EV charging
3. Evaluate key domestic and global players, assessing their offerings, technology, service models, and market strategies

**Resources:**

- Project team with research skills
- Free online resources

**Deliverables:**

- Comprehensive market analysis report
- Competitor landscape analysis report

**Phase 2: Need Identification & Solution Brainstorming (3 weeks)**
**Activities:**

1. Analyze market and competitor data to identify unmet needs and gaps
2. Utilize design thinking methods (e.g., brainstorming, workshops) to generate potential solutions (IS and non-IS)
3. Conduct user research or leverage online communities to gather user feedback and validate needs

**Resources:**

- Project team with diverse skillsets (research, design thinking)
- Online communities (if available)

**Deliverables:**

- Identified market needs report
- Shortlisted candidate solutions with feasibility assessments
- User feedback report (If available)

**Phase 3: Solution Selection & Refinement (2 weeks)**
**Activities:**

1. Evaluate shortlisted solutions based on feasibility, impact on identified needs, value proposition, and alignment with project objectives
2. Select the most promising solution for further development
3. Refine the chosen solution based on user feedback and feasibility analysis

**Resources:**

- Project team with technical and design expertise
- User feedback (If available)

**Deliverables:**

- Selected solution report
- Refined solution concept document

**Phase 4: Impact Assessment & Communication (3 weeks)**
**Activities:**

1. Assess the potential impact of the chosen solution on the market (scalability, cost, environmental impact, user adoption)
2. Develop communication materials (presentations, reports) tailored as per the client or stakeholders' requirements

**Resources:**

- Project team with communication skills
- Presentation materials

**Deliverables:**

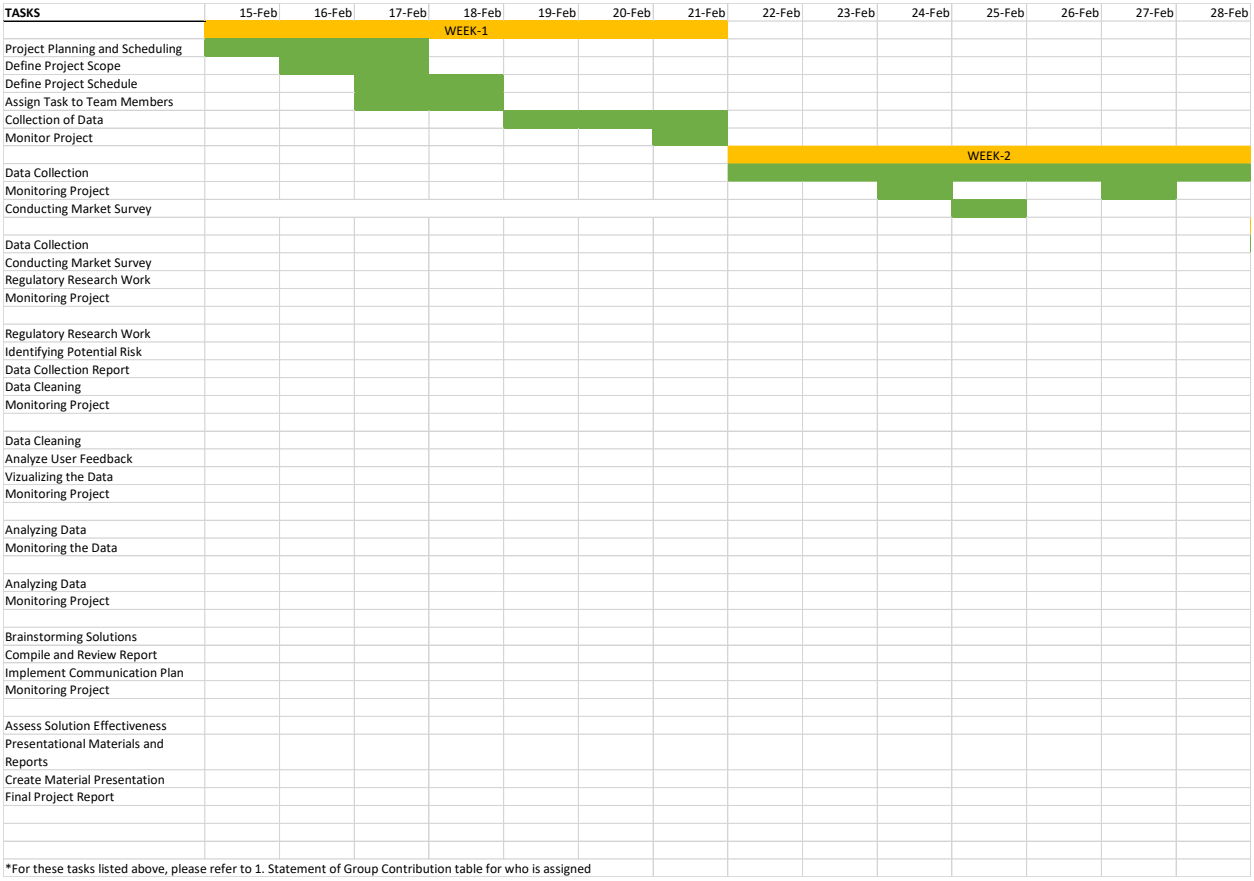
- Solution impact assessment report
- Final client/stakeholder presentation and report

## 3.3 Gantt Chart

***Author:*** Jatin Gopisetty

***Editors:*** Vaishnavi Gawali, Suresh Gopalakrishnan, Jatin Gopisetty, Tarun Latchireddi, Aleen Le, Saurabh Nair, Yash Shiyani, Sowmya Yella

Below is the Gantt chart for the project. Please refer to the email attachment to view the full schedule.



### 3.4 Financial Plan and Budgeting

***Author:*** Suresh Gopalakrishnan

***Editors:*** Vaishnavi Gawali, Suresh Gopalakrishnan, Jatin Gopisetty, Tarun Latchireddi, Aleen Le, Saurabh Nair, Yash Shiyani, Sowmya Yella

| SL | Description | Hours | Amount $ |
|---|---|---|---|
| 1 | Staff Salary at 75$ blended rate for 8 associates in following roles for 8 weeks | 2560 | $ 192,000.00 |
| | Project Manager | | |
| | Scrum Master | | |
| | Data Analyst | | |
| | Market/Research analyst | | |
| | Developer | | |
| | Solution Architect | | |
| 2 | AWS Infrastructure 2 Months | NA | $ 2,826.00 |
| | | | |
| | | Total | $ 194,826.00 |

- Budget for the Information System build and corresponding resource cost will be updated as we complete market analysis and recommendations from the stakeholders to build an information system
- Electric Vehicle market is expected to grow by 100% by 2028 (Source: Statistica) and there is a strong need for charging stations (Source:CBC.ca), at a high level if we capture 10% percent of the Single-phase charger market, we will be able to Get ROI of the project investment in one Year
- NOTE: ROI Subject to change based on final business strategy and system requirements.

### 3.5 Sustainability & Growth Strategy

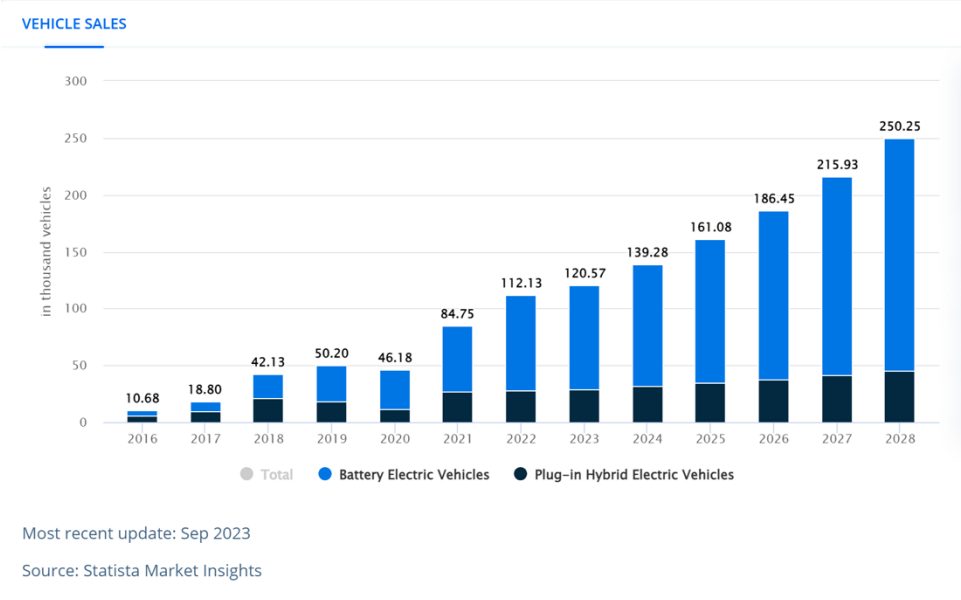
***Author:*** Aleen Le

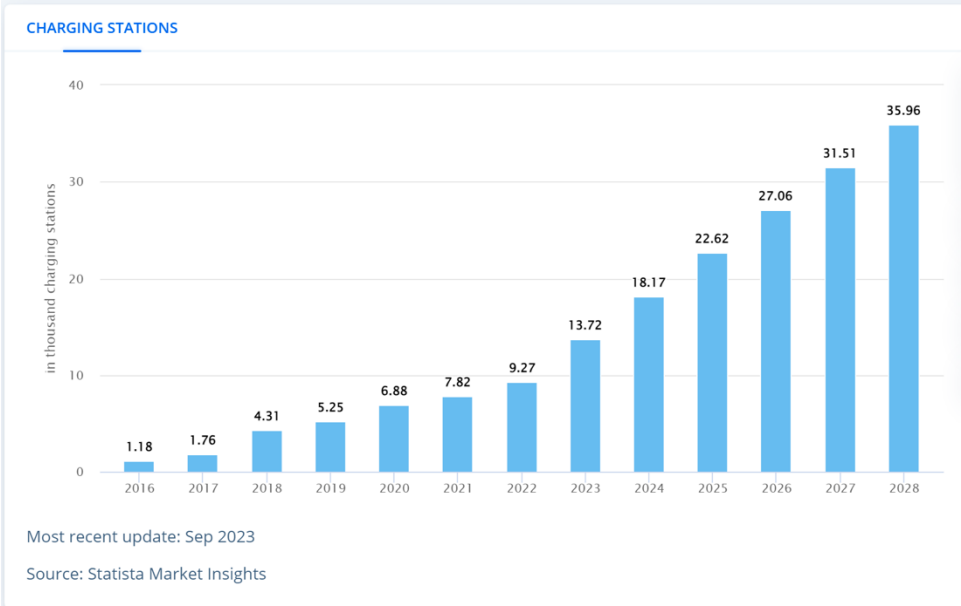
***Editors:*** Vaishnavi Gawali, Suresh Gopalakrishnan, Jatin Gopisetty, Tarun Latchireddi, Aleen Le, Saurabh Nair, Yash Shiyani, Sowmya Yella

Preliminary research shows the following:

- The market size for EVs was 368.2 billion USD in 2022. This is expected to grow from 493.36 billion USD in 2023 to 2071.02 billion USD by 2032.[3]

The graphs below show the projected growths for EVs and charging stations for the next 4 years.






- Charging stations are projected to increase significantly over the next 4 years. There were 13.72 thousand charging station units in 2023, and it is expected to reach 35.96 thousand units by 2028. Based on these patterns, approximately 4.5 thousand charging station units are needed to be installed in Canada annually.[4]

- In terms of scaling for the project, the growth data needs to be analyzed, then used to determine how many more EV charger units per year that need to be produced to keep up with the demand of the EV sales.
- For market expansion, research and analysis needs to be done on the competition and location sales to determine opportunities to secure a position in the industry.
- For future development opportunities, research needs to be done on market trends and analyzed to determine how to market products to a wider consumer base effectively.

While no data was found for personal EV chargers and growth, data was found for charging stations. Based on these market projections, with the assumption that the demand for personal EV chargers will grow proportionally with the number of EV sales, there will be a steady demand for more EV chargers annually. In conclusion, entering this market should be sustainable and profitable for at least the next 4 years.

# 4. References


1. Aziz, Wan, and Wan A. Hanis. "Implementation of User Acceptance Test (UAT) to Validate Functional Requirement of Integrated Computerized Banking Solution (ICBS) Modules." 2017, http://eprints.utm.my/id/eprint/91976/.
2. https://fastercapital.com/content/The-complete-guide-to-startup-risk-assessment.html
3. https://www.marketresearchfuture.com/reports/electric-vehicles-market-1793
4. https://www.statista.com/outlook/mmo/electric-vehicles/canada#unit-sales