

Steed Arena

System Analysis & Design

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Fall 2023

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Table of Contents

Steed Arena.....	1
Table of Contents	2
Executive Summary.....	3
Information Systems Background.....	5
Business Description	6
Description of current system	6
System Users.....	8
System Concerns.....	10
Solar Panels.....	11
Humidity.....	11
Compressors	12
Needs of the business	12
Objectives of the proposed system	14
Benefits of the proposed systems	15
Project Purpose and Scope	16
In Scope.....	16
Out of scope for project.....	17
System Requirements	17
Web-based Platform:	17
Mobile Compatibility:	17
Security Measures:.....	17
User-Friendly Interface:	17

Functional Requirements: Data Flow Diagrams.....	17
Environmental Requirements	18
Similar business research.....	19
Overview of proposed alternatives	19
Section 1: Solar	20
Section 2: Humidity.....	21
Sections 3: Compressors	22
Cost estimate of the proposed system	24
Citations	27

Executive Summary

Before our meeting with Mr. Jed Snyder, the esteemed owner and general manager of the arena, we embarked on an initiative to enhance the existing ticketing system employed for events. Presently, when users visit Steedarena.com to purchase tickets for upcoming games, they are directed to email sales@helenabighorn.com. Alternatively, tickets can be acquired at the venue's physical location or through the front door via a QR code. However, we identified this process as outdated, potentially confusing, and ripe for improvement.

Considering this, we explored several Software as a Service (SaaS) options that could enhance the efficiency of the current system and provide a centralized platform for financial

management. Our objective is to streamline the ticketing process, ensuring a more user-friendly experience for patrons while concurrently optimizing the operational aspects for the arena's management. This proposed enhancement aligns with industry best practices and aims to elevate the overall ticketing infrastructure to meet contemporary standards.

Following our meeting with Mr. Jed Snyder, we gained valuable insights into the specific dynamics of Steed Arena. Contrary to our initial understanding, we discovered that the sale of game tickets for the local hockey team, the Helena Bighorns, is currently facilitated through the team's dedicated website, helenabighorns.com. This service is provided by Vivenu, with Steed Arena receiving a percentage of the online sales. They will have their website fixed to direct the user to helenabighorns.com to purchase tickets easier by Jan 1st, 2024.

Interestingly, it became evident that the primary concern for the arena does not revolve around the ticketing system, as it operates as the sole hockey rink in the locality, enjoying a lack of direct competition. Consequently, the imperative is not to boost ticket sales by attracting more attendees but rather to address more immediate challenges associated with mechanical operations. Specifically, issues with the current cooling system and the potential for optimizing energy costs have emerged as key focal points.

Moreover, we learned that being a for-profit entity, Steed Arena has encountered difficulties in securing grants from Northwestern Energy.

In response to these newly revealed needs, our team is poised to present a range of strategic alternatives and suggestions aimed at mitigating costs for Steed Arena. By addressing specific operational challenges, our proposals are designed to enhance the arena's overall sustainability and financial resilience.



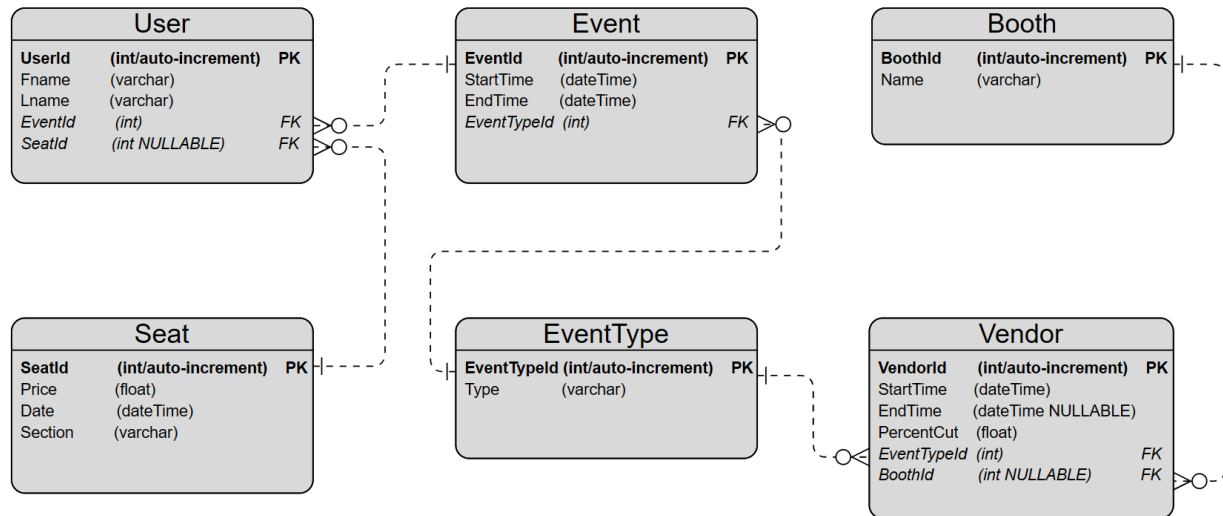
Information Systems Background

The hockey team and rink, under new ownership since April 2021, have undergone significant changes. The rink's revenue streams include concessions, beer sales, and flat-rate rentals, while the website is undergoing redevelopment.

Despite challenges, the owner is investing personal capital to improve the rink's energy efficiency. Efforts include exploring solar power, though facing hurdles with grants and utility cooperation. Questions for future meetings delve into the rink's current energy consumption and potential efficiency measures. The owner is also considering options like C Pace loans for funding, although challenges with local authorities persist.

Despite facing challenges in obtaining funding, the owner remains committed to optimizing the rink's operations and energy efficiency for long-term sustainability.

Figure 1



Business Description

The current ticketing system involves manual processes, email-based transactions, and Excel spreadsheet management. Post-meeting with Jed, it was clarified that the hockey team handles ticket sales through their website, eliminating the need for a new ticketing system. The primary focus shifted to addressing high energy costs and optimizing arena operations.

Description of current system

Pre meeting with Jed

The current system of Steed Arena involves a manual ticketing process that relies on customers purchasing.

Email-Based Ticket Purchases

In the current system, customers express their interest in event attendance by sending email inquiries to a designated address. A dedicated staff member stationed at a desk is responsible for receiving and processing these email requests.

Manual Tracking Through Emails

Upon receiving customer emails, a staff member manually processes each request, which involves confirming availability, determining ticket pricing, and providing payment instructions. The entire transactional history is recorded and tracked through a series of email exchanges.

Excel Spreadsheet Management

The ticket sales information is then transcribed into Excel spreadsheets, serving as a makeshift database for recording and organizing customer details, event information, and financial transactions. However, this method poses challenges such as potential data entry errors, limited accessibility, and the absence of real-time reporting.

Vending Lease Renewal via Email

Similarly, vendors seeking to renew their lease for vending locations communicate through email, with the renewal process relying on manual correspondence.

Post meeting with Jed

In Steed Arena's current landscape, we're grappling with aging compressors, over 30 years old, consuming a significant amount of power. Monthly bills fluctuate between \$8,000 and \$13,000, and maintenance feels like a perpetual challenge—fix one thing, and another issue arises. The

internal atmosphere battles difficulties, especially in the summer, where rain-induced challenges demand extra time for correction.

While the idea of embracing solar power for sustainability is on the horizon, the journey involves complexities, from research to securing grants. Notably, the ticketing system, managed through Vivenu, functions seamlessly. However, our focus today is on optimizing our energy-intensive machinery for long-term efficiency.

System Users

Pre meeting with Jed

Customers:

Event attendees: Customers purchasing tickets for specific events, including hockey games, curling events, free skate sessions.

Season ticket holders: Individuals who hold season tickets and attend multiple events throughout the season.

Arena Staff:

Ticket Booth Operators: Staff members responsible for processing on-site ticket sales, managing credit card payments, and scanning mobile tickets.

Vendors: Individuals managing concessions or other vending services within the arena.

Season Ticket Holder Management: Staff handling season ticket purchasing and renewals.

Arena Manager: Overseeing day-to-day operations, scheduling events, and managing overall arena activities.

Accounting Department:

Accountant: Responsible for gathering and managing ticket sales information for financial reporting and bookkeeping.

System Administrators:

IT personnel: Overseeing the technical aspects of the ticketing system , including database management, security, and system maintenance.

Vendors:

Vendors' Representatives: Individuals from external vendors who need to interact with the system for lease renewal and coordination of vending activities.

Post meeting with Jed

Jed Snyder, Owner and General Manager: "I am eager to minimize the overall operating costs of my business, particularly as costs are a significant challenge in running an ice rink. Any reduction in expenses would open avenues for enhancing the customer experience, such as upgrading our bar facilities or investing in a superior sound system to further delight our patrons."

Mike, Maintenance and HVAC Master: "While I'm committed to the upkeep, it's evident that addressing one issue often leads to another. The implementation of improved systems would

not only streamline operations but also provide peace of mind, ensuring a more stable and reliable environment for our day-to-day activities."

[The Helena Bighorns, hockey team](#): expressed their appreciation for the facility while acknowledging a limited understanding of the operational costs and environmental aspects of running an ice rink. They emphasized the significance of community support. "With improved conditions, we believe our performance could be enhanced, and we would avoid potential injury risks associated with unforeseen issues related to the ice. The community's support through a better facility means a lot to us."



System Concerns

Pre Jed:

Email-based transactions can result in delays and require significant manual effort:

- Impacts the overall efficiency of the ticketing process.

- Manual effort is needed to manage a process each email inquiry, potentially resulting in delays in response to customers.

The lack of a centralized database makes managing and tracking ticket sales inconvenient:

- Creates a challenge to manage customer details, event information, and financial transactions.
- Manually tracking email exchanges can result in data inconsistency and problems retrieving information in real time.

Manual processing causes delays in information reporting:

- Lack of automated system impedes the ability to provide timely and accurate insights into ticket sales, attendance, and revenue.

Vendor lease renewal is hindered by time-consuming email exchanges:

- Email exchanges are prone to errors and time-consuming, potentially affecting vendor relationships.

Solar Panels

- Investment Costs: Evaluate the initial investment required for solar panels and the timeframe to break even on the investment.
- Efficiency Selection: Research and choose solar panels with a high efficiency percentage to maximize energy production.
- Installation Process: Assess the complexities and challenges associated with the installation process, including finding qualified professionals for the job.
- Roof Coverage Percentage: Determine the optimal percentage of the roof to cover with solar panels for the best balance of energy production and aesthetic considerations.
- Grant Acquisition: Explore options for obtaining grants to help offset the initial investment costs of solar panels.

Humidity

- Infrastructure Compatibility: Evaluate how well the proposed humidity control system aligns with the existing infrastructure to ensure seamless integration.

- **Reliability:** Assess the reliability of the new humidity control system to minimize downtime and ensure consistent performance.
- **Implementation Costs:** Estimate the costs associated with implementing the new humidity control system, considering both upfront and ongoing expenses.
- **Vendor Support and Maintenance:** Verify the availability and responsiveness of vendor support for troubleshooting, repairs, and ongoing maintenance.

Compressors

- **Sizing and Compatibility:** Determine the appropriate sizing and compatibility of the new compressor system with the existing infrastructure.
- **Cost and Maintenance:** Evaluate the total cost of the new compressor system, including maintenance expenses for long-term budget considerations.
- **VFD Learning Curve:** Consider the learning curve associated with systems incorporating Variable Frequency Drives (VFDs) and ensure that staff can effectively operate the new technology.
- **Regulatory Compliance:** Ensure that the new compressor system functions in compliance with relevant regulations and safety standards.

Needs of the business

Considering our comprehensive examination of Steed Arena's operations and discussions with Mr. Jed Snyder, it is evident that the business has specific needs that necessitate attention. The identified needs fall into three primary categories: energy efficiency and cost reduction, environmental control, and financial support.

Energy Efficiency and Cost Reduction:

Cooling System Optimization: Steed Arena currently faces challenges with its cooling system, leading to inefficiencies and increased energy consumption. Addressing this issue is crucial, as it

not only impacts the comfort of patrons but also has the potential to reduce operational costs associated with excessive energy usage.

Compressor Energy Consumption: The compressors supporting the ice rink operations significantly contribute to overall energy consumption. Investigating and implementing solutions to optimize their efficiency is essential for curbing energy costs and ensuring the sustainability of the arena's operations.

Solar Panel Installation: While Mr. Snyder has expressed interest in harnessing solar energy, the high upfront costs pose a financial challenge. Exploring feasible options and financial models for solar panel adoption is important to align this aspiration with Steed Arena's budgetary constraints.

Environmental Control:

Humidity Regulation: Steed Arena faces humidity challenges, especially in summer. Beyond occupant comfort, these levels can impact the arena's infrastructure. Irregular humidity risks rain within, jeopardizing the ice quality. Proper control is vital not just for comfort but also to preserve the arena's integrity. Implementing precise humidity measures is crucial for maintaining optimal conditions for ice-related activities.

Financial Support:

Grant Acquisition: Steed Arena, as a for-profit entity, faces obstacles in securing grants from Northwestern Energy and the state of Montana. Overcoming these challenges is a huge goal for the implementation of sustainability initiatives. Developing a strategic approach to navigate these barriers and exploring alternative funding sources or partnerships will be beneficial for the successful execution of proposed enhancements.

In conclusion, addressing these identified needs is pivotal for Steed Arena's operational efficiency, with certain aspects holding more immediate significance while others contribute to the broader objectives of sustainability and financial resilience. The forthcoming proposals will be thoughtfully crafted to offer viable solutions, considering both practical constraints and the aspirations of Steed Arena.

Objectives of the proposed system

1. Enhance Energy Efficiency:

- Implement solutions to optimize the cooling system and reduce overall energy consumption.
- Investigate and improve the efficiency of compressors supporting ice rink operations to minimize energy costs.

2. Explore Sustainable Energy Sources:

- Research and propose viable options for the adoption of solar panels, considering budget constraints and potential financial models.
- Develop a roadmap for the gradual integration of sustainable energy sources to minimize the environmental impact.

3. Precise Humidity Control:

- Implement a robust humidity control system to address challenges during the summer months.
- Ensure precise regulation to prevent adverse effects on the arena's infrastructure and the quality of the ice surface.

4. Financial Support Strategies:

- Develop a comprehensive strategy to overcome obstacles in securing grants from Northwestern Energy and the state of Montana.
- Explore alternative funding sources, partnerships, or incentives to support the implementation of sustainability initiatives.

5. Long-Term Sustainability Planning:

- Craft proposals that not only address immediate operational challenges but contribute to the overall long-term sustainability of Steed Arena.
- Ensure that proposed solutions align with the practical constraints and aspirations of the arena, balancing short-term gains with lasting benefits.

These objectives aim to create a comprehensive and tailored system that addresses Steed Arena's specific needs, fostering a more efficient, sustainable, and financially resilient operation.

Benefits of the proposed systems

Harnessing solar power presents a significant opportunity for Steed Arena to substantially curtail operational costs. The prospect of securing the desired grant would further incentivize the adoption of solar energy, offering a substantial bonus to facilitate the execution of this sustainable initiative.

Moreover, contemplating an upgraded humidity control system emerges as a pivotal enhancement for the business. Jed highlighted the challenges of humidity regulation during the summer months, emphasizing the difficulty in maintaining control. Implementing a well-designed and efficient humidity control system would not only streamline operations by reducing the time and energy required for ice corrections but also contribute to substantial energy savings by avoiding the need for excessive adjustments.

Realizing the advantages of a modernized compressor system extends beyond mere energy efficiency. Upgrading the compressors would result in a reduced energy draw during system initiation, and once operational, the compressors would be sustained at an optimal energy consumption level. Notably, the current compressors, aged over 30 years, lack Variable Frequency Drives (VFDs), a crucial component for enhancing efficiency.

Introducing a new compressor pack or retrofitting the existing system with VFDs stands to significantly benefit the arena. VFDs play a pivotal role by enabling the adjustment of motor speed through varying frequencies. This not only optimizes energy consumption but also enhances operational flexibility. The capacity to modulate motor speed according to demand translates into substantial energy savings, contributing to a more sustainable and cost-effective operational model.

Project Purpose and Scope

Project purpose is to test methods on reducing energy costs and consumption. Finding alternatives and testing the math for cost versus return on investment to enlighten the business on a potential financially sound method to cut down on the power bill. The owner has expressed how he doesn't want to affect the cost to the public and without charging more for tickets the owner needs to find alternatives to reducing costs.

In Scope

- Solar panel analysis
 - Cost breakdown
 - Potential cost
 - Potential Savings
 - Return on Equity
- VFD analysis
 - Quoted cost

Out of scope for project

Looking into the costs of changing the compressor system. This would require an energy audit of the building, which has not been done. This, however, would be a recommended step to take to further improve the efficiency of the building.

Looking into solar providers has not been done. All data is taken from generalized sources, and the actual cost of the project will vary.

Researching loan options will have to be investigated further by Steed Arena as it has not been analyzed here. C Pace loans are mentioned here but not researched.

System Requirements

Ticketing System:

Web-based Platform:

The enhanced ticketing system should be accessible through a web browser to ensure ease of use for patrons.

Mobile Compatibility:

The platform should be mobile-friendly to accommodate users who prefer to purchase tickets using their smartphones.

Security Measures:

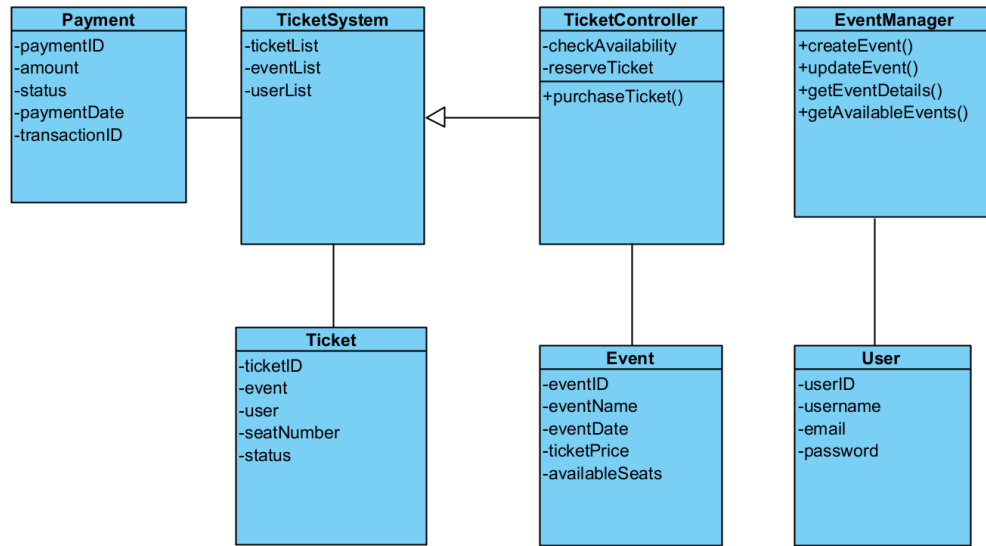
Implement robust security measures to protect sensitive customer information and financial transactions, ensuring a secure online ticket purchasing experience.

User-Friendly Interface:

Ensure an intuitive interface for ease of use, facilitating efficient financial tracking and reporting.

Functional Requirements: Data Flow Diagrams

Pre meeting with Jed



Environmental Requirements

Energy consumption: Setting goals for reducing overall energy consumption with encouraging the use of renewable energy sources, such as solar panels, to contribute to a more sustainable energy profile for the arena.

Sustainable practices: Promote the efficient use of resources, including water and materials, to minimize waste and reduce the environmental footprint.

Safety standards: Comply with safety standards to protect both the environment and the health and well-being of occupants.

Community Engagement: Engage with the local community to understand and address any environmental concerns or expectations.

Environmental Monitoring: Establish systems for monitoring environmental performance, including energy usage, emissions, and waste generation.

Lifecycle Assessment: Conduct lifecycle assessments of products and systems to understand their environmental impact from production to disposal.

Continuous improvement: Implement continuous improvement strategies based on the findings of lifecycle assessments to enhance overall sustainability.

Similar business research

Overview of proposed alternatives

Pre Jed:

1. [Brushfire — Ticketing, Registration, Virtual Events, & Event Apps](#) SaaS
 - a. Price is determined through consultation.
 - b. Brushfire is a comprehensive event management platform designed for seamless ticketing, registration, virtual events, and event apps
 - c. Brushfire offers a user-friendly, all-in-one event management solution with flexible pricing, robust virtual event capabilities, and dedicated customer support. It caters to events of various sizes, providing tools for ticketing, registration, and enhancing overall attendee experience.
 - d. Platform that allows users to design and sell tickets. Also provides a registration process that allows form creation for customer info. Seems easy to use.
2. [OSEM](#) Self-hosted
 - a. Open Source Event Manager (OSEM) is an event management app tailored for free software conferences
 - b. Pricing is free
 - c. OSEM is an open-source event management solution designed specifically for free software conferences. Its features cover paper submission, marketing,

analytics, and comprehensive event administration. The platform is used by notable events like LinuxFest Northwest, emphasizing its reliability and effectiveness in managing free software conferences.

- d. You have complete control over your sales and flow and are community driven. This does come with some heavy considerations with technical skills and maintenance.

3. [Eventbrite](#) SaaS

- a. Eventbrite's user-friendly interface, robust features, and wide-reaching platform make it a popular choice for event organizers looking to streamline the ticketing process and maximize attendance.
- b. Price Flex \$9.99 per event, For up to 100 tickets \$24.99 per event for up to 250 tickets \$49.99 per event for unlimited tickets – Pro \$29 per month, For up to 100 tickets \$79 per month for up to 250 tickets \$159 per month for unlimited tickets – Premium contact sales.
- c. Eventbrite offers flexible ticketing options. Organizers can create different types of tickets (e.g., general admission, VIP, early bird) with varying prices and quantities.
- d. You can also set up promotional codes and discounts to incentivize ticket purchases.
- e.

Right off the home page you get local events and buy tickets for them, ease of use for the business, they offer mobile app for sales, attendee communications.

Section 1: Solar

We looked at turning Steed Arena to full solar power. This would potentially have large cost savings as well as the publicity of going to fully “green” energy. These savings would come from the NWE energy buy back.

However, it's important to note that the money you get from the buyback only applies as credit against your NWE bills for that same year. At the end of 12 months, it resets to \$0 credit.

When running the numbers on this option it would take at least 55% of the roof being covered in solar panels to completely mitigate the yearly NWE bill. This would cost an estimated \$1.6M.

However, at an interest rate of 8%, and assuming that the current compressors don't break, the investment is only making around \$4k a year.

Therefore to get a higher ROE you would need to spend less on solar panels. To hit a ROE of 10%, that would be just 25% of the roof covered, and you would still have a NWE bill to pay each month / year.

Section 2: Humidity

Currently there is no humidity control in the arena.

Maintaining optimal humidity levels in an ice arena is crucial for ice quality and energy efficiency. High humidity can lead to a rugged surface and increased energy consumption. Factors like ventilation, door openings, showers, and crowd size contribute to humidity. Excessive humidity poses risks, including heat release into the ice surface, reduced insulation effectiveness, and structural damage.

To address this, modern dehumidification systems with sensors offer automated control, ensuring excellent ice quality and energy savings. Treating resurfacing water, using unheated water, and implementing return brine loops with frost formation at low temperatures are alternative approaches. Madison Gas & Electric suggests a brine loop set to 22°F with a defrost cycle to maintain humidity below 50% and prevent significant increases in cooling loads. These measures collectively enhance ice quality, energy efficiency, and the overall integrity of the facility.

Optimal humidity for an ice arena is between 50-55%.

Automated systems can be installed, which use sensors in and outside the facility, which helps arena operators adjust dehumidifiers at any time.

- [Desert Aire](#)

Their innovative, automatic hot gas “defrost-on-demand” technology ensures proper performance of their systems at the low temperatures required by ice rinks. The cost of their dehumidification systems is not mentioned on their website.

- [Climate by Design International](#)

Uses desiccant dehumidifiers. A properly sized desiccant system is the most cost-effective way to condition an ice arena to eliminate fog and condensation because it is the only reasonable way to get very low humidity air. Depending on fuel pricing and availability, it can also yield significant energy savings for the rink.

- [Munters](#)

The advantages of a Munters dehumidified ice rink include reduced condensation and improved visibility, improved ice quality and reduced costs for keeping ice surface free of ice build-ups, building structures are protected from deterioration caused by moisture, reduced maintenance costs, and improved indoor air quality without mold and bacteria growth.

Sections 3: Compressors

Variable Frequency Drives (VFDs):

VFDs are devices that control the speed of an electric motor, in this case, the compressor motor.

Installing VFDs can provide significant energy savings by allowing the compressor to operate at varying speeds based on the demand for cooling. This can result in more efficient energy consumption, especially during periods of lower demand.

Challenges with Older Compressors:

Older compressors may not be compatible with modern technologies like VFDs, as they might not have been designed with such features.

Retrofitting VFDs onto older compressors can be technically challenging and, in some cases, impractical due to compatibility issues and the cost of modifications.

Need for a New System:

In some cases, upgrading to a new compressor system may be the most effective solution, especially when dealing with aging equipment that lacks energy-efficient features.

Newer compressor systems are designed with the latest technologies, including VFDs, and can offer better performance and energy efficiency.

Cost Considerations:

The cost of a new compressor system can vary widely depending on the size of the ice rink, the specific requirements, and the chosen technology.

While upfront costs can be significant, it's essential to consider the long-term savings in energy costs and potential operational efficiencies that come with a modern, more efficient system.

Energy Efficiency Incentives:

Depending on the region, there may be energy efficiency incentives or grants available for businesses that invest in modern, energy-efficient systems. Exploring such opportunities can help offset the initial costs.

Bitzer:

Bitzer is a globally recognized manufacturer of refrigeration and air conditioning compressors. They offer a range of products suitable for ice rinks, including smaller systems that may be appropriate for smaller buildings.

Danfoss:

Danfoss is a well-established manufacturer of compressors and other HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) components. They offer solutions that cater to various sizes and applications, making them a suitable choice for smaller ice rink facilities.

Mayekawa:

Mayekawa, a Japanese company, is involved in the development of industrial refrigeration and compression systems. They provide solutions suitable for ice rinks, and their products are designed to be energy-efficient.

Cost estimate of the proposed system

While running the numbers for the costs of the proposed system – solar panels – it's first important to

note some assumptions / variables that were used in the calculations. Since the analysis has around 20 variables as inputs, changing any of these may affect the equations in unexpected ways. Take a look at the spreadsheet for further inspection.

Important variables to note:

- Percent efficient
 - This is the percentage efficiency of the solar panels. In our research we found that at the low-end solar panels would be around 15% efficient, then at the high end closer to 30%. While changing the percentage efficiency it's important to note that you'll also have to manually adjust the cost per solar panel to

accurately adjust the cost when looking at the more expensive, but more efficient solar panels.

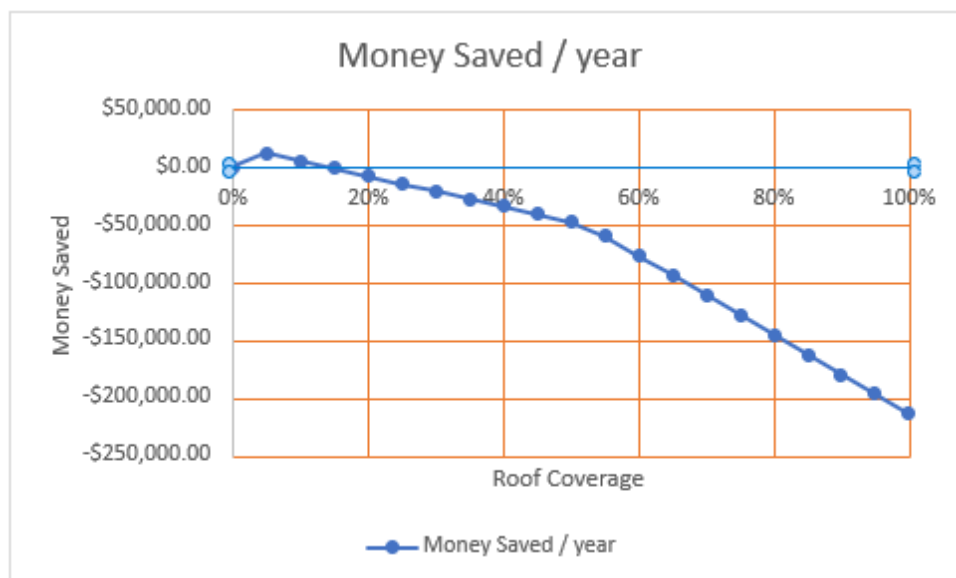
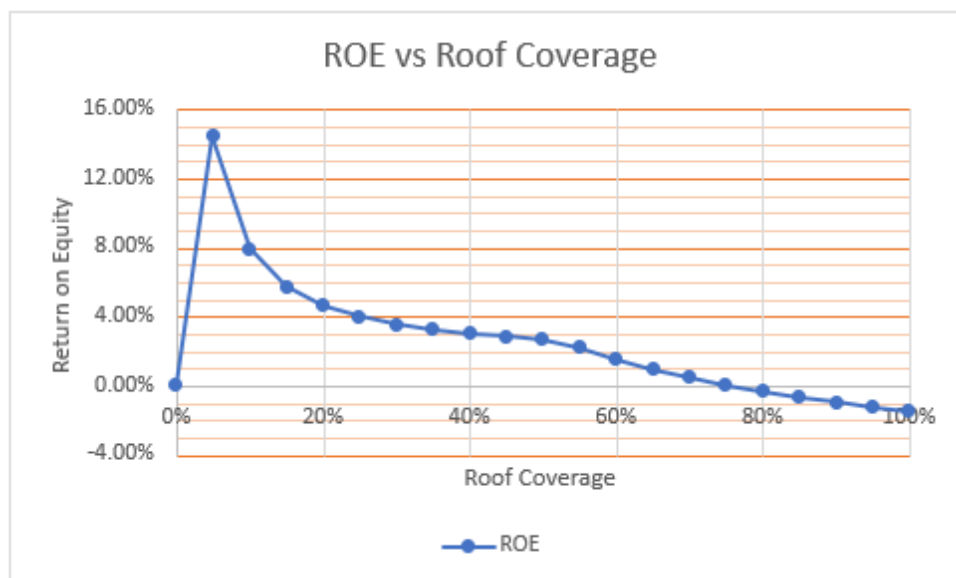
- Hours of Sun
 - Hours of sunlight - on average across the year – that the solar panels will get each day. From 5 to 6 hours a day on average for Montana.
- Solar panel costs
 - Several fields here to note, looking at the spreadsheet to see how these are calculated would be your best option for learning about them. These will directly affect the cost of the project.
- Interest Rate on Loan
 - This spreadsheet assumes that you'll have to get a loan to pay for the solar panels. Interest rate will massively change the ROE of this project.

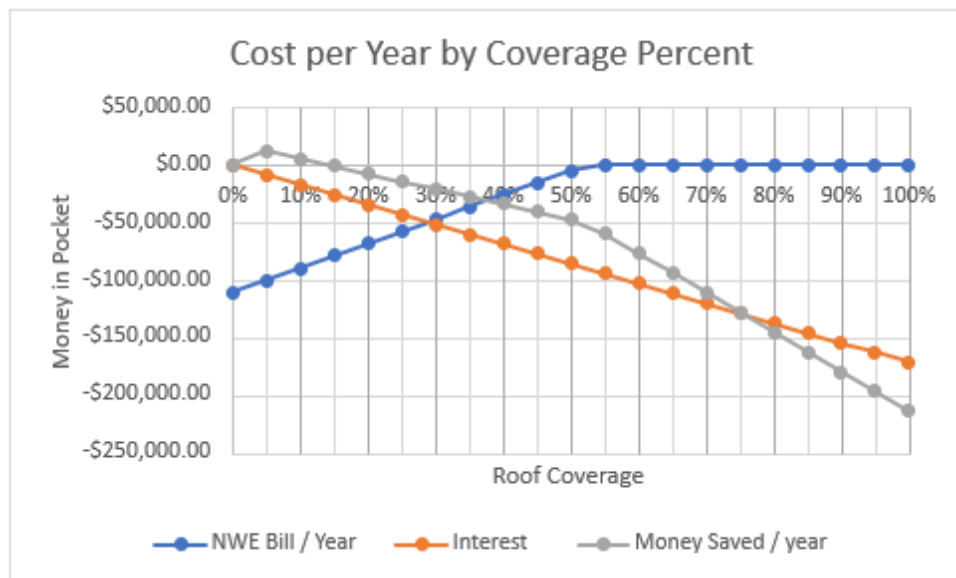
This analysis was done with the following variables:

- 15% Efficiency
- 5.7 Hours of sun
- \$39.77 / sq ft for solar panels
- 6% interest rate

Using these inputs, if Steed Arena were to go for 5% or 10% roof coverage, they would have a ROE of 14.49% and 7.94% respectively. Any higher than 10% roof coverage ROE drops below the interest rate, and you start losing money.

This ROE is also dependent on the compressors not needing to be upgraded, as the savings from not having to buy new ones are calculated into the ROE. It is expected that the compressors would cost \$375k to buy and install new ones, and they would be operational for the next 20 years.





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