

## THE NGIF/EFFECT HOME BUILDERS ENERGY EFFICIENCY PROJECT

SUBMITTED BY | NGIF / CGA

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### Executive Summary

In 2018, Effect Home Builders – an Alberta-based home and commercial space construction company – undertook an ambitious project to convert a 1940’s-era two-storey building into a commercial office space for their team of 11 people. The aim of the project was to make the building self sufficient to meet its energy needs and be independent of the electrical grid. Effect Home Builders followed a unique approach of combining environmentally sustainable subsystems and having them function in unison to achieve greater benefits. Effect Home Builders was able to successfully complete the project through the funding support from the Natural Gas Innovation Fund (NGIF).

NGIF was created by the Canadian Gas Association to support the funding of cleantech innovation in the natural gas industry. NGIF fills a technology-development gap in the sector and invests in innovation led by cleantech start-ups and small and medium-sized enterprises enabling natural gas solutions for current and emerging challenges facing Canada’s energy system. Along with financial support, NGIF also provided management support to Effect Home Builders for the successful execution of the project plan.

The new commercial office space, that has now been reliably functioning and providing workspace for the team of Effect Home Builders for the past 18 months, had to be constructed using a unique systems design approach. The approach in itself is a testament to Effect Home Builders’ innovative way of thinking. Their incorporation of new and emerging clean technologies for the project showcases that energy efficient and environmentally sustainable solutions are here and ready for Canadians.

## Project Summary

### A SYSTEMS DESIGN APPROACH TO PROVIDING SOLUTIONS

The project of upgrading the two-story residential building to a commercial office space took a systems design approach. The focus of the project was to maximize the energy efficiency of operating the commercial space for Effect Home Builders. Subsystems – particularly, space and water heating systems, electricity generation and storage systems, and heat loss prevention systems – were analysed for the project. Those subsystems made up of clean technologies were then integrated in a way that made the building as a whole energy efficient. Special focus was given to the environmental benefits of each of those subsystems and an analysis was performed to evaluate the emissions reduction opportunity offered by the implementation of the integrated system. Based on NGIF’s assessment of this clean technology and the market-rollout plan of Effect Home Builders, the GHG emissions reduction is estimated to be around 4,600 T of CO<sub>2</sub>e by 2030 in Alberta alone. The ability to realize those environmental benefits rely on the capability of each of the subsystems performing efficiently - individually and also as a whole.

### SUBSYSTEMS AND THEIR INFLUENCE ON ENERGY EFFICIENCY

- 1. Space and water heating systems:** micro Combined Heat and Power (mCHP) units powered by natural gas were used for the project to provide space and water heating for the building. The benefits of having a natural gas-driven system were two-fold: lower emissions and strengthened resiliency.

The mCHP, in addition to generating heat, also generates electrical power. This electrical power can be utilised on-site (in this case, the commercial space) or, it can be supplied to the grid. The ability of the mCHP to cogenerate heat and power reduces the electrical dependency of the building on the electrical grid. This lowered demand reduces the consumption of grid electricity that is generated using more carbon-intensive sources.

Natural gas systems are inherently resilient. Natural gas utilities develop comprehensive plans and manage assets including firm supply, transportation and storage of natural gas. This provides their customers and communities with the safe and reliable delivery of natural gas. Having a resilient system dependent on a reliable supply of natural gas allows for a consistent and efficient operation of the commercial space for Effect Home Builders.
- 2. Electricity generation and storage system:** The utilization of mCHP allows for electricity generation on-site. The high cost of delivery of grid electricity is not incurred because of the cogeneration ability of the mCHP. The cost benefits resulting from the implementation of such a system are transferred to the users directly. It has been estimated by the American Gas Association that the utilization of mCHP systems costs 50% less than traditional forms of electricity delivery<sup>1</sup>. These benefits are more apparent during the colder months of the year when the mCHP is utilised significantly more to match the heating demand of the building.

To supplement the electricity demand of the building during the warmer months (when the mCHP is not being extensively utilised), the photovoltaic array was installed on the roof of the building to provide solar electricity. The photovoltaic array and the mCHP work in conjunction to meet the electricity demand of the building throughout the year. At all times, a battery storage system is connected to the mCHP and the photovoltaic array to store any excess electricity that gets generated.

<sup>1</sup> <https://www.energy.gov/sites/prod/files/2015/01/f19/AGA.Resiliency%20Metrics%20workshop.pdf>

3. **Heat loss prevention systems:** In order to maximize the benefits resulting from heat and power cogeneration, it was planned to retrofit the building with new doors and windows that provide effective insulation. Roof treatment and other insulations were evaluated to be necessary for heat retention inside the building. It is estimated that 20% of the cost can be saved on energy bills with adequate space insulation.

first-of-kind commercial demonstrations for scale up to market rollout. NGIF’s investment process includes comprehensive technical peer review to select and approve clean technology providers and provide them with management support to help achieve the projects’ objectives. Figure 1.0 below illustrates the NGIF investment and management process.

## NGIF’S ROLE

NGIF offers a unique proposition for clean technology providers, such as Effect Home Builders, to bring their technology to market for large-scale adoption. NGIF, an industry led, industry funded granting organization, offers cleantech providers and integrators financial and management support to execute a project to de-risk these technologies and get them closer to market. The projects can range from technology development through pilots and field trials to

## WAY FORWARD

From the demonstration and successful completion of the project by Effect Home Builders, it is apparent that the technology for efficient energy utilization is available for all Canadians. The accessibility of natural gas even in the remote parts of Canada make technologies such as the one demonstrated by Effect Home Builders promising for most Canadians. The systems design approach of Effect Home Builders is useful in accommodating a variety of regions in Canada. For example, the size and the capacity of each of the subsystems can be determined whether the solution is being developed for utilization in the busier Greater Toronto Area or a modestly accommodated part of Northern Saskatchewan. The approach for systems’ implementation allows for adaptability across varying regions.

Effect Home Builders is one of the many examples of how Canadian entrepreneurs are helping meet Canada’s environmental goals. The need for innovation has been far greater than before and NGIF is committed to support Canadian entrepreneurs and innovators and bring clean technologies to market to drive continued environmental and economic performance.

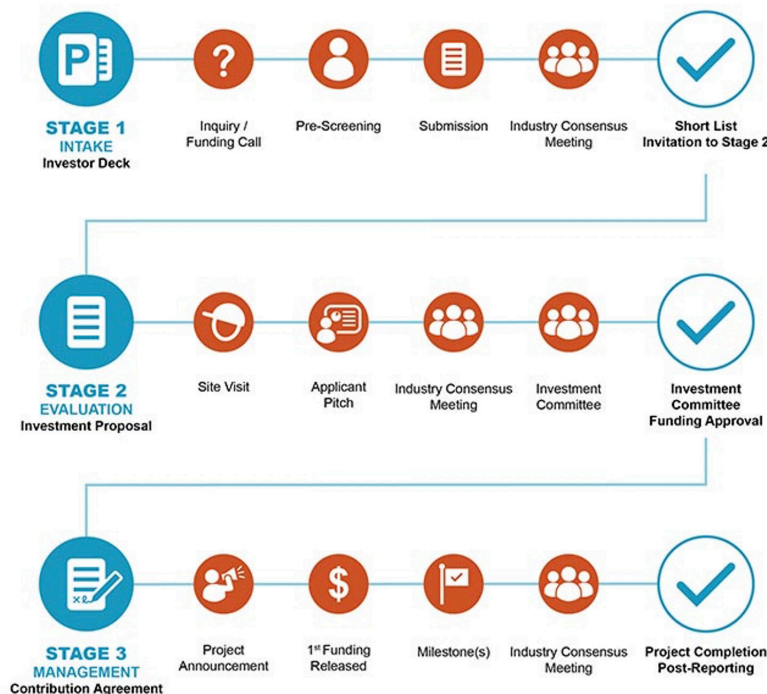


Figure 1.0