

## CLIMATE CHANGE INNOVATION AND TECHNOLOGY FRAMEWORK

### Awardee Summary

<b>CCITF PROGRAM</b>	Clean Technology Development
<b>PROJECT TITLE</b>	Development of Next Generation Nanotech coatings for solar Low-E materials
<b>ORGANIZATION</b>	University of Alberta
<b>SECTOR</b>	Green Buildings, Energy Efficiency
<b>PROJECT LEAD</b>	Sinoj Abraham
<b>AI PROJECT ADVISOR</b>	Mehr Nikoo
<b>GRANT AMOUNT</b>	\$95,000
<b>START DATE</b>	2018-10-01
<b>END DATE</b>	2020-09-30

**PROJECT OBJECTIVE:** To develop a low cost proprietary low emissivity coating for retrofitting existing windows in Alberta which still have a significant life expectancy.

**PROJECT PROFILE:** With increasing concerns over climate change and energy security, it is critical to use energy resources efficiently. Housing remains one of the most energy intensive requirements for populations around the world. Reports show in North America, 65% of residential energy consumption goes towards space heating and cooling, while in the commercial/institutional sector 53% of energy consumption is directed towards climate control. According to the survey published in 2017 by Energy Efficiency Alberta, typical Alberta households use about 7200 kWh of electricity and 120 GJ of natural gas in a year and 64% of this is used for space heating and cooling. NRCAN reports that almost 80% of GHG emissions occur from human activities related to energy consumption, such as energy and electricity production, heating and cooling of buildings etc. In general, Canadians have a high per-capita energy use because of the extreme temperature conditions.

Windows, doors, and skylights have seen considerable improvement over the years with many newer structures including multiple sheets of glass, low-emissivity (low-E) coatings, and insulating gas fills. But, still 14% of homes have single pane windows with no low-E coating, and 60% have double pane windows with no low-E coating. These windows could be replaced with more energy efficient models, but the cost to do so is considerable. An alternative is to retrofit these windows by applying a cost-effective coating that maintains the transparency of the window while at the same time improving the energy efficiency. There are few coatings in the market utilizing dyes and pigments, which also lose the efficiency over time after application and create a worst looks with cracks.

In this project we aim to develop a low cost proprietary coating for retrofitting the existing windows in Alberta which still have a significant life expectancy. We propose to improve on our existing patented transparent coating based on TCO nanoparticles (Transparent Conducting Oxides). This low-E coating can be

applied using a simple electrostatic painting process or a simple paint roller onto existing windows. Previously, we have developed and tuned a robust process to produce Indium Tin Oxide and demonstrated its effectiveness towards blocking UV and IR range of the solar spectrum. However due the cost of indium, driven by its scarcity, coupled to the common use of ITO in flat panel displays and thin film solar cells, cost would be a barrier for introducing a competitive product since we believe the retrofit market is generally at a very low price point compared to new construction where cost is embedded in the capital investment of entire houses. Building on the strengths of this first-generation material, we will develop a second-generation product based on more cost-effective and abundant materials; this offers improved performance in the near IR portion of the solar spectrum, has added commercial value by being tunable to individual installation requirements, and is amenable to additional building envelope applications. We aim to also design surface properties to attract buyers who seek a low maintenance cleaning solution.

## **GHG EMISSION REDUCTION SUMMARY:**