# LDC Tomorrow Fund

## PROJECT UPDATES

*OCTOBER 2005*

***ELECTRIC THERMAL STORAGE UNITS PROJECT***

***RESIDENTIAL POWER FACTOR CORRECTION PROJECT***

***FINANCIAL GRANTS FOR INDUSTRY INNOVATION***

MANAGED BY
THE MEARIE GROUP

# LDC TOMORROW FUND

The purpose of the LDC Tomorrow Fund is to fund research projects and finance energy innovation and opportunities for Local Electricity Distribution Companies (LDCs) in Ontario. The Fund is designed to support initiatives that enhance the competitiveness and success of LDCs in Ontario. Funding is in the form of non-repayable grants.

Application for funding is open to LDCs, government agencies, academic institutions and others who work in the electricity industry. The MEARIE Group is appointed by the LDC Tomorrow Fund Trustees to act as Fund Manager. Decisions for approval for funding are made by the trustees.

Projects that are currently in progress:

**A. Electric Thermal Storage Units Project**
**B. Residential Power Factor Correction Project**
**C. Broadband - Over - Powerline for Smart Metering Project**

## LDC TOMORROW FUND NEWSLETTER

This newsletter provides updates on current projects supported by the LDC Tomorrow Fund. It is intended that through these updates, the knowledge and experience gained from the projects are shared with the LDC community and other interested parties.

If you need further information on the projects, please visit www.mearie.ca and click on Products/Services and the LDC Tomorrow Fund icon. Alternatively, you can contact John Wong of The MEARIE Group at 905-265-5358 or by email at jwong@mearie.ca.

# HOW TO SUBMIT A PROPOSAL

As the manager of the LDC Tomorrow Fund, the MEARIE Group is pleased to invite applications for funding of projects that will benefit LDCs in Ontario. The process for requesting funding is relatively straight forward provided the criteria as listed below are met.

## THE CRITERIA TO EVALUATE PROPOSED PROJECTS TO BE CONSIDERED FOR FUNDING INCLUDES:

1. Applications must be related to the development of commercial opportunities within the electricity market in Ontario.
2. Projects are expected to be beneficial to the majority of LDCs in Ontario over the short and mid-terms in the new competitive market.
3. Projects must represent advancement of technology, procedures, knowledge, and experience.
4. Recipients of funding must be prepared to share results and make presentations on the results of the project.

## WHAT TO INCLUDE:

A Project Plan including the following information must be submitted in order for a project to be considered for funding:

- ▲ Applicant name
- ▲ Location(s) of applicant
- ▲ Funding request
- ▲ Disbursement timing
- ▲ Project description
- ▲ Identification of innovative potential
- ▲ Financial and other contributions by the applicant
- ▲ Deliverables
- ▲ Parties involved
- ▲ Project benefits to LDCs
- ▲ Transferability of results
- ▲ Budget for the project
- ▲ Other sources of funds
- ▲ Identification of commercial opportunities

## THE REVIEW PROCESS

The following outlines the complete review process for successful applications. At any stage, the proposal may be returned to the applicant for clarification or more information.

### STEP 1

- ✓ Applicant submits proposal to the Fund Manager
- ✓ Initial assessment conducted by the Fund Manager

### STEP 2

- ✓ Fund Manager submits proposal to the Trustees
- ✓ Trustees make a decision on the proposal

### STEP 3

- ✓ The Fund Manager informs applicant of the decision
- ✓ Agreement developed between Trustees & applicant
- ✓ Funds will be authorized for release

**For more information on the LDC Tomorrow Fund, please contact John Wong, Director, Financial and Business Solutions at (905) 265-5358 or at jwong@mearie.ca**

# ELECTRIC THERMAL STORAGE UNIT PROJECT

Since April 2004, most Ontario consumers have paid a two-tiered price for the electricity they use. This current price structure is set to change once again sometime between 2006 and 2010 when consumers are required to adopt the Smart Meter.

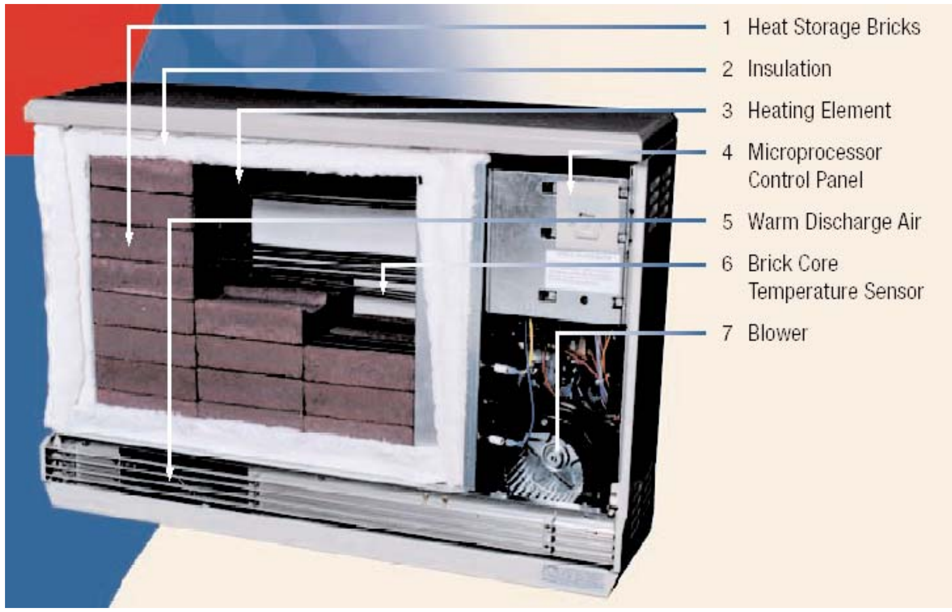
Under the new price plan, the price that consumers will pay for electricity will vary based on the period during the day when electricity is used. (See pricing table on page 5).

Enter Peterborough Distribution Inc. with a not-so-new electrical heating technology that can help reduce the sticker shock of "on-peak" use.

Electric Thermal Storage (ETS) heating was developed in Europe in the 1940s, and crossed over to the United States in the 1980s. This type of space-heating system is capable of providing all of a home's heating requirements by storing heat produced during the night when hydro rates are low. Most of the ETS systems now available can provide 24 hours of on-peak heat from as little as eight hours of off-peak charge.

Although a few LDCs have tested electric storage heaters before (ten years ago), those studies were based on the previous industry environment and the findings were not released to the LDC community. With the arrival of the Smart Meter and it's "time of day" billing and metering, the electric storage heater will certainly play an increasingly important role.

Peterborough Distribution Inc. submitted a proposal to the LDC Tomorrow Fund and was provided a grant to re-examine the economic feasibility of electric storage heaters as a heating option for residential customers in the new industry environment. If found to be viable, a substantial business opportunity would be created for the installation of heaters and for LDCs to retain and even expand their loads.




**Electric Thermal Storage Units can be used to replace standard electric base-board heaters. Even after the heat is turned off, the ceramic bricks will emit a comfortable heat for hours. With an internal temperature exceeding 760° celsius, the external covering remains at a safe 82° degrees celsius.**

Robert Lake, President of Peterborough Distribution Inc. said that "if we can shift the load requirements from on-peak times to off-peak times, we will reduce the strain that impacts the grid and rely less on energy imports". He goes on to say that "LDCs, consumers and municipalities could save tremendous amounts over both the short and long term because ETS units have a greater ability to shift the consumption pattern and therefore flatten the load".

Peterborough focussed their attention on electrically heated social housing, since in most municipalities, it is the municipality that is required to pay the heating portion of the energy bill. Lake noted that in many cases concerning social housing, the residents did not exercise conservation of energy. "I saw windows open on some units [during winter]... and residents made the comment that they had the right to keep the temperature at 30° celsius if they wanted".

The project started in November 2004 with the installation of several heating units in 5 apartment units and 2 "time of use" meters in 2 neighbouring units. These last two units were to act as the "control" group to assess the amount of electricity that is used off-peak under regular conditions.

Not knowing what would be considered

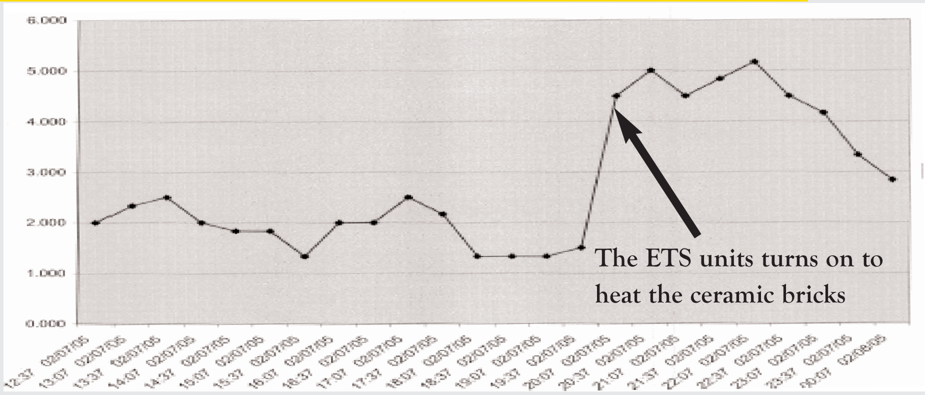
## WHAT IS LOAD MANAGEMENT?

Electric load management is the reduction in the use of electrical energy through the direct control of electric loads such as water heating and electric space heating. This control occurs during times when the demand for power reaches a peak situation.

When we reduce the energy use during peak demand times, we forestall the need to build new, expensive electrical generation facilities and transmission equipment to meet the electrical needs. Load management also provides for more efficient use of the facilities we have, which means future rate increases can be held to a minimum.

# ELECTRIC THERMAL STORAGE UNIT PROJECT

### Increase in Amps When the ETS Units are Turned on




**This graph plots the primary current on a single phase 16kv distribution transformer used to serve the Storage heaters. the transformer supplied not only the 5 units but also 15 other non-participating units with baseboard heating.**

as off-peak hours, Peterborough installed their "time of use" meters that measured peak as any day 8:00am to 8:00pm. Off-peak was considered any day 8:00pm to 8:00am.

In the row of housing that was selected, two storage heaters were placed on the main floor and one storage heater placed in the upper floor in the units at the end of the row where heat loss was the greatest, and in the inside units only one storage heater was installed on each of the main floors and upper floors. The other existing baseboard heaters were either easily removed or disconnected. All of the storage heaters in all of the five units were controlled by the use of one controller which employed power line carrier technology to send the control signal to the individual storage heaters. One controller would be able to control any storage heater connected to the secondary side of a distribution transformer.

### Smart Meter Pricing Chart: available at www.oeb.gov.on.ca

| Day | Time | Time of Use | Price in cents/kWh |
|---|---|---|---|
| Weekends & Holidays | All day | Offpeak | 2.9 |
| Summer Weekdays May 1 to Oct 31 | 7:00am to 11:00am | Mid-peak | 6.4 |
| | 11:00am to 5:00pm | On-peak | 9.3 |
| | 5:00pm to 10:00pm | Mid-peak | 6.4 |
| | 10:00pm to 7:00am | Off-peak | 2.9 |
| Winter Weekdays Nov 1 to Apr 30 | 7:00am to 11:00am | On-peak | 9.3 |
| | 11:00am to 5:00pm | Mid-peak | 6.4 |
| | 5:00pm to 8:00pm | On-peak | 9.3 |
| | 8:00pm to 10:00pm | Mid-peak | 6.4 |
| | 10:00pm to 7:00am | Off-peak | 2.9 |

Under "normal" conditions a time of use meter would provide a contact to tell the controller when peak and off-peak times occurred. As Peterborough did not want to expose the experiment to the risk of wrong time signals, in lieu of the meter contact, they used a controller, managed by a radio signal to their SCADA system, to tell the heating controller when peak and off-peak times were occurring.

During the 2nd week of the experiment, the peak and off-peak signals became "crossed", so they were in fact taking energy at peak times and using the stored heat during off-peak times. Had this been operating as intended, the percentage of off-peak energy use would have exceeded 87.8%.

### Lessons Learned

Lake and his team of electrical engineers noted that despite the fairly easy installation and hook up procedures, one issue did surface. When installing storage heaters, the capacity of the transformer should be examined. Typically the current increased from about 2 amps to 5 amps when the storage heaters began their cycle charge.

One option that Peterborough will employ is the delaying of the charge cycle for some of the heaters served by the distribution transformer. Each of the electric thermal units takes about 4 hours to "charge up" the ceramic bricks so the solution lies in staggering the period in which they are on.

The City of Peterborough's recent study on converting social housing to gas came in at roughly $20,000 per unit while installing an ETS system would cost approximately $4,000. The LDC is scheduled to install Smart Meters on those units and begin to bill using "Time of Use" rates. Compared to the current 5.8 cents per KW, the annual savings will be approximately $400. Robert Lake expects that the savings will be greater when mandatory "Time of Use" rates arrive.

He says that even greater savings could be generated by being able to control the maximum temperature of the thermal unit so that abuse and wasted heat is limited.

The lessons learned by Peterborough Distribution Inc. re-affirm the need to flatten the load and shift the load requirements to off-peak time. With the imminent arrival of the Smart Meter, there is no time like the present to contemplate the widespread use of electric thermal units in residential housing.

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To read Peterborough Distribution Inc.'s full "Draft" report on this project, visit www.mearie.ca and click on Products & Services/LDC Tomorrow Fund.

# RESIDENTIAL POWER FACTOR CORRECTION PROJECT

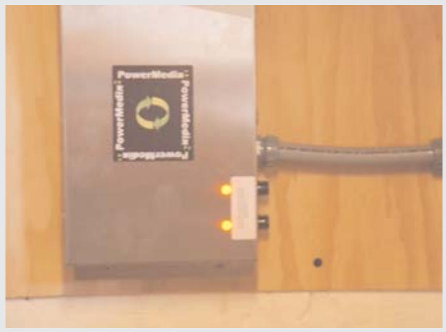
The current strain on Ontario's electrical grid and the constant demand for electricity within the province recently prompted Whitby Hydro to look for innovative ways to reduce the strain on their distribution network.

Whitby Hydro made a request to the LDC Tomorrow Fund for a grant by submitting a proposal to study "Power Factor Correction" issues in residential homes. Although the issue of Power Factor Correction is common in industrial facilities, few, if any, studies have been conducted at the residential level.

Power Factor is the ratio between the amount of energy supplied (kVA) and the actual amount of energy used (kW). The result is known as reactive power (kVAR) and is essentially wasted energy capacity.

The most economical point of power operation is 100 percent, yet most industrial and commercial customers operate between 100 percent and 75 percent. A low power factor means that customers are not utilizing all of the electrical power being supplied.

After receiving a confirmation that their proposal was accepted by the LDC Tomorrow Fund, Whitby Hydro set out to research residential Power Factor issues and determine exactly what amount of power was being wasted in residential homes.



**Residential Capacitors, such as this one, valued at $491 per unit, were installed by Whitby Hydro in several test homes.**

Whitby Hydro's study involved 31 homes within its distribution territory. The homes that volunteered to participate were all located in a new residential neighbourhood, and were all consistent in size, age and type of heating. Each household completed a survey in advance to determine an average number of family members as well as the number of appliances, equipment, pumps and other items that required motor loads.

For the project, a benchmark was established for the loading of area transformers. Three transformers were metered for a two month period prior to the installation of the capacitors. The information gathered included kW, kVAR, volts and amps.

Once the benchmark was established, homes fed from two of the transformers were equipped with capacitors providing 3.34 kVAR into their distribution panel.

Residential capacitors developed by Cos Phi Inc. out of London, Ontario were used in this project. The "Power Medix" units were specifically designed for residential and small commercial applications.

These units included surge suppression for cable, phone and satellite. The cost without this feature was approximately $300.00 per unit and was the value Whitby Hydro used to calculate savings. Installation costs including material and inspection were $150.00 per unit.

The dimensions of the capacitors were relatively small at 12"x8"x4" and were wired directly into the electrical panel of the home. Readings at the transformer continued for an additional two month period after the units were installed in the homes. In addition two homes were equipped with

## POWER FACTOR: WHAT EXACTLY IS IT?

**Electrical inductive loads from items like motors, transformers and magnetic ballasts carry real power (measured in kilowatts, kw) and reactive power (measured in kilovolt-amperes reactive, kvar). Real power does the "productive" work. Reactive power generates the magnetic field required for inductive devices to operate. The total, or apparent power (measured in kilovolt-ampere, kva) is the vector sum of the two.**

**If the circuit is purely resistive, the power factor is 100 percent. As the amount of inductive load increases, the power factor decreases. One of the most common and economical means of improving power factor is by using capacitors.**

**Because power factor correction capacitors generate the reactive (magnetizing) power (kvar) required by inductive loads locally, this magnetizing current doesn't have to be produced by your own distribution system. This greatly improve efficiency, for example:**

**A typical 10 HP three-phase motor, operating at 230 volts with a power factor of 87 percent, draws 23.8 amps. The utility and customer equipment must carry 23.8 amps of line current. A portion of this current is used to magnetize the motor.**

**A 3-kvar capacitor supplied at the motor would provide approximately 7.5 amps of magnetizing current. Therefore, utilizing the power triangle, only 21.1 amps are needed from the source. The resulting power factor is 98 percent.**

Text courtesy of www.psnh.com

metering devices that allowed the measurement of power factor.

Although a $10.00 a month incentive was offered to all customers enrolling in the pilot, not all customers participated. Only two customers fed from TX5545 were interested in participating in the pilot. This transformer was therefore selected as the benchmark site and the homes fed from it were not equipped with Power Medix units. Transformer TX5554 had 9 customers interested in participating in the pilot and 9 homes were fitted with the units. Transformer TX5547 had 8 customers interested in participating in the pilot and 8 homes were fitted with the units.

Power Factor at the transformer was the first value to be analyzed. KW and kVAR was measured at 15 minute intervals for the pilot period. This information was used to determine monthly power factors and other related billing determinants at the transformer.

The peak Power Factor each month can be seen in the table below.

### Peak Power Factor

| Transformer | March PF | April PF | May PF | June PF | July PF |
|---|---|---|---|---|---|
| TX5545* | 96.6 | 96.1 | 95.1 | 92.7 | 93.0 |
| TX5554 | 98.4 | 98.8 | 99.9 | 99.1 | 99.9 |
| TX5547 | 97.9 | 98.5 | 98.3 | 97.1 | 95.7 |

(* TX5545 is the benchmark transformer of which capacitance was not added)

During the study, Whitby Hydro quickly realized that although the study group was selected for its consistency, variances in ON and OFF-peak Power Factor clearly indicated that there was little or no consistency on how or when motor loads were used. Even though an attempt was made to pick homes with similar characteristics there was enough variance in how and when motor loads were used to cause inconsistency between the transformers.

This made it difficult to determine the full effect that the added capacitance had on Power Factor at the transformer.

However, based on the fact that kW and kVAR were being measured it was easy to see the impact the added capacitance had on kVAR at the transformer.

Also, because kVAR is a factor when determining generation requirements, this unit of measurement would allow LDCs to determine the impact on provincial generation.

The improvements in kVAR can be seen in the following table.

### kVAR Improvements

| Transformer | March (kVAR) | April (kVAR) | May (kVAR) | June (kVAR) | July (kVAR) |
|---|---|---|---|---|---|
| TX5545* | 4.2041 | 3.3670 | 3.053 | 7.1944 | 7.5343 |
| TX5554 | 2.3756 | 2.3999 | -0.991 | -4.303 | -4.026 |
| TX5547 | 3.1778 | 2.6754 | 0.9480 | 3.0449 | 2.9364 |

(* TX5545 is the benchmark transformer of which capacitance was not added)

To further verify the impact of the capacitance on power factor two homes were directly measured. These homes were fitted with capacitors that would turn on and off on twenty four hour cycles to show day to day comparison on power factor. Typically, the average power factor when the units were off was 87%. When the units were turned on the power factor was over 99%. (See graph on next page).

To get a real understanding of the positive impact power factor correction has on generation, a cost-benefit analysis was carried out to see if such a project would make sense en masse. Four assumptions were used in this analysis:

### Assumptions

1. A typical home has a 5kW demand
2. The cost of new generation is about $1,000,000 an MVA
3. A typical home's power factor is improved from 87% to 99% when 3.34 kVAR of capacitance is added
4. The cost of the Power Medix units is $450,000/1,000 units installed

With an example of 1000 homes each using the above information, the generation requirement would be 5.75MVA (5kW/.87PF x 1000). By installing capacitance at the residential level the requirement of the generator for the 1000 homes would now only be 5.05MVA (5kW/.99PF X 1000) or 700 kVA less.

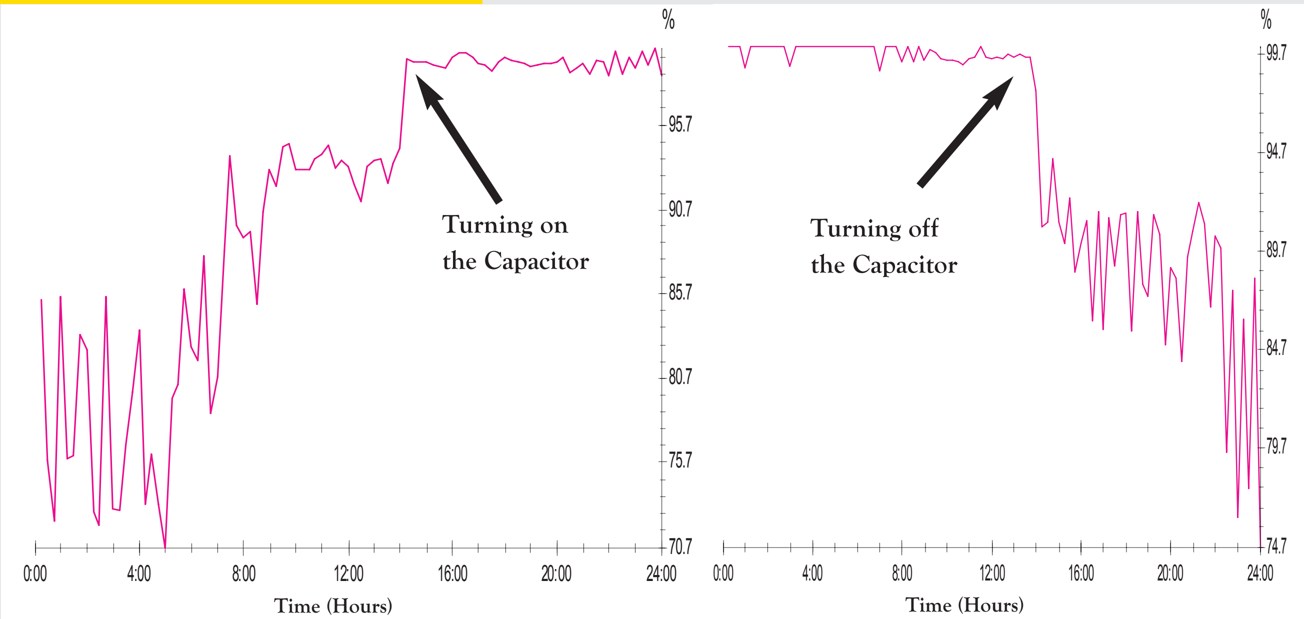
Therefore the cost to generate 700 KVA would be $700,000 (.700MVA X $1,000,000). The cost to supply and install capacitance at the residential level to free up the same amount of capacitance would be $450,000. The environment and health costs associated with the generation of electricity are also removed making the economics even stronger.

**Power Factor Correction makes power utilization more effective. It eliminates unwanted bumps and spikes and protects against voltage "transients."**

The project showed that the installation of capacitors at the residential level could be a viable option in freeing up capacitance

# RESIDENTIAL POWER FACTOR CORRECTION PROJECT

**Impact of the Power Medix Capacitor**




**Residential Capacitors, when turned on, reduced household consumption of power. Although the incentive is small, the real benefit of adding capacitance is that it improves the efficiency of the current provincial generation and transmission system.**

within the province if deployed en masse. The savings can also be achieved without having the customer drastically changing their lifestyle.

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To read Whitby Hydro's full "Draft" report on this project, visit www.mearie.ca and click on Products & Services/LDC Tomorrow Fund.

The MEARIE Group is a progressive and innovative provider of insurance, financial and business solutions to the energy industry in Ontario. We are proud to state that we have 100% of Ontario's LDCs benefiting from our products and services. As a trusted and long-term service provider, The MEARIE Group can offer unique solutions to help manage your business effectively.

We offer an extensive range of services including Property and Casualty Insurance, Group Benefits, HR and Actuarial services, Trades Training, Cash Management and Pooled Financing services, a Consultant Network, and we organize leading industry conferences with over 6000 attendees.

We are proud to be the manager of the LDC Tomorrow Fund. On behalf of the LDC Tomorrow Fund Trustees, we help industry innovators find needed grants to carry out their projects.

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