

Calgary Transit Fleet Trial Application – Candaxa Renewable Diesel Trial

NOTE: The information submitted by the applicant (denoted in blue italics below) has not been verified or endorsed by Calgary Transit, and is the subject of further testing being proposed.

- 1 Date of Submission:
May 26, 2017
- 2 Vendor Name:
*Candaxa Energy Inc. (incorporated under the laws of Alberta),
3815 32 Street NE, Calgary, Alberta*
- 3 Product Details:
 - 3.1 Product Name
Candaxa RDF (renewable diesel fuel)
 - 3.2 Product Group (Material, Equipment, Opportunity)
Material
 - 3.3 Description of Product
Candaxa RDF (renewable diesel fuel) is an ultra clean burning, sustainable, petroleum-free “drop-in” replacement fuel for diesel engines. Renewable diesel often called “green diesel” or “second generation diesel,” refers to petro-diesel-like fuels derived from biological sources that are chemically not esters and thus distinct from biodiesel. Renewable diesel is chemically the same as petro-diesel (complies with ASTM D975 and CGSB 3.517 standards), but it is made of recently living biomass such agricultural waste products (wheat straw, barley straw, corn-stover, etc.) and forestry residues (wood chips, wood shaving, sawdust, etc.), plus fiber derived from autoclaving municipal solid waste. Renewable diesel can also be made from hydrogenation of vegetable oil and waste animal fats. Renewable diesel can be used at the R100 level and will not void vehicle manufacturer warranties. Renewable diesel fuel does not contain oxygen and is completely pipeline fungible and suitable for all existing fuel infrastructure from tanks, pipelines and pumps. Renewable diesel does not require engine modifications and has excellent storability with no “best before date”. Renewable diesel significantly reduces greenhouse gas and tailpipe emissions (PM, NOx, CO, HC).
 - 3.4 List of currently available test data & reports (including testing agency/body)
***Appendix A** – Presentation provided to the SPC on Transportation & Transit, March 15, 2017*

Appendix B – SGS lab report on ASTM D975 certification of Proton Power Inc.'s renewable diesel fuel (Note: Candaxa currently secures its RDF product from Proton Power in Tennessee).

Appendix C – Carbon Intensity/CO₂ Life Cycle report for Proton Power's renewable diesel (>90% reduction in greenhouse gas emissions relative to petroleum diesel fuel)

Appendix D – U.S. Government Fleet feature, "What You Need to Know About Renewable Diesel", March 2016.

Note: fuel analysis is currently being conducted in Edmonton and the results will be sent once the analysis is complete. This analysis should confirm the SGS results in Appendix B.

4 Reason for Trial – list of benefits

4.1 Economic

- Chemically identical to petroleum diesel fuel
- No retrofitting of engines
- No need for infrastructure or fuel system changes
- No storage stability issues
- Exempt from the 8.03 ¢/l Alberta Carbon Levy (2018)



Prolongs life of existing rolling stock, which saves >\$1 billion in fleet replacement costs

4.2 Environmental

- Process is carbon negative, however, on a full life cycle basis (includes trucking of biomass), the process reduces greenhouse gas (GHG) emissions by >90%.
- RDF reduces tail pipe emissions, i.e. there is a reduction in particulate matter (PM), nitrogen oxide (NOx) and carbon monoxide (CO)
- Reduced emissions = cleaner air = improved public health

4.3 Societal

- Reduced GHG emissions equates to fulfilling not only The City of Calgary's Climate Change accord, this program is also in alignment with Alberta's Climate Leadership Plan and the Paris Agreement on Climate Change

4.4 Operational

- Drop in fuel with no changes to the diesel fleet rolling stock or infrastructure
- Fuel switching to Candaxa RDF can occur seamlessly overnight
- Fuel has a higher cetane number which will reduce engine exhaust port plugging
- The lower wear scar means improved lubricity and less wear on the engine

5 Scope of Test/Trial

5.1 Proposed Project plan/schedule

- *June 2017 - ASTM D975/CGSB 3.517 Candaxa RDF certification in Alberta*
- *July 2017 – Calgary Council approval*
- *August – September 2017 – Finalize Agreement*
- *September 2017 to April 2018 – on-road trial of Candaxa RDF in two or more 40 ft. Excelsior New Flyer buses.*
- *Dynamometer testing pre-trial and post trial*
- *Full life cycle analysis per Alberta requirements so Candaxa RDF can be registered as a “qualifying renewable diesel fuel” under Alberta’s Renewable Fuels Standards Policy*

5.2 Duration

- *Fall, Winter and Spring*

5.3 Scope

- *Confirmation that Candaxa RDF is a drop in replacement for petroleum diesel fuel and that fuel switching can occur seamlessly overnight without change in infrastructure and without any harm to the bus engines*
- *Confirmation that Candaxa RDF is a drop in fuel, with no storage stability issues, no retrofitting of engines, no need for infrastructure or fuel system changes will also demonstrate that fuel switching can prolong the life of the existing rolling stock and significantly reduce life cycle GHG emissions.*

5.4 Material provided by Supplier & Calgary Transit & Others

- *Candaxa will ship the RDF to Calgary*
- *Calgary Transit will provide fuel storage, the fuel pump with automated temperature compensation to 15C*
- *Calgary Transit will provide a minimum of two New Flyer 40 ft. Excelsior buses*
- *Calgary Transit will wrap the buses to promote the trial of renewable diesel similar to what was done with the CNG on-road trial*

Calgary Transit Material Contribution	Cost to Calgary Transit
Provision of storage tanks for the RDF fuel and pumps for fueling the buses.	Cost - \$48,000 Tank Installation (design, permitting and project management) - \$12,000 Tank rental – Estimated cost of \$3,000/month. Total cost for 1 year is \$36,000
Wrapping of two buses to improve public awareness of this “green energy” project	Cost - \$15,000 The wrap on the bus will promote renewable diesel as an alternate fuel. It will not be specific to one manufacturer or promote specific proposed benefits that have not been tested by Calgary Transit.
Cost of fuel (56,000L)	Cost – \$11,760 Calgary Transit will pay CANDAXA \$1.03 per L for fuel. Transportation and importation of fuel is the responsibility of CANDAXA.
Cost Summary	Cost – \$74,760

5.5 Manpower provided by Supplier & Calgary Transit & Others

- *Calgary Transit shall provide personnel to fuel the buses*
- *Calgary Transit shall provide the bus drivers*
- *Candaxa will supervise the overall trial along with designated personnel from Calgary Transit*

Calgary Transit Manpower Contribution	Cost to Calgary Transit Staff Time (estimated at \$100/hour)
Provision of a minimum of two 40 ft. diesel transit buses for testing RDX.	Staff Time – \$1,000 It is expected that the buses used in the trial will be dispatched the same as any other vehicle in the fleet. There will be some staff time required to prepare the vehicles for testing (cleaning of DPF). During the trial no additional maintenance costs on top of regular maintenance are expected. Maintenance cost per km will be tracked and monitored and any increase will be investigated.
Provision of storage tanks for the RDF fuel and pumps for fueling the buses.	Staff Time – \$4,000
Personnel to operate, maintain and fuel the test buses	Staff Time – \$15,000 Fueling time – the vehicles using RDX will need to be fueled separately from the rest of the fleet. Estimated at 30 minutes per day for two buses.
Setting up monitoring process for bus reliability and usage including daily kilometers, fuel usage, maintenance, reliability, fuel efficiency	Staff Time – \$2,000 The two test buses will be tracked separately from the rest of the Calgary Transit bus fleet. Any laboratory testing will be the responsibility of CANDAXA.
Monthly reporting, tracking and investigating issues	Staff Time – \$25,000 A monthly performance report will be sent to CANDAXA and involved City of Calgary staff. Estimated at approximately one hour per day.
Cost Summary	Staff Time - \$47,000

5.6 Financial support provided by Supplier & Calgary Transit & Others

- *Calgary Transit will purchase Candaxa's RDF at \$1.03/L*

- 5.7 Support - Technical support model during trial
- *Candaxa and Calgary Transit will approach SAIT to provide dynamometer testing pre-trial and post trial (SAIT to partner)*
 - *Alternatively Candaxa and Calgary Transit will cost share dynamometer testing at a commercial facility in Calgary*
- 6 Risk Management
- 6.1 Insurance program for Calgary Transit assets (dependant on scale of project)
- *Candaxa will secure an insurance policy on the bus engines and fuel systems for the duration of the on-road trial*
- 6.2 Other Risk Management measures
- *Since the fuel is stored above ground and outside, Candaxa may elect to use a heated blanket during extreme low temperature conditions*
- 7 Reporting
- 7.1 Proposed reporting - Interim and final
- *Reporting schedule to be developed*
 - *Candaxa will provide a final written report regarding the on-road trial*
- 7.2 Public Communication
- *Calgary Transit and Candaxa will jointly agree on public communications including press releases and messaging on the inside and outside of the buses (the "wrap")*
 - *Through goodwill both parties will endeavour to promote the benefits of RDF once the benefits have been proven and corroborated*
 - *The buses will be made available for special events and trade shows subject to operational requirements*
 - *The parties may also elect to present papers regarding the on-road trial at technical conferences*
- 8 Completion
- 8.1 Detail description of proposed next steps if any
- *Calgary City Council will receive this report for information including the specific requirements for an on-road trial of Candaxa RDF in a minimum of two New Flyer 40 ft Excelsior buses (target July 19th meeting of SPC on Transportation and Transit)*
 - *If the application is approved to proceed after technical review, Calgary Transit will work with the City's Supply Management group to follow the appropriate next steps in establishing a trial complying with procurement legislation, trade agreement, policies and procedures*