



Schedule 1: Description of Services

For

Fairbanks Economic Development Corporation

For

Gasification and Fischer-Tropsch Plant Pre-Screening Study

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Appendix A: Hatch Estimating Functional Guide document number FG-004, Rev. M-1

1. Introduction

Given current global trends in the availability and cost of energy, Fairbanks Economic Development Corporation's (FEDC's) envisages the use of local coal resources to supply power, fuels and heat.

This Description of Services for a Gasification and Fischer-Tropsch Plant Pre-screening Study reflects agreements made with FEDC at the meeting in Fairbanks on May 7/8, 2008.

The scope-of-work for this assignment includes technology reviews and evaluations, environmental and operation evaluations, capital and operating cost estimates, block flow diagrams and project implementation schedule. The project will be managed by senior engineering personnel as indicated in Section 4 and presented to the FEDC in a final report, including recommendations.

The work would be completed mainly in our Mississauga, Ontario office with input from individuals throughout various Hatch offices as required.

As discussed in the above meeting, both FEDC and Hatch envisage a long-term working relationship. This first phase of work would likely be followed with further engineering services through to project realization and beyond.

2. Scope-of-Work

The scope-of-work described herein conforms to the approach for an FEL1 Study as described in Hatch's project lifecycle methodology (reference Hatch Estimating Functional Guide document number FG-004, Rev. M-1, dated July 2007 attached hereto as Appendix A).

The purpose of the work is: to develop the inputs for an economic assessment of this project; provide the key data required for FEDC to initiate the permitting process; provide the basis for the next phases of engineering namely Pre-Feasibility (FEL2) and Front End Engineering Design (FEL3); and, to enable FEDC to initiate a project financing plan.

2.1 Plant Description

As a guideline, the plant will have the following performance criteria:

- 20,000 bbl/day to 40,000 bbl/day of liquid fuels. Jet fuel is the primary product; diesel, naphtha and LPG are potential co-products which may also be of interest to FEDC.
- 60 to 200 MW of electricity generation for export.
- Export of waste heat for district heating.
- Primary feedstock will be Healy coal
- Biomass feedstock is also available for consideration (at up to 1,000 tons per day).

2.2 Plant Scope

The plant shall comprise all of the equipment and unit operations required to convert coal to liquid fuels and produce power / heat for export.

The following items are excluded from the study:

- Design / development of the coal mine
- Transport of coal to the plant
- Transport of liquid products, co-products to market and by-products to disposal (including design of slimes dam for flyash)
- Any transportation pipelines (outside the plant boundary) and underground facilities related to CO₂ sequestration

- Electricity connections to the grid
- Any facilities related to natural gas treatment or connections to natural gas pipelines which may in future be available to FEDC (outside the plant boundary)
- Any facilities related to district heating (outside the plant boundary)
- Any work related to permit applications

2.3 Methodology

The work will be conducted in approximately the following sequence:

- Prepare a detailed workplan including tasks, estimated man-hours for defined work packages and a detailed schedule with milestone dates for the study.
- Prepare a design basis document.
- Prepare an AspenPlus simulation, from which consumption rates of raw material and production rates of products will be estimated.
- Solicit information from various process licensors, prepare a technology selection discussion document for review with FEDC and, together with FEDC, select which process licensors technology to incorporate into the study.
- Discuss terms of co-operation with selected process licensors.
- Estimate capital and operating costs.
- Construct an economic model using this information.
- Complete and submit draft report for review with FEDC.
- Prepare final report incorporating FEDC feedback.

Progress meetings (via teleconference / Webex) will be conducted every two weeks, with the first meeting scheduled tentatively for Tuesday June 3, 2008 at 09:00 am Alaska time. A final meeting will be scheduled in Fairbanks for formal presentation of the results of this study.

Hatch recognizes the need to obtain committed information in support of this study from licensors and key vendors. While every effort will be made to obtain this information, it may be necessary to make use of our in-house information database and publically available literature to complete the technology selection exercises. An important criteria for selection of technologies shall be an availability of 92% and a 30-year lifecycle.

All cost items will be expressed in USD. Where conversions from other currencies have been made the source and date of the exchange rates shall be stated (London Financial Times). All technical data will be expressed in US Standard English units.

2.4 Deliverables

A final report will be issued to FEDC containing the following deliverables:

- Technology selection for the major portions of the plant with discussion describing the basis for these selections (i.e. Gasification, Gas Purification and Fischer-Tropsch Synthesis).
- Block flow diagrams describing two (2) scenarios:
 - ◆ Coal/biomass-to-liquids plant plus power production based on coal/biomass only as feedstock
 - ◆ Coal/biomass-to-liquids plant plus power production making use of natural gas to maximize the conversion of carbon to useful products
- Commentary on gasification of biomass as a potential additional feedstock for the facility.
- Process description for each of the block flow diagrams above.
- Mass balance for each of the block flow diagrams above (including composition, flow rate, temperature and pressures for selected major process streams).
- Review of optimal strategy for power production (e.g. production of naphtha for use in existing gas turbines versus use of syngas in a new combined cycle power plant).
- List of all utilities (including water) required for plant operation, with capacities / duties
- Consumption rates and specification of all raw materials required for the plant
- Production rates and specification of all products, co-products and by-products
- Production rates and specifications of all aqueous, gaseous and solid effluents
- Special consideration will be given to carbon dioxide (CO₂) effluents with the production rates split into CO₂ which can be easily captured and CO₂ which can be captured with difficulty. An estimate for the costs of disposal will be included as part of the operating cost estimate.
- Capital cost estimate and operating cost estimate to FEL1 guidelines. These will be provided as tables. Capital cost estimate will be broken down by process block. Operating cost estimate will be broken down into its components (e.g. feedstock, utilities, catalyst and chemicals, labour, maintenance, etc.).
- Discussion of the licensing strategy for each process technology required and the likely cost of Fischer-Tropsch catalyst.
- Economic model. An electronic version of the model will be provided to FEDC which includes facilities for FEDC to adjust various input parameters for sensitivity studies.
- Plant plot plan indicating access requirement for road and rail.

- Artist's conceptual drawing of the plant. Special consideration will be given to the requirements for housing of unit operations in buildings, to suit Arctic conditions.
- Project implementation schedule with high level cash flow forecast. The schedule will include completion of relevant studies, FEED package, equipment procurement cycle, detailed engineering, construction cycle, commissioning and ramp-up to full production. Critical path items will be indicated if and where these are known.

2.5 Project Administration and Documentation

The project requires management and administrative duties in order to ensure a high quality of work and efficiency. The project shall be managed by senior engineering personnel with experience in the gasification, power and Fischer-Tropsch sectors.

2.6 Travel

As indicated above, two Hatch engineers will visit Fairbanks on completion of the study to formally present the results. These trips are included in the study budget. Any other travel which may become necessary and is approved by FEDC shall be for FEDC's account and in accordance with the general conditions of contract attached hereto.

3. Information to be Provided by FEDC

The following information shall be provided by FEDC within 2 weeks of the date on which the Services commence (see Section 5.2):

- Coal analysis to be used as the basis for the study, to be provided in accordance with ASTM D388 and include: proximate and ultimate analyses, ash melting temperatures (oxidizing and reducing environments), heating value, ash analysis together with analysis of trace components.
- Specification for diesel, naphtha and LPG currently in use in interior Alaska.
- Climatic /site conditions for the Fairbanks area, including:
 - ◆ Elevation
 - ◆ Maximum, minimum and average temperatures (expressed on a monthly basis)
 - ◆ Maximum, minimum and average barometric pressure (expressed on a monthly basis)
 - ◆ Relative humidity (expressed on an average monthly basis)
 - ◆ Precipitation (rain and snow expressed on an average monthly basis)
 - ◆ Seismic conditions
- Cost of coal, biomass and waste feedstock inputs.
- Cost of feedstock transportation.
- Cost of money.
- Data regarding current electric power generation profile (e.g. MW generated, fuel used) and expected demand growth / shortfall.
- Current district heating usage and expected demand growth / shortfall (regional requirements, temperature / pressure requirements for hot water / steam).
- Potential consumers for CO₂ (e.g. carbonated beverage producers, industrial uses, etc.)

4. Project Team

Key team members from Hatch will be:

- Jim Sarvinis, Director of Energy Technologies. Jim will be the Project Manager for this assignment.
- Dr. William Davey, Gasification / CTL Group Leader. William will lead the technical efforts on this project.

Other team members may include:

- Rory Hynes, Director of Thermal Power Technologies
- Benjamin Deng, Thermal Power Specialist
- Mark Berkley, Energy Technologies, E.I.T.
- George Cooper, Energy Technologies, E.I.T.
- Vessel Nel, Senior Engineer (Fischer-Tropsch Synthesis)

5. Commercial Offer

5.1 Budget

The estimated budget for this project is \$550,000 USD.

These services will be provided on a reimbursable basis according to the actual time spent and the Hatch standard hourly rates provided in the Fee Schedule attached to the Professional Services Agreement. The estimated budget will not be exceeded without the written agreement of the FEDC.

A special condition of this Agreement is that Hatch will control its rate of spending such that the cumulative amount of \$200,000 USD will not be exceeded before July 1, 2008. FEDC shall provide Hatch authorization to continue with project billing within 5 business days following July 1, 2008.

5.2 Schedule

It is expected that this Scope of Work can be completed within four (4) months of start of the Services. Services will commence upon receipt in Hatch's account of the Down-Payment described below.

5.3 Commercial Terms

Commercial terms are defined in the Professional Services Agreement.

5.4 Payment Terms

- A first invoice will be issued to FEDC upon signature of the Professional Services Agreement for a Down-Payment amount of \$50,000 USD.
- Monthly invoices will be submitted thereafter for man-hours expended.
- Invoices will be reconciled against the Down-Payment.
- Invoices will be based on the Fee Schedule attached to the Professional Services Agreement, with Canadian dollar rates converted to USD at the exchange rate prevailing at the date of invoicing.
- Invoices shall be paid within thirty (30) calendar days from the date of issue.
- All change orders shall be processed and approved within ten (10) working days from the date of issue.

5.5 Proprietary Information

Hatch recognizes FEDC's need to submit study information to its potential partners, other community groups and other bidders for future work.

However, information regarded as proprietary to Hatch or process / technology providers shall not be released without the written permission of Hatch or the process / technology provider. Hatch will not unreasonably withhold such permission. To facilitate the identification of information which shall be treated as confidential / proprietary, such information shall be clearly identified with the word "Confidential" stamped across each document. Hatch will act reasonably and thoughtfully when marking documents as Confidential.

5.6 Publicity

Prior to any public release of information by either party, the other party will be notified and be given the opportunity to review the information prior to its disclosure.

6. Key Contacts

Hatch:

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or

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