Turnagain Arm Tidal Energy Corporation (TATEC)

Tidal Power Project
Anchorage, Alaska

April 2012

Prepared By:

Turnagain Arm Tidal Energy Corporation

An Alaskan Independent Power Producer
EXECUTIVE SUMMARY

Turnagain Arm Tidal Energy Corporation. (TATEC) proposes to build a 240 megawatt tidal power plant with a potential for expansion to 1,200 megawatts that will be market-ready by 2018. This innovative project will offer numerous major advantages and advances. It will:

- Generate an inexpensive, non-exhaustible, zero-emission, predictable and scalable source of environmentally-safe electricity in one of the premier spots in the world for the development of tidal energy. The Turnagain Arm of Cook Inlet, located at Anchorage, Alaska, has the second highest tidal energy potential in the world. This site fulfills the two key conditions for success: Having high tides and secondly being near a key market, Anchorage, home to half the Alaskan population.
- Create well over 4,600 jobs, not including the multiple of this number resulting from the powerful macroeconomic effects such as allowing new industries to enter the market.
- Produce 240 megawatts of tidal energy electricity for a total cost of $880.3 million dollars. The current peak electrical power demand in the Anchorage area is 803 megawatts. With operations and maintenance of such a facility at about 1% of the construction cost, the first phase debt can be repaid within six years once operating, and within one year on the Phase II expansion.
- Use proven yet patent pending technology held by TATEC’s CEO The LaRance Tidal Power Plant in France has been in operation since 1966, and produces 240 megawatts electricity, which is in turn, sold to its local residents at 1.2 cents/kilowatt-hour, the most reliable and lowest cost renewable energy available in the world.
- Produce power with an always constant output, a base load source of power, essential in an area with a relatively small ‘backup’ grid.
- Allow TATEC to sell tidal power to local utilities and residents at an estimate of a minimum of $0.08 to $0.10 per kwh, which contrasts dramatically with the $0.16 to $0.24 they currently pay.
- Have the potential to be expanded to a 1,200 megawatt plant with 240 megawatt increments. The capital cost per kilowatt of generated electricity in this stage should be even lower than the initial phase, at about a penny per kilowatt-hour.

JOB CREATION

TATEC estimates that during the construction (2014 to 2018) phase approximately 4,000 direct new jobs would be created by this tidal energy project. Once construction has been completed over 300 direct new jobs would be created during the next few decades (see the table below). The indirect macroeconomic effect of reducing the cost of electricity by over 50% would be even more dramatic. Many more peripheral jobs, perhaps in the five to seven times multiplier range, would be created indirectly by the state having access to relatively inexpensive electricity. For example, at reasonable electricity prices aluminum, zinc, and smelting of other metals would be economical in Alaska since mines are local and many jobs would be produced.
The decrease in jobs in these few quarters results from completion of the various studies.

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A SOLUTION ADDRESSING A COMPELLING NEED

The current need for inexpensive electricity is crucial. The five electric utilities in the Anchorage and surrounding areas can now generate a peak power of 803 megawatts to meet the average baseline need of 413 MW of power. Existing generation equipment is over 30-years-old however, and fueled by natural gas. The sole local gas company, ENSTAR Gas, has announced that they will run out of supply in three to four years as local gas producing wells are exhausted. Gas is currently selling for over $8.20 per 1000 CF (ft³); consequently, utilities in the Anchorage area are charging their customers 16 cents to 24 cents per kilowatt hour of electricity.

TATEC employs an existing bulb-type turbine technology first introduced in 1966 at the La Rance Tidal Power Plant in France to generate electricity. Several companies currently manufacture this design of turbine: The EDF of France, General Electric, Siemens of Germany, and ABB of Switzerland. These are all proven technologies that are in use in tidal projects in Canada, U.K, South Korea, France and China. Currently, the largest operational tidal energy project using bulk turbines is the 240 MW LaRance facility, which produces electricity at 1% of construction cost, $800,000 yearly, and sells the electricity for 1.2 cent per kwh, the cheapest electricity rate in the world. South Korea is currently building a 1,300 MW tidal energy project at Inchon, slated to be in operation by 2016.
CURRENT STATUS

The project has been organized into two phases with eight benchmarks in Phase I. Tasks I through III have already been completed\(^1\). TATEC has already invested a considerable amount of time, energy, and funds and has also cleared many of the most difficult political hurdles in pursuing the vision of completing this project. Details are presented in the main body of this business plan.

ECONOMIC ANALYSIS

The estimated cost of the 240 MW project is $880.3 million. Given that the plant is designed to continuously operate\(^2\) at its rated capacity of 240 MW, the yearly output would be 2,102 GWh. This power can be sold for as low as $0.10. At $0.10/kilowatt hour the total annual income would be $210,205,240.

The funding disbursement schedule based on the detailed pro forma is shown in the table below. We assume that 25% of the total, $220.075 million, is paid to the escrow account upon initial project funding. The requests are then made in three equal payments in the quarter before funds are estimated to be near depletion. The maximum rate of use of funds occurs during the construction phases, the most capital intensive period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Q3 2012</th>
<th>Q3 2015</th>
<th>Q1 2016</th>
<th>Q2 2017</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget Request (million)</td>
<td>220.075</td>
<td>220.075</td>
<td>220.075</td>
<td>220.075</td>
<td>880.3</td>
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The funding outlay in the period from 2012 through 2013 would be used to prepare the project for construction, which would begin in early 2014. Given that the rate of use of funds may be different from the estimated value, the request may be made at slightly different times.

When the locally generated natural gas that drives utility turbines expires within about four years installing a $32 billion pipeline to import gas from the North Slope would not be feasible. The only option would be for oil companies to agree to build a LNG (liquefied natural gas) facility and ship 97% to the Asian market since the Anchorage area would use less than 3% of this supply.

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\(^1\) All applications and correspondence with the U.S. Federal Energy Regulatory Commission can be viewed at [http://www.ferc.gov](http://www.ferc.gov) by accessing the e-library and entering the Project No.: P-13-509-000-Alaska, Dates: June 2009 to present.

\(^2\) In 44 years of operation, La Rance tidal project has performed well, with no major breakdowns. It is operating at 100% capacity.
The company assumes a conservative 100% capacity factor, namely that the plant would operate at full capacity 24/7/365. The ability to be able to generate a base load power is a unique situation for sustainable power plants.
TURNAAGAIN ARM TIDAL
ELECTRICAL GENERATION PROJECT

FERC PROJECT #P-13509
TURNAAGAIN ARM TIDAL
ENERGY CORPORATION
821 N ST. SUITE 207
ANCHORAGE, AK 99501
PHONE: 907-277-6249
FAX: 907-277-3300
TURNAGAIN ARM TIDAL ENERGY PROJECT

TURNAGAIN ARM TIDAL ENERGY CORPORATION
821 “N” ST. SUITE 207
ANCHORAGE, AK  99501
# Future of Energy in Alaska’s Railbelt - Proposals

<table>
<thead>
<tr>
<th>Source</th>
<th>Concerns</th>
</tr>
</thead>
</table>
| Natural Gas             | • Exploration  
                          | • Pipeline                                      |
| Hydroelectric           | • Expense  
                          | • Seismicity                                    |
| Wind and Solar          | • Cost/kwh  
                          | • Intermittent                                  |
ADVANTAGES OF TIDAL ENERGY FOR RAILBELT REGION

ABUNDANT - AVAILABLE
- 329 sq. mi. in Turnagain Arm Basin
- 26-33 ft. tide

CLEAN - SAFE
- No Co₂
- No danger from seismic activity

RENEWABLE
- Energy will never run out
- Energy is entirely predictable
FEDERAL ENERGY REGULATORY COMMISSION

• FERC WEBSITE
  • Go to www.ferc.gov
  • Go to e-library
  • Go to Docket Search
  • Enter No. P-13509

• For all TATEP/FERC Documents
PROJECT LOCATION

TURNAGAIN ARM OF COOK INLET IS ONE OF THE PREMIER LOCATIONS IN THE WORLD FOR TIDAL ENERGY
THE TIDE
A UNIQUE RENEWABLE ENERGY SOURCE
• CLEAN: PRODUCES NO GREENHOUSE GASES
• RENEWABLE: USES THE POWER OF THE MOON TO PRODUCE ENERGY
• PREDICTABLE: TIMING AND SIZE OF TIDES ARE ENTIRELY PREDICTABLE
• AFFORDABLE: AFTER INITIAL INVESTMENT, ENERGY IS VERY INEXPENSIVE
• AVAILABLE: ONE OF THE PREMIER LOCATIONS FOR TIDAL ENERGY IS AT OUR DOORSTEP

Fourth Highest Tide in the World in Turnagain Arm
TURNAGAIN ARM TIDAL ENERGY PROJECT

- PREMIER SITE FOR TIDAL ENERGY

- TIDE 26’ – 33’
  - RENEWABLE, CLEAN, PREDICTABLE

- CRITICAL SHORTAGE IN RAILBELT AREA
  - TIDAL SAFER, LESS EXPENSIVE, MORE RELIABLE THAN OTHER SOURCES OF ENERGY
TIDAL ENERGY CONSTANT WITH STORAGE TANK DESIGN

GATE SEQUENCE PLAN 1
N.T.S.

Note: See sections on following pages

Total future turbine station generator capacity, 1200 kW

Sequence 1
Flood tide
Figure 2

Reservoir is filled 20 feet higher than high tide level (by previous pumping)
G1, G2 closed, G3 open
Flood tide comes in, turns turbine for a period of 6 to 8 hours
Route of Transmission Line
Alternate Route for Transmission Line
TIDAL POWER FROM HOMER TO FAIRBANKS
What about the experimental status of Tidal Power?

An amazing fact:
Tidal energy has been in use for 44 years!
**Rance Tidal Power Station**
**Brittany, France Since 1966**
Con. Cost: $88 Million
1.2¢/Kwh since 1986
Rance Tidal Power Station

World’s First Tidal Power Station
1966-Present
Rance River, Brittany, France
240 Megawatts – Annual Output 600 GWh
RANCE TIDAL POWER STATION

LOCATION: BRITTANY, FRANCE
OWNER: ELECTRICITE DE FRANCE
STATUS: IN OPERATION
FUEL: TIDE
TECHNOLOGY: TURBINE TURBINES 24
INSTALLED CAPACITY 240 mw
ANNUAL GENERATION 600 GWh

COMMISSIONED 26 NOVEMBER 1966
CROSS-SECTION OF BULB TURBINE AND GENERATOR

10 Mw each

24 Total

Annual Output:
600 GWh

Barrage:
750 m (2,461 ft.)

Power Plant Portion:
332.5 m (1,091 ft.)
Rance Power Station/Bridge
OFF-SHORE TIDAL PLANT DESIGN

- USE OF PROVEN BULB TYPE TURBINES
- USE OFF-SHORE PLANT LOCATION TO MINIMIZE ENVIRONMENTAL DISRUPTION
## TATEP Uses Bulb Turbine with Off-Shore Location

<table>
<thead>
<tr>
<th>Advantage of Bulb Turbine</th>
<th>Advantage of Off-Shore Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulb Turbine Technology is Proven</td>
<td>• Wet construction will reduce disturbance to environment; to fish and sea mammals</td>
</tr>
<tr>
<td>• Bulb Turbine has been in use successfully for many years</td>
<td>• Tidal plant will function as an island; fish and sea mammals can swim around it</td>
</tr>
<tr>
<td></td>
<td>• Plant may provide habitat for birds/sea mammals</td>
</tr>
</tbody>
</table>
STORAGE TANK PROVIDES CONSTANT ENERGY

<table>
<thead>
<tr>
<th>LIMITATIONS OF RENEWABLE ENERGY</th>
<th>TIDAL WITH RESERVOIR IS PREDICTABLE AND CONSTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WIND AND SOLAR POWER ARE INTERMITTENT AND UNPREDICTABLE</td>
<td>• SLACK TIDE IN TURNAGAIN ARM IS SHORT: 15-30 MINUTES</td>
</tr>
<tr>
<td>• TIDAL IS ENTIRELY PREDICTABLE, BUT STILL INTERMITTENT BECAUSE OF THE SLACK TIDE PERIOD UNLESS</td>
<td>• RESERVOIR PROVIDES WATER MOVEMENT FOR ENERGY PRODUCTION DURING SLACK TIDE</td>
</tr>
<tr>
<td>A STORAGE TANK IS PROVIDED</td>
<td>• CONSTANT POWER MAKES TRANSMISSION TO THE EXISTING GRID EASIER AND LESS COSTLY</td>
</tr>
</tbody>
</table>

RESERVOIR PROVIDES WATER MOVEMENT FOR ENERGY PRODUCTION DURING SLACK TIDE
ROCK BARRAGE SECTION

WATER LEVEL INSIDE STORAGE TANK

WATER BARRIER TO KEEP WATER FROM LEAKING INTO THE INLET

ROCK BARRAGE SLOPE 1 TO 1

INLET WATER LEVEL AT LOW TIDE

BOTTOM OF INLET

ROCK BARRAGE SECTION B-B
N.T.S.
SLOT GATE SECTION

MOTOR TO LIFT AND LOWER SLOT GATES

INLET WATER LEVEL

24" W X 30" L SLOT GATE IN OPEN POSITION

WATER FLOW THRU SLOT GATE WHEN OPEN ON EBB TIDE

WATER LEVEL INSIDE STORAGE TANK

STRUCTURAL SUPPORT

ROCK FOUNDATION

BOTTOM OF INLET

SLOT GATE SECTION C-C
N.T.S.
GATE PERSPECTIVE

24’ WIDE X 30’ HIGH OPENINGS FOR WATER TO FLOW THRU

HOIST

MOTORS

36 FT

SLOT GATE IN OPEN POSITION

36 FT

1.10 SLOT GATES AT WEST SIDE OF STORAGE TANK

36 FT

SLOT GATES AS SHOWN IN SECTION C-C

GATE PERSPECTIVE
N.T.S.
TURBINE ISOMETRIC
TURBINE AT FLOOD TIDE

HIGH TIDE RESERVOIR LEVEL 20 FEET ABOVE INLET BASIN HIGH TIDE LEVEL

PREVIOUSLY PUMPED VOLUME

GATE 1 CLOSED

SEA LEVEL (HIGH TIDE)

WATER LEVEL RISING

BEGIN FLOOD TIDE WATER LINE

TURBINE BLADES

ROCK FOUNDATION

SLOPE 1/2

BOTTOM OF INLET

FLOOD TIDE

FIGURE 2A

N.T.S.

TURNAGAIN ARM BASIN
EBB TIDE OPERATION

Diagram showing a turbine with a reservoir level, gate 1 closed, and water dropping to low tide level. The diagram includes annotations for rock foundation, slope 1/2, bottom of inlet, and a turbine basin.

Figure 2C
Questions Addressed in the FERC Permitting Process

- FERC Permitting Process will call for studies on the impact of the project on fisheries, water quality, sediment transport and deposition, and threatened and endangered species, and any other issues raised by Stakeholders.

- The procedure is to determine all current information and then devise studies to answer questions that are not clearly addressed.
JOBS FOR ALASKANS

- 4,500 JOBS FOR 5 YEARS OF CONSTRUCTION
- 100 JOBS FOR MAINTENANCE & OPERATION
- ESTABLISH ALASKA AS TIDAL POWER CENTER FOR USA & PACIFIC RIM
- ADDITIONAL 5,000 JOBS FOR LOWER 48 FABRICATION AND SUPPORT OF TIDAL PROJECTS
- INEXPENSIVE ENERGY FOR DEVELOPMENT OF NEW INDUSTRIES IN ALASKA
What about the permitting?

**FEDERAL ENERGY REGULATORY COMMISSION**
- PRELIMINARY PERMIT FOR AREA IN TURNAGAIN ARM

**CURRENT**
- FILED WITH ADNR
- FILING FOR ADNR LEASE
- NOI/PAD FILED W/FERC
- FIRST SCOPING MTG 8/9/2011
UNITED STATES OF AMERICA  130 FERC ¶ 62,131
FEDERAL ENERGY REGULATORY COMMISSION

Turnagain Arm Tidal Energy Corporation

Project No.  13509-000

ORDER ISSUING PRELIMINARY PERMIT AND GRANTING PRIORITY TO FILE LICENSE APPLICATION

ISSUED:  February 5, 2010
TIDAL ENERGY IS A NO-BRAINER FOR THE ALASKAN RAILBELT

- TIDAL ENERGY IS AT OUR DOORSTEP
  - NO PIPELINES OR DRILLING NEEDED
  - ABUNDANT ENERGY AT POPULATION CENTERS

- TIDAL ENERGY IS FOREVER
  - IT IS ABUNDANT AND NEVER RUNS OUT
  - IT PRODUCES NO GREENHOUSE GASES, POLLUTION

- TIDAL ENERGY IS CLEAN
  - PRODUCES NO GREENHOUSE GASES
  - CALLS FOR NO PIPELINES, TANKERS, OR TRUCKS
TATEP THE ENERGY SOURCE FOR THE ALASKAN RAILBELT

• ENVIRONMENTALLY FRIENDLY
  • USES NO FUEL, PRODUCES NO EMISSIONS
  • DOES NOT BLOCK MIGRATORY PATHWAYS
  • OPERATION IS QUIET

• EARTHQUAKE PROOF

• SOLVES PROBLEM OF INTERMITTENT POWER OF RENEWABLE ENERGY SOURCES
TATEP THE ENERGY SOURCE FOR THE ALASKAN RAILBELT

- Economic benefits to Alaska
  - Central to Railbelt
  - Inexpensive source of energy
  - Jobs for 2000 people for 4 years working directly on project; 200 permanent jobs
  - Jobs for related businesses
- Reduction of electrical cost to consumers in Railbelt area
- Model project for development of tidal energy in the U.S. and other countries