Clean Current Power Systems Incorporated

Presentation to

Fisheries and Oceans Canada

Pêches et Océans Canada

Canada

May 2004

Agenda

Introductions

People and Organization

Renewables overview

Technology development plan

Institute for Ocean Technology testing

Competing tidal turbine technologies

Race Rocks as possible site for demonstration unit

Project Timeline

Next steps

• Clean Current Power Systems Incorporated

Does Tidal Turbine Technology fit the Management Plan for Race Rocks?

"Facility Management

Objectives:

- ***To showcase alternative, low impact technologies"***

p. 16 Management Plan for Race Rocks Ecological Reserve

People and Organization

May 2004

Clean Current Power Systems Incorporated

Vision

Clean Current developed, licenses and continues to improve the pre-eminent technology for tidal current turbine electricity generation. This means that Clean Current is the supplier of choice and dominates the tidal power market.

Mission

Our mission is to design, test and optimize for our customers efficient, scalable and reliable turbine generators that produce low cost electricity from tidal currents.

Corporate Structure

Canadian Controlled Private Corporation – 70% Canadian

Incorporated as a BC company

15 Founding Shareholders – 12 Canadian, 3 USA

Principal office in Vancouver

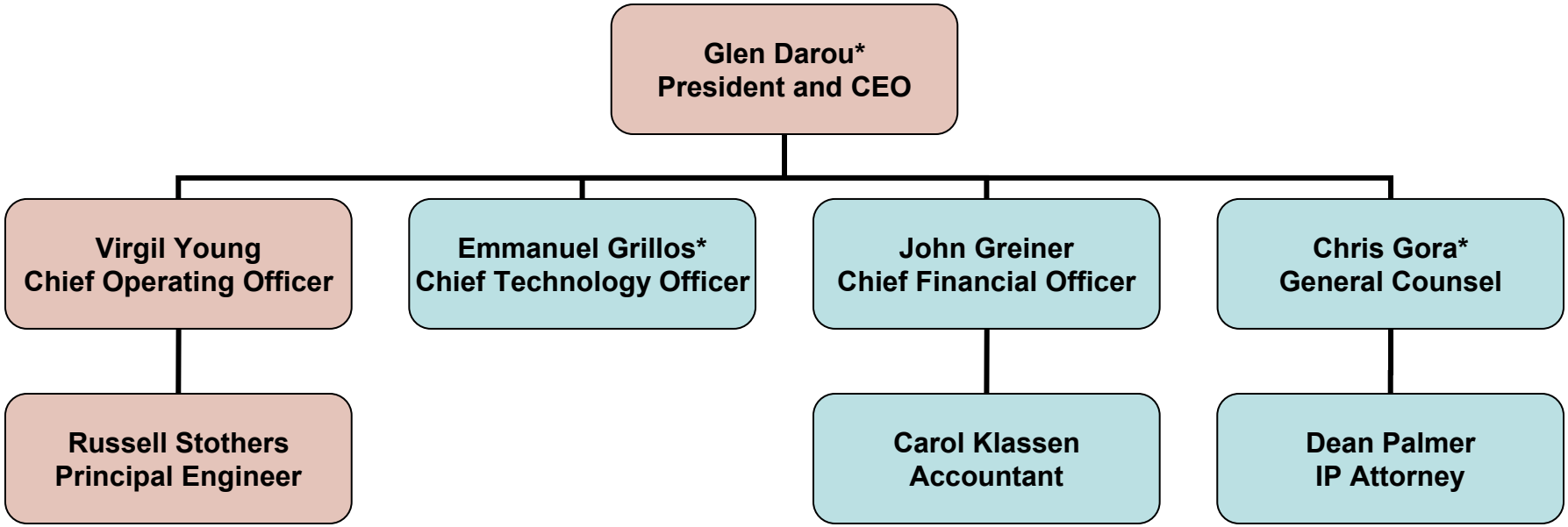
Inventors

Emmanuel Grillos – Aeronautical Engineer

Barry Davis – deceased – Aeronautical Engineer

Stephen Allison – Mechanical Engineer

Current Organization

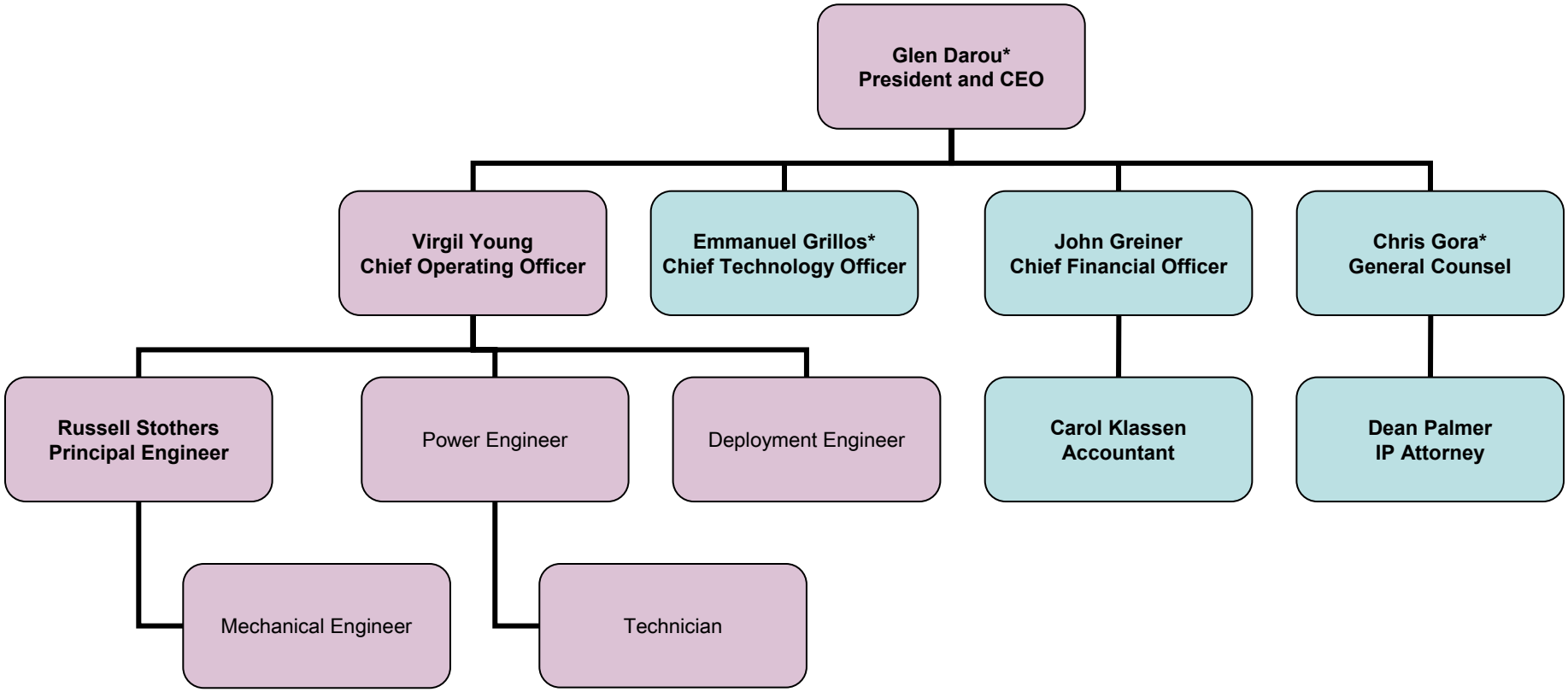


Full Time Commitment

Part Time Commitment

*** Board of Directors**

New Organization



Full Time Commitment

Part Time Commitment

*** Board of Directors**

Advisory Board

- George McCrae – Generator technology
- Martin Puterman – Mathematical modeling and system optimization
- Jessica MacLean – Computer network and graphic design

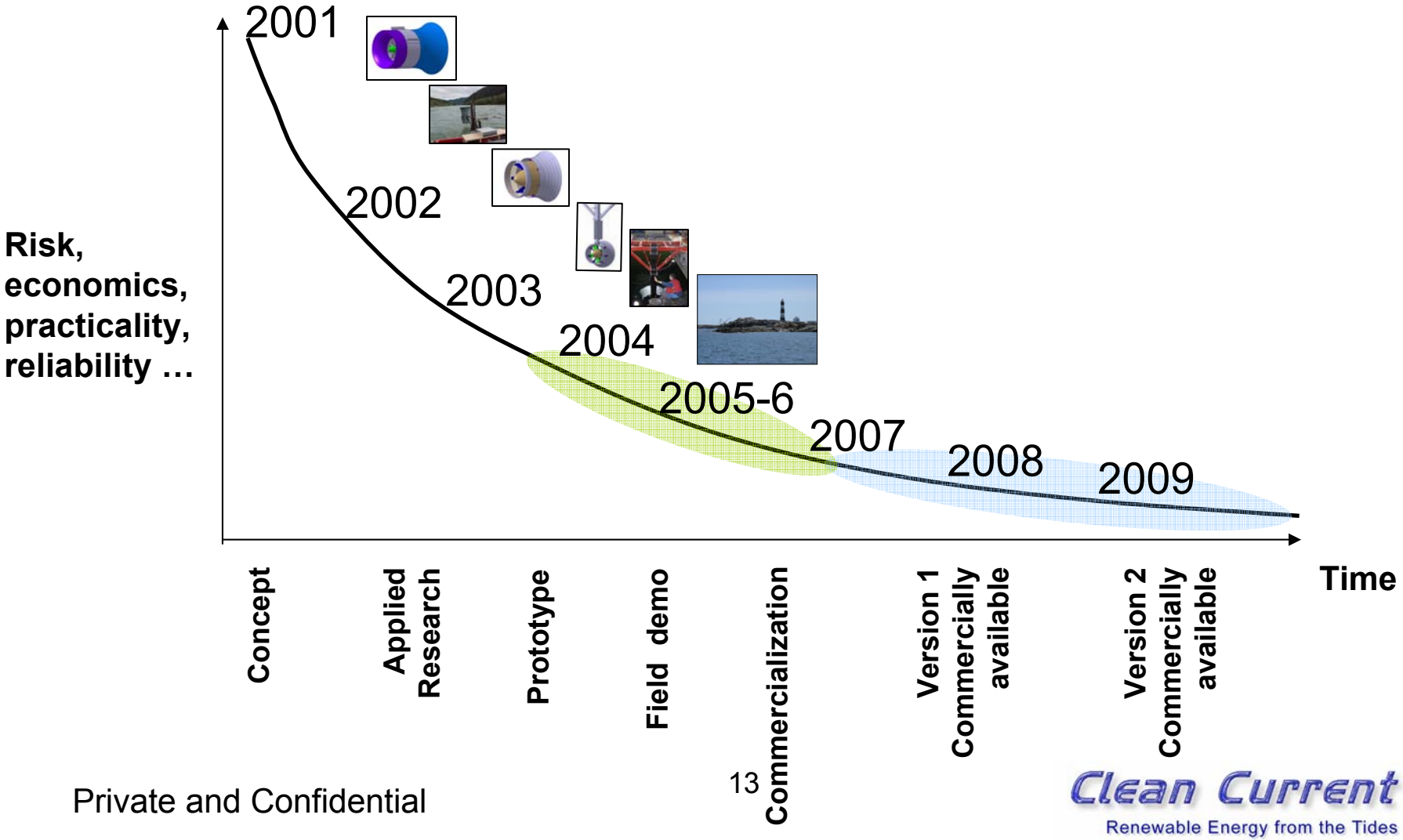
Focus 2001 –2004

- **Prove the technology**
- **Protect the technology**

Energy Technologies

	Renewable Resource	Low Capital Cost	Low Operating Cost	Minimal Environmental Impact	Predictable Output	Minimal Visual Impact	Modular Construction
Tidal	✔	✖	✔	✔	✔	✔	✔
Wind	✔	✖	✔	✔	✖	✖	✔
Wave	✔	✖	✔	✔	✖	✔	✔
Solar	✔	✖	✔	✔	✖	✖	✔
Hydro	✔	✖	✔	✖	✔	✖	✖
Nuclear	✖	✖	✖	✖	✔	✖	✖
Fossil	✖	✔	✖	✖	✔	✖	✖

Clean Current Technology Plan



Prototype Testing Program

Institute for Ocean Technology
St. John's, NF

Institute for Ocean Technology (IOT) 200 metre Wave/Tow Tank

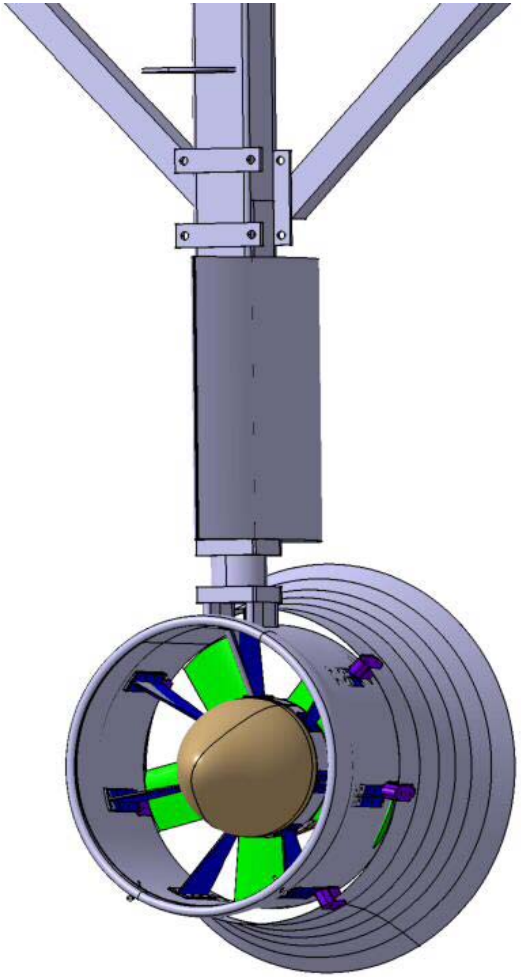
Specifications:
Length 200 metres
Width 12 metres
Still Water Depth 7 metres

~ Most accurate in world
~ Used in design of Whitbread, America's Cup and Admiral's Cup yachts

Applications:
~ Resistance and Propulsion Testing of Ship Models in Calm Water and Waves
~ High-speed Marine Craft Testing

Institute for Ocean Technology
Test Configuration

Testing Dates:
March 27-29, 2004

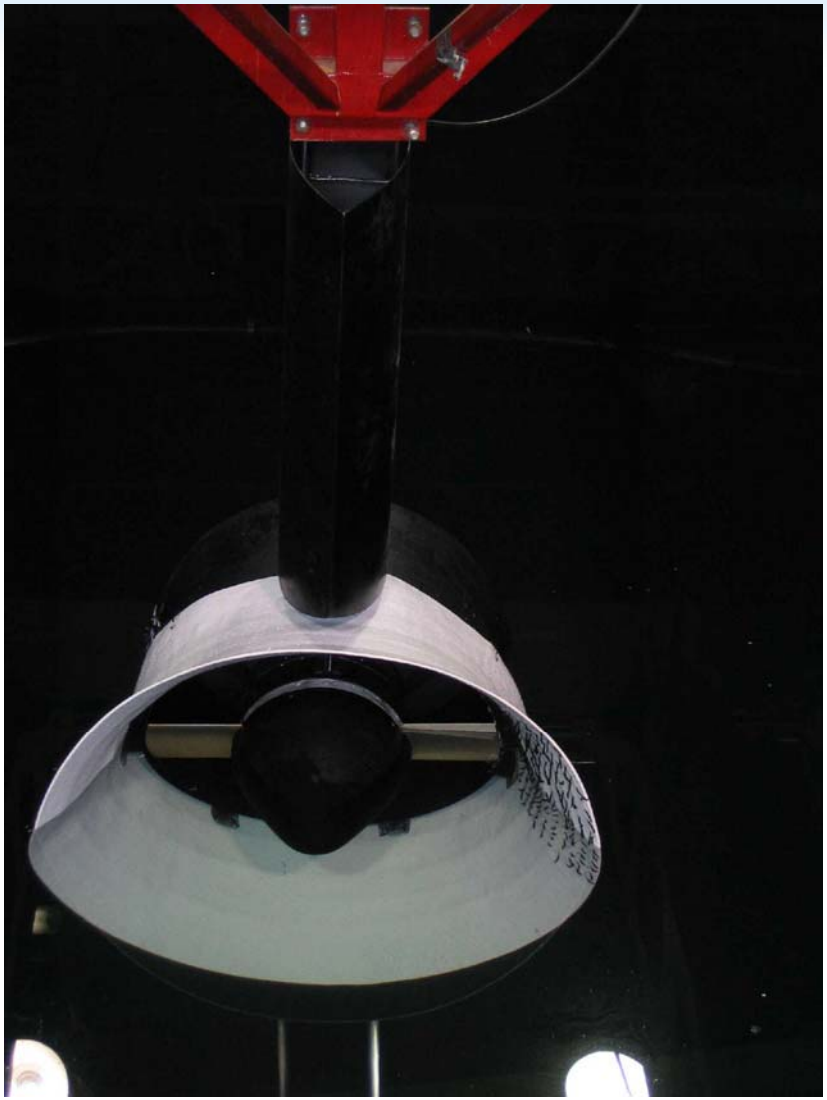


Mounting Post & Fairing

Moving Test Unit to Carriage

Lowering Test Unit into Carriage

Calibrations Prior to Test



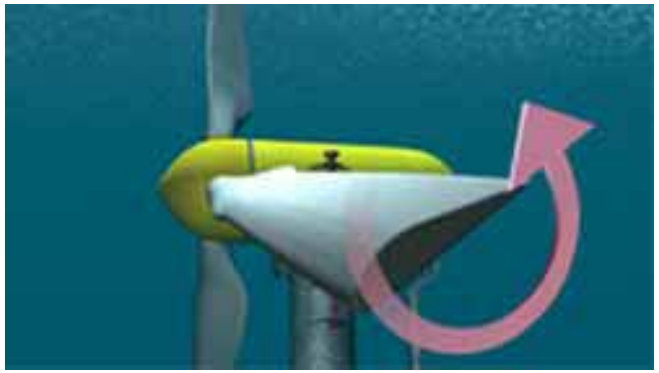
Overall Setup

Testing at 2.75 m/s

Competing Tidal Technologies

May 2004

Hammerfest Strøm AS



http://www.e-tidevannsenergi.com/index.htm

Hammerfest Strøm AS

Marine Current Turbines Ltd.

http://www.marineturbines.com/home.htm

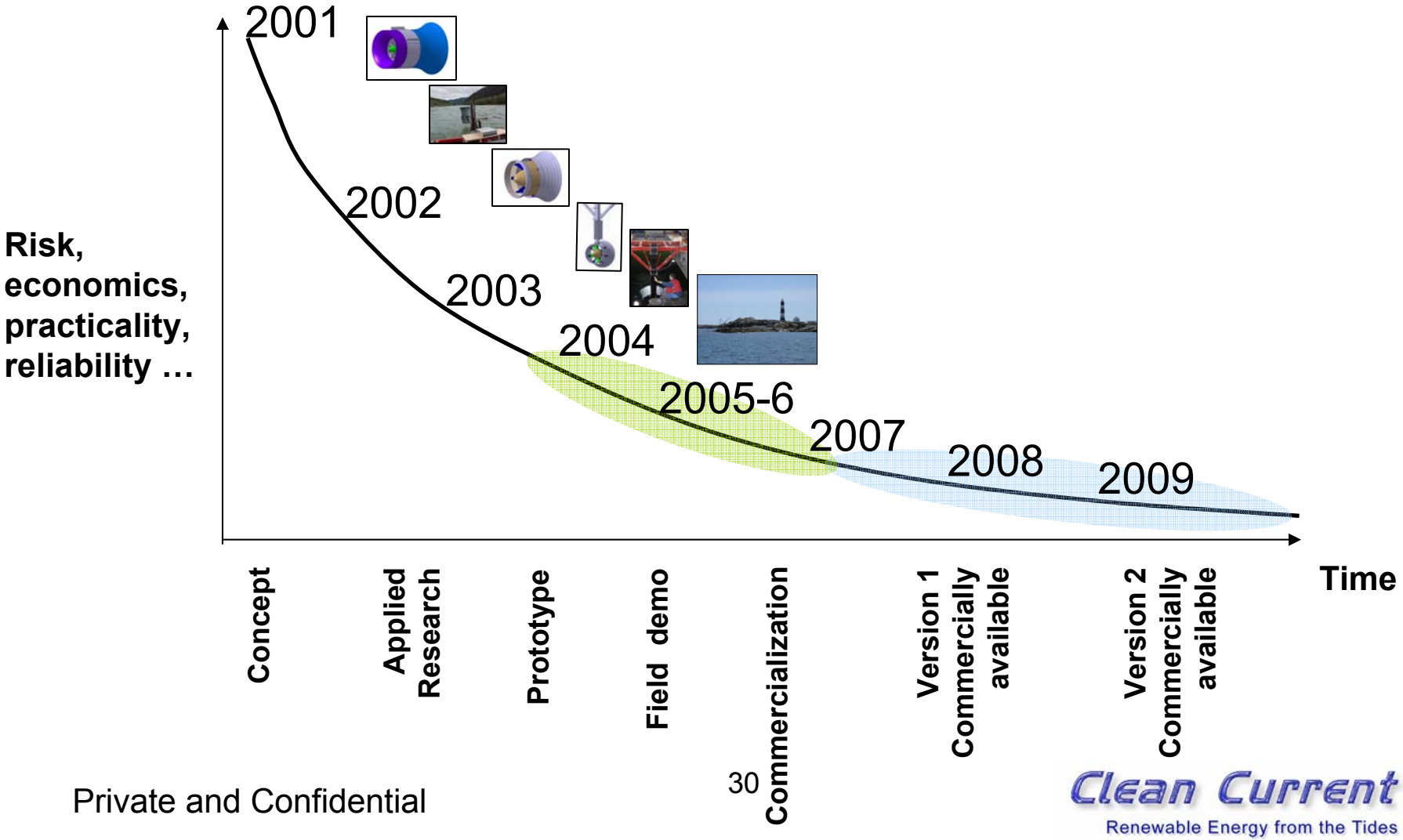
Marine Current Turbines Ltd.

Marine Current Turbines Ltd.

UEK Corporation

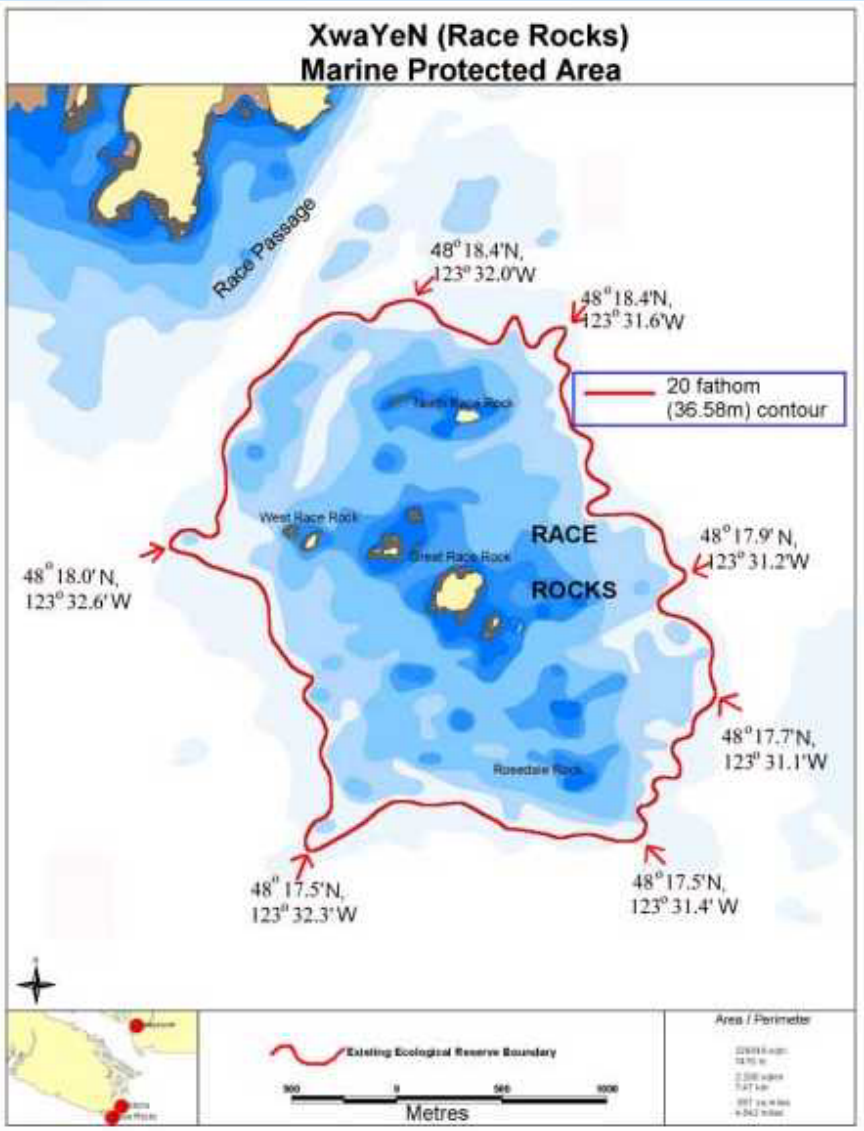
http://uekus.com/index.html

Clean Current Technology Plan



Demonstration Program
Race Rocks Site

Location of Race Rocks



Objectives of Demonstration Program

Overall

- Produce sufficient energy to displace existing diesel generation
- 3+ metre design directly scalable to 1.0 MW unit.
- Validate design prior to the 1.0 MW program.
- Demonstrate reliability of unit

Generator

- Demonstrate generator performance
- Develop a control system to maximize power output at a given flow condition
- Perform power conditioning based on site requirements

Objectives of Demonstration Program continued

Turbine

- Validate blade and overall hydraulic performance
- Quantify starting performance and cut-in speed

Deployment

- Determine deployment configuration
- Demonstrate method of deployment
- Develop periodic maintenance techniques and schedule

Material

- Perform material testing in areas of biofouling and corrosion resistance
- Assess materials resistance to impact and erosion


DIESEL
DIESEL

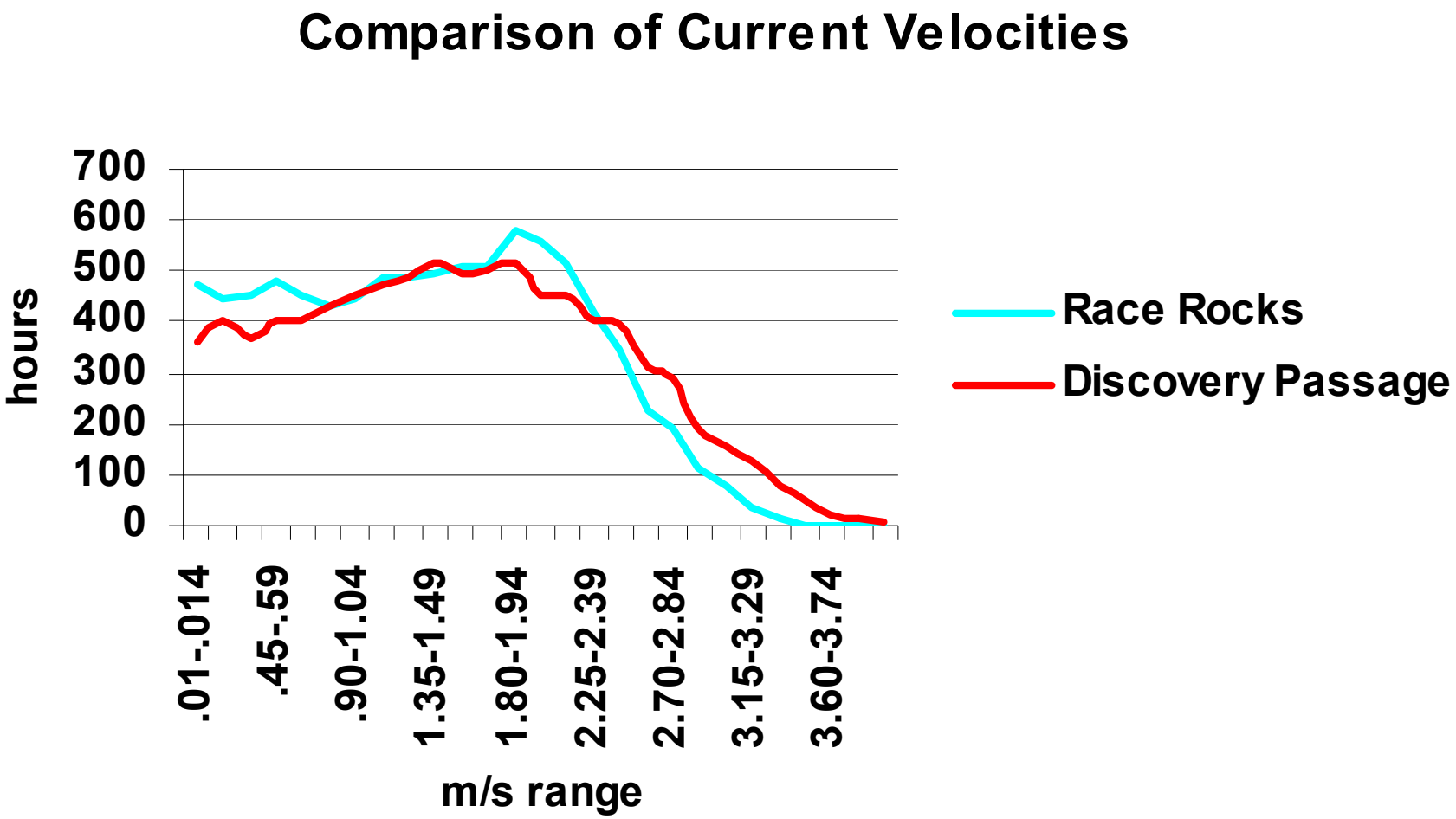
Comparison of Solar, Wind and Tidal Technologies [3]

System Installed	Storage Size (days)	Installed Capacity (kW)	Equivalet Area Required (m^2)
Solar	5	944	8000
Wind	5	6999	26935
Tidal	5	44	49
Solar	14	472	4000
Wind	14	395	1520
Tidal	14	35.4	39.4

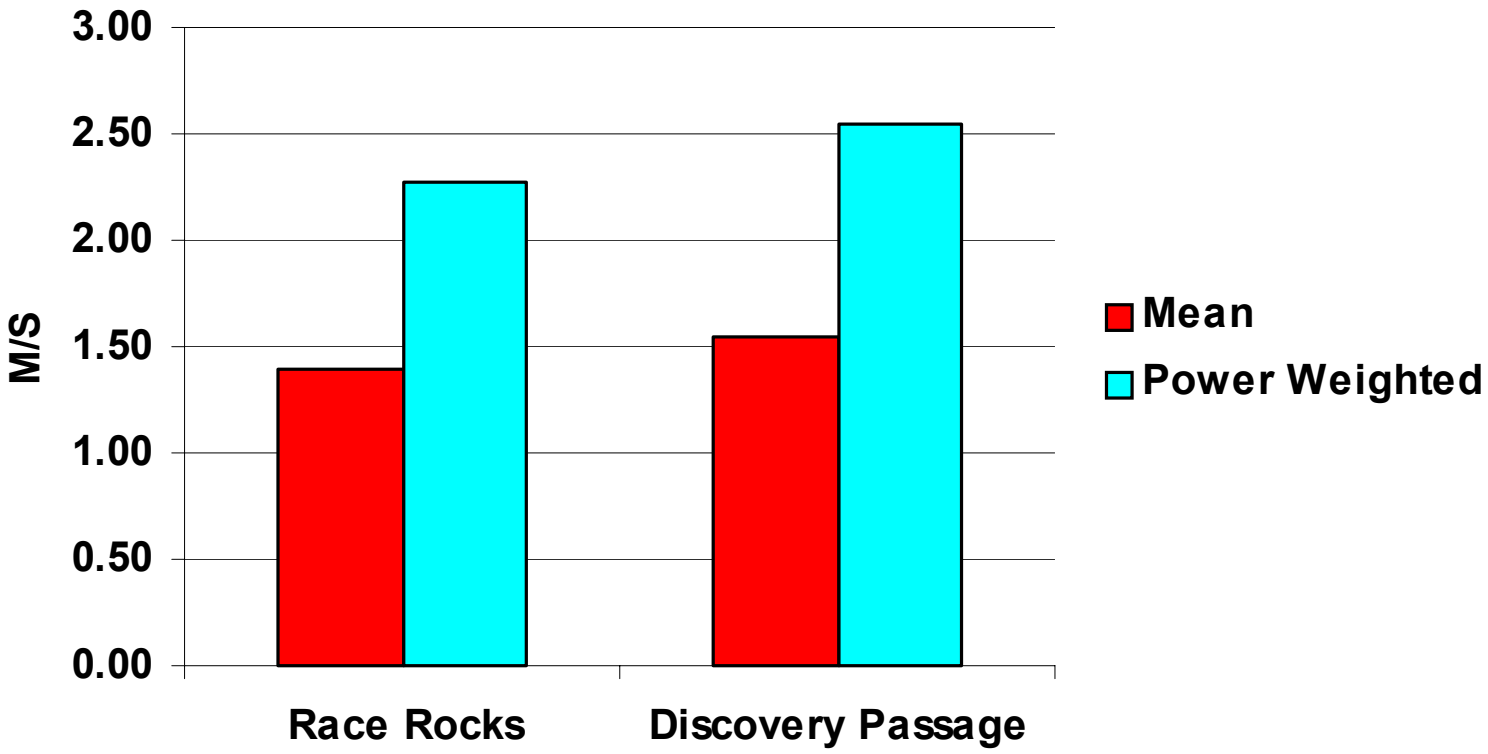
Based on an average load = 8 kWh
Area of Great Race Rock = 14800 m^2

[3] Source:Modelling Renewable Energyat Race Rocks, Taco Anton Niet, University of Victoria, 2001

Tidal Current Comparison

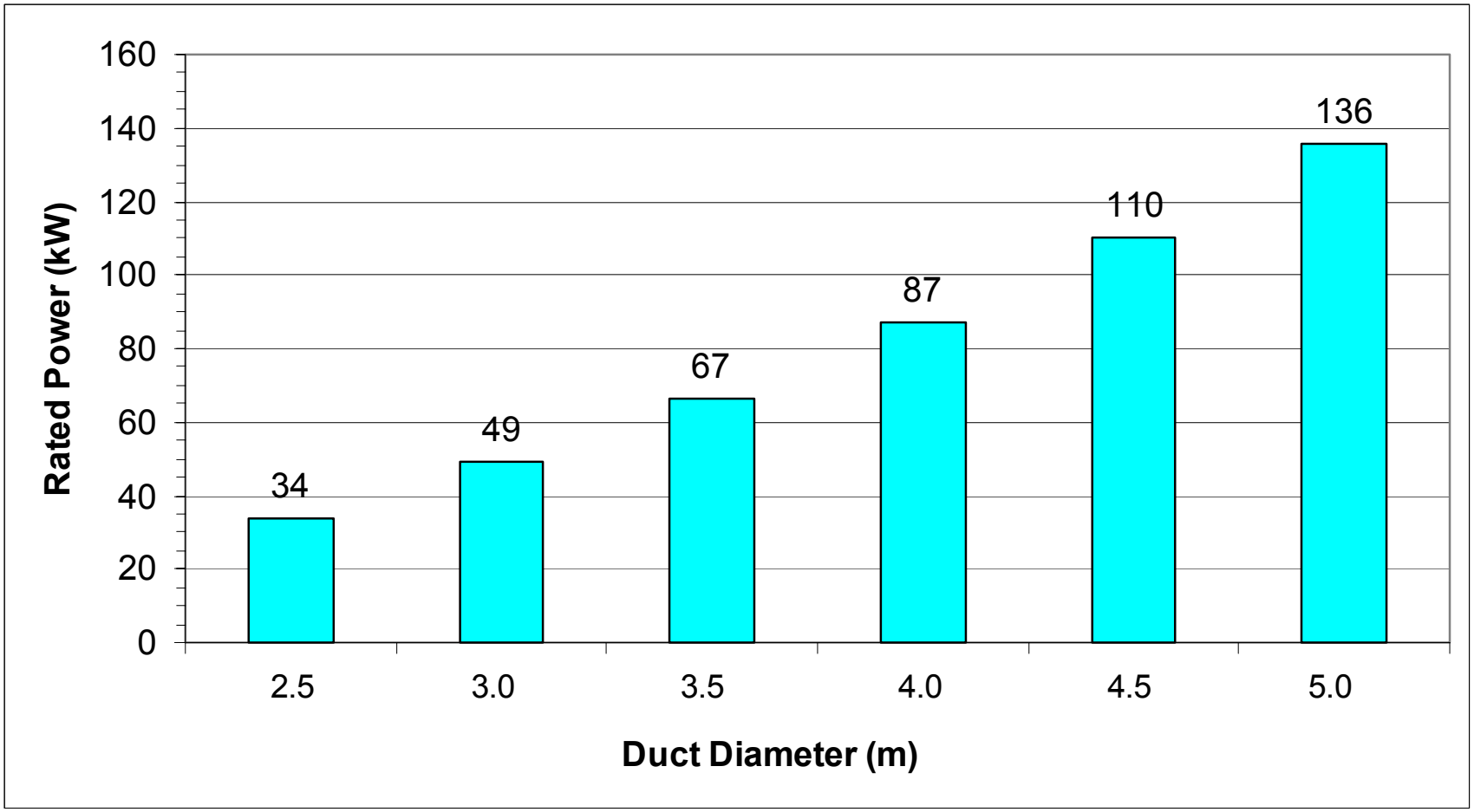


Average Velocity Comparison



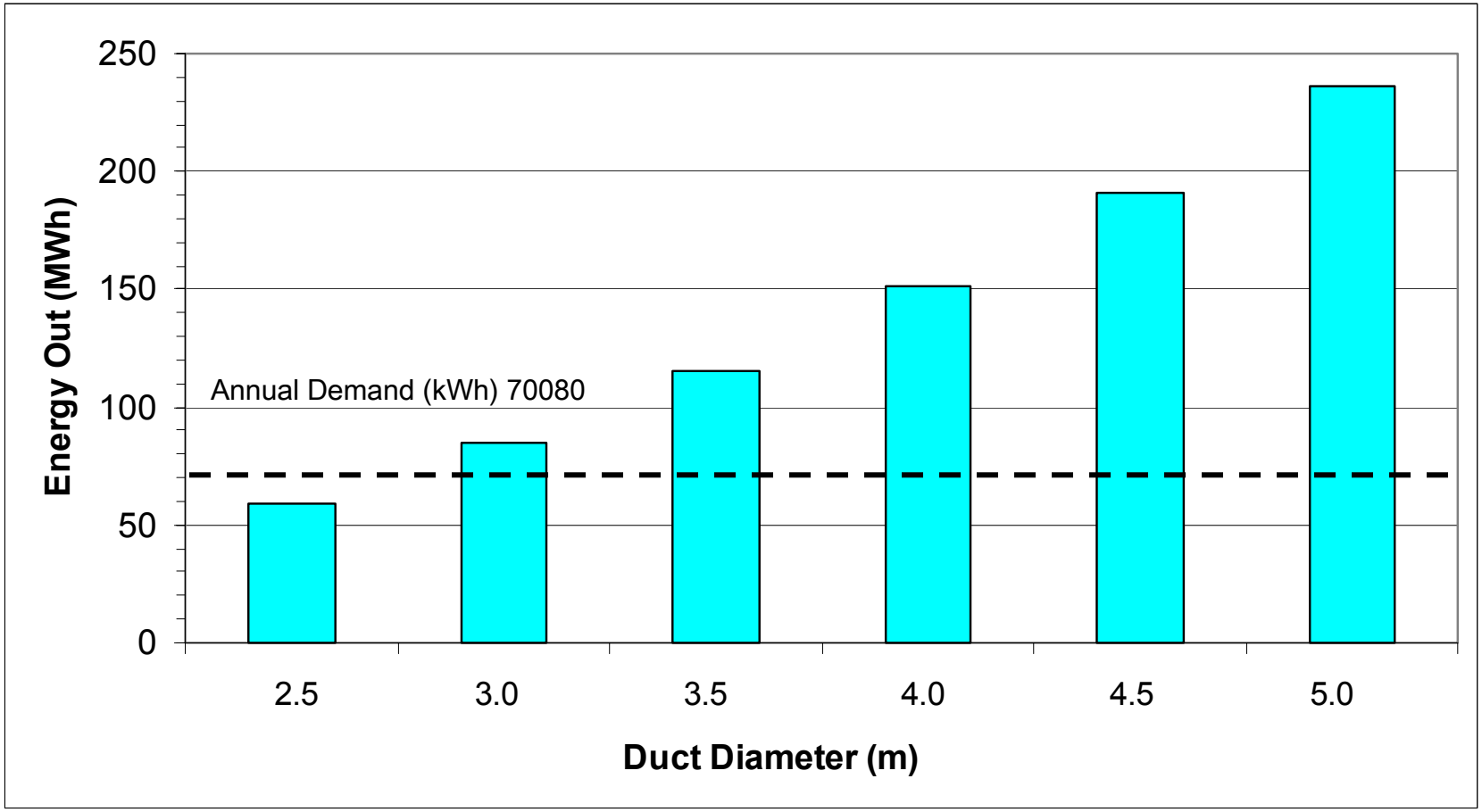
Rated Power

Rated Current Speed = 3.0 m/s

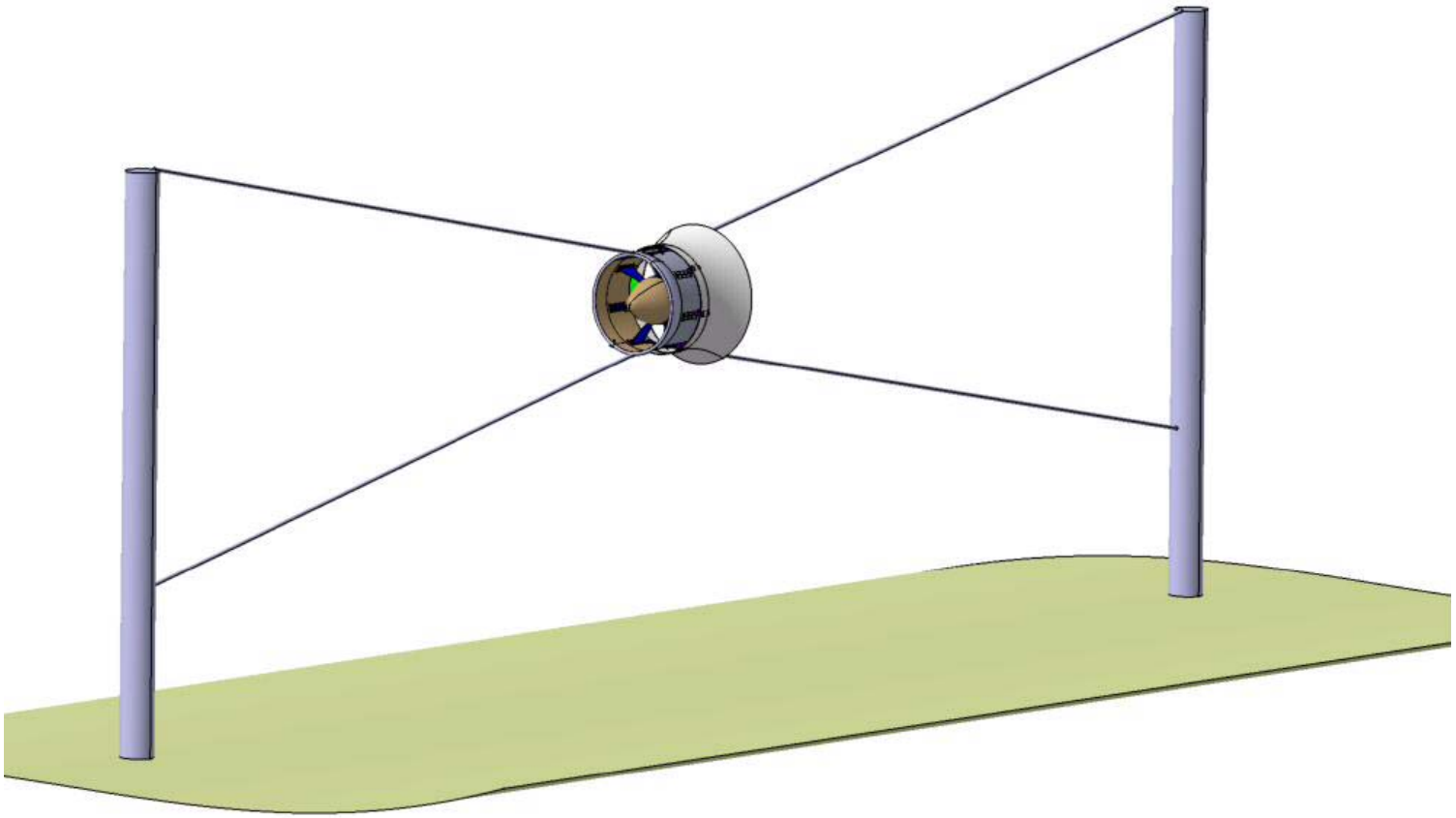


Annual Energy Produced

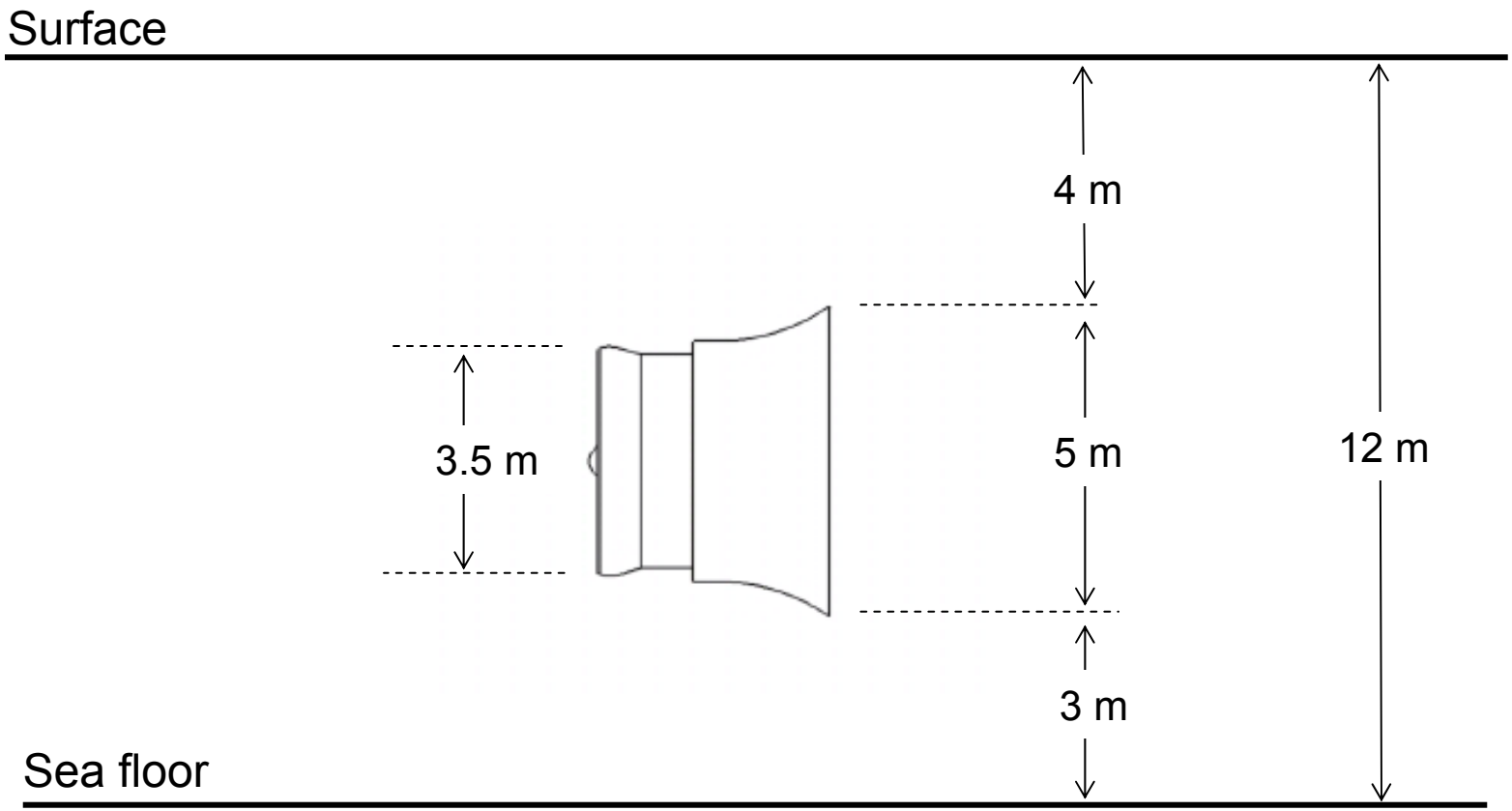
Race Rocks



Deployment/Anchoring Scheme



Position of Tidal Generator



Environmental Concerns

Construction Phase

- Impact of construction & installation processes
- Seasonal closures due to wildlife nesting and migration

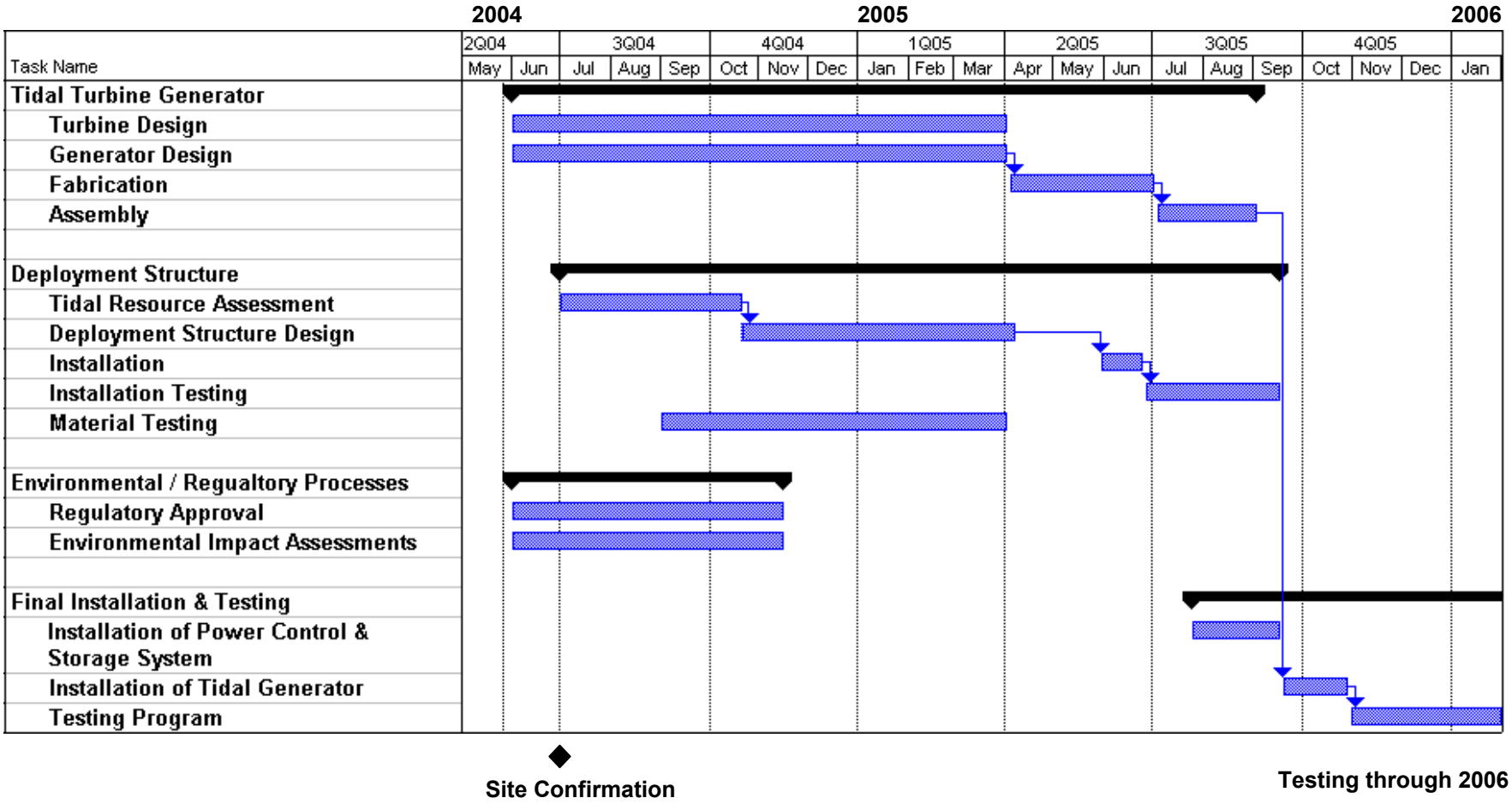
Operational Phase

- Regional effect of a tidal installation
- Effect on sediment suspension and deposition
- Turbine blades effect on fish and other marine life
- Impact of acoustic signature on cetaceans
- Proximity to marine traffic
- Impact on recreational and commercial fishing

Benefits of Race Rocks Demonstration Program

- Displace the existing generator and therefore reduce the risk of diesel fuel on Race Rocks.
- Provide a representative tidal environment to demonstrate Clean Current's tidal generator technology.
- Opportunity to showcase low impact, renewable energy technology developed in Canada and implemented in an Ecological Reserve.
- Enhance educational experience for Pearson College students.

Demonstration Project Schedule



Next Steps

What processes must Clean Current complete?

What is probable timetable?

What ultimate approvals are required?

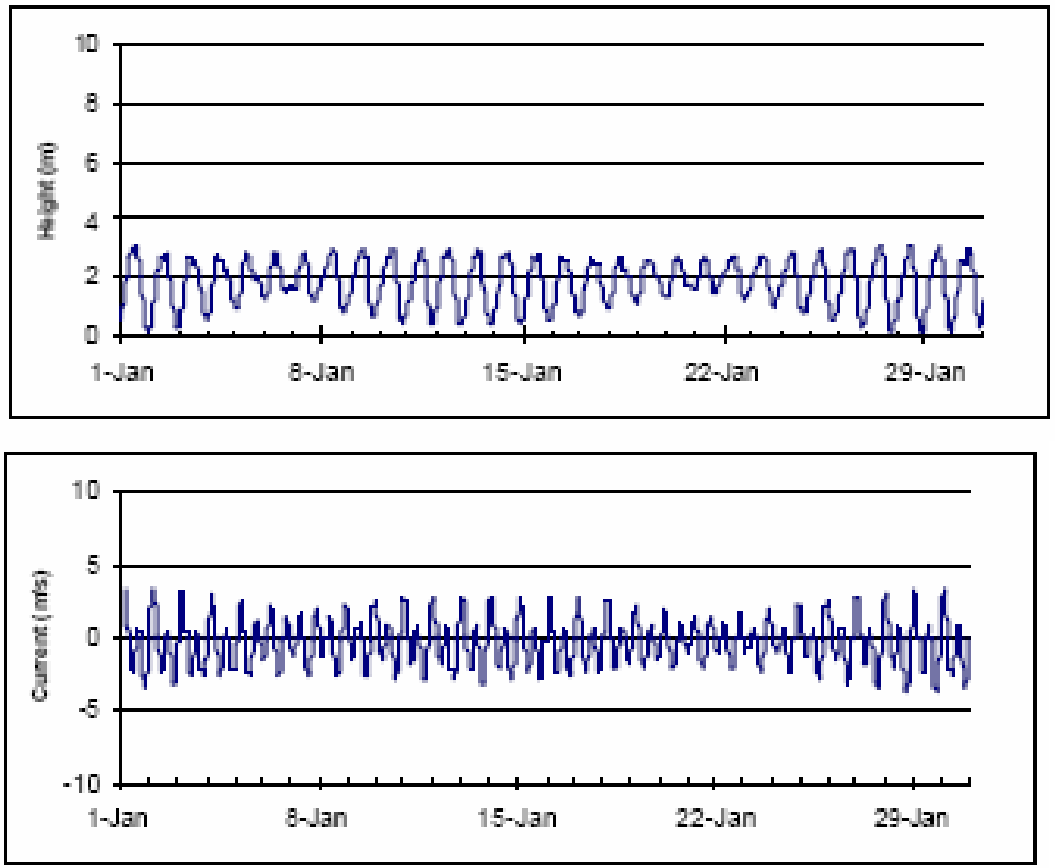
Other organizations or agencies involved?

What is first step?

Demonstration Program
Race Rocks Site

Tide Profile at Race Passage[1]

VICTORIA



[1] Source: Triton Consultants Ltd.

BC Tidal Current Power Sites [2]

Mean Current Speed > 2.0m/s, Depth >10 m

Site Name	Latitude	Longitude	Maximum Current Speed Flood	Maximum Current Speed Ebb	Mean Maximum Depth Average Current Speed	Mean Power Density	Passage Width	Passage Depth	Flow Cross-sectional Area	Mean Potential Power
			knots	Knots	m/s	kW/m2	m	m	m2	MW
Current Passage 1	50.41	125.87	5	5	2.06	0.81	1398	100	143331	116
Current Passage 2	50.39	125.86	6	6	2.47	1.40	1502	80	123931	174
Weyton Passage	50.59	126.82	6	6	2.47	1.40	1535	75	118985	167
Dent Rapids	50.41	125.21	11	8	3.91	5.56	420	45	19955	111
Blackney Passage	50.57	126.69	5	5	2.06	0.81	814	40	34598	28
Discovery Pass. S.	50.00	125.21	7	7	2.88	2.23	1866	35	69993	156
Green Pt 2	50.45	125.52	6	6	2.47	1.40	538	35	20157	28
Surge Narrows	50.23	125.16	6	6	2.47	1.40	413	30	13432	19
Whirlpool Rapids	50.46	125.76	7	7	2.88	2.23	321	28	9804	22
GreenPt Rap. 1	50.44	125.51	7	7	2.88	2.23	440	25	12093	27
Green Pt 3	50.44	125.57	5	5	2.06	0.81	673	25	18498	15
Perceval Narrows	52.33	128.38	5	5	2.06	0.81	382	25	10518	9
Active Pass	48.86	123.33	8	8	3.29	3.32	561	20	12628	42
Race Passage	48.31	123.54	6	7	2.68	1.78	884	20	19885	35
Nitinat Narrows	48.67	124.85	8	8	3.29	3.32	61	20	1376	5
Quatsino Narrows	50.55	127.56	9	8	3.50	3.98	207	18	4240	17
First Narrows	49.32	123.14	6	6	2.47	1.40	418	16	7734	11
Porlier Pass	49.01	123.59	9	8	3.50	3.98	339	15	5926	24
Second Narrows	49.29	123.02	6	6	2.47	1.40	254	14	4159	6
Chatham Islands	48.45	123.26	6	6	2.47	1.40	903	12	13099	18
Charles Bay Rapids	50.42	125.49	5	5	2.06	0.81	664	12	9631	8
							Total Mean Potential Power (MW)			1036

[2] Source: Triton Consultants Ltd.

Annual Energy Output vs. Rated Speed

Race Rocks, B.C.

Rated Current Speed		Rated Power (kW)	Mean Power Out (kW)	Annual Energy Available (kWh)	Annual Energy Output (kWh)	Capacity Factor
2.00		14.5	6.6	175626	57441	45%
2.25		20.6	7.9	175626	68810	38%
2.50		28.3	8.8	175626	77298	31%
2.75		37.7	9.4	175626	82447	25%
3.00		48.9	9.7	175626	85050	20%
3.25		62.2	9.8	175626	86009	16%
Assumptions						
Rotor Diameter (m)		**3.00**		**Average Energy Demand (kWh)**		8.0
Area (m^2)		7.07		**Annual Energy Demand (kWh)**		70080
Salt Water Density (Kg/m^3)		1025				
Overall Efficiency		**50%**				