January 2017

THEMIS

PROJECT DEVELOPMENT
&
TRANSACTION ADVISORY

HQ Power

80MW Peat Power Plant
Rwanda, Gisagara district, Mamba sector

What is peat ?

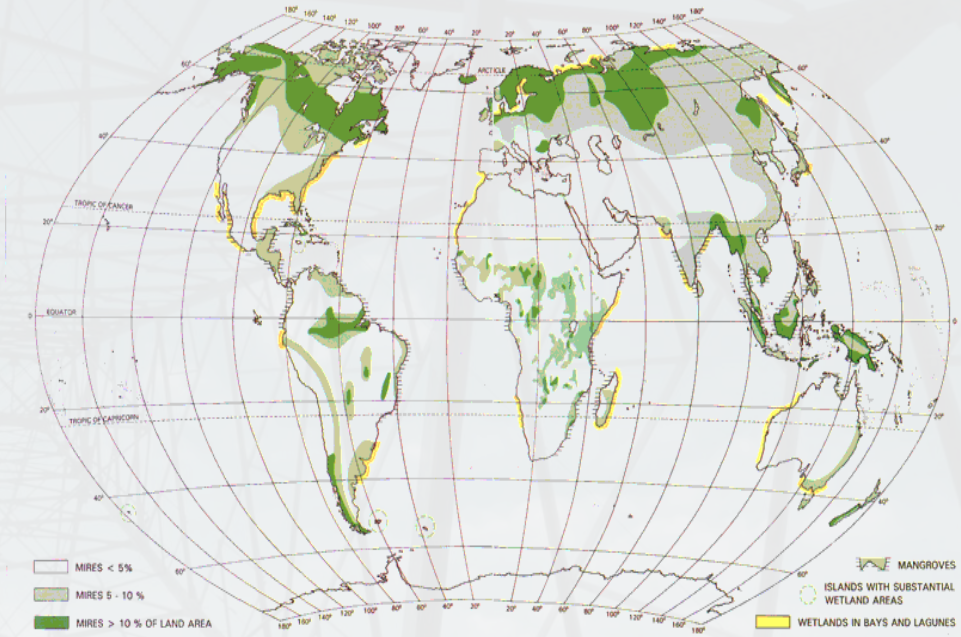
- Peat is a form of biomass at early decomposition stage (circa 500 years in Africa)
- Peat is formed in anaerobic condition i.e. no oxygen (in wetlands, swamps)
- Peat has been used in Northern Europe for 2,000 years at least for housing heating and cooking, as an alternative to firewood or coal. Later peat has been used for electricity generation starting from 19th century.
- Peat heating characteristic (18-20MJ/kg) can be compared to lignite or mid/low-quality coal
- Rwanda peat reserve is estimated at 155 million tons (Ekono report 1993) , equivalent to circa 500MW electrical power during 30 years

World of Peat
a mature technology

Finland is the world leader in peat resources utilisation with 55 peat-fired power plant boasting 7.800MWth installed capacity

Selected Peat Power Plants around the world

Name	Country	Capacity MW	Commissioning
Shatura	Russia	1,020	1925
Kirov	Russia	300	1963
Keljonlahti	Finland	209	2010
Toppila	Finland	190	1977
West ofally	Ireland	150	2004



Peat in Europe	Finland	Ireland	Sweden	Estonia	Latvia	Lithuania	EU Total
Fuel Peat Resources (ktoe)	1,100,000	47,500	370,000	10,000	57,000	4,000	1,589,000
Annual Peat Use (ktoe)	1,980	984	372	28	0	4	3,368
Number of Peat Fired Power Plants	55	3	20	40	0	7	125

Comparison Northern Europe vs. Rwanda

Whereas Swedish peatlands are located in forest, Rwanda peatland is free from trees and roots which has the advantage of (i) being environmental friendly as it avoids deforestation (ii) easing operations.

Rwanda peatland

Sweden peatland

Project Highlights

The project will serve the Rwanda strategy of developing indigenous energy sources . This private investment of USD 350 million is structured under Project Finance principles

Project Rationale

- Generation tariff 40% less than current average
- 40% additional generation capacity from 190MW today to 270MW
- Ideal location of the power plant on the biomass (peat) resource

Technical Configuration

- 80MW (2x40MW) installed capacity
- 4,200 ha. of peat land enough for min 30 years of operation
- 720,000 t/year peat extraction

Legal Configuration

- BOOT basis with a 26 years PPA
- Government Guarantee covering the PPA and Concession Agreement
- Eligibility to Investment Certificate and fiscal incentives

Project Development Timeline

2012

Execution of Concession Agreement, Power Purchase Agreement and Government Guarantee (the "Project Agreements")

2013

Engagements of Sponsor's advisors

Execution of Soil and Peat Analysis

Approval of Feasibility Study

Approval of Environmental & Social Impact Assessment Report

2014

Engagement of Africa Finance Corp. as the MLA and the Lenders' Advisor

EPC & Boiler Bidding

Access Road Improvements

Temporary transmission line for construction completed

Peat harvesting pilot

2015

EPC award

O&M Award

Lenders' due diligence

Lenders' negotiation with the Government

2016

PPA amendment executed

Signing of Financial documentation

2017

Reaching Financial close on January 2017

Start of construction in March.

Power Plant Comissioning by first quarter of **2020**

Key Connected Projects

Transmission Line

(Government Obligation)

- Ongoing 220 kV220kv line through Mamba – Rwabusoro – Kigoma - Bwishyura
- Will be procured by Government of Rwanda
- According to the PPA, the Government of Rwanda needs to complete the T-line within 27 months after PPA Effective Date

Peat Operations

- Engagement of Swedish peat harvesting professionals
- Milled peat with dry harvesting method
- 80 peat samples analysed by Tractebel and 700 peat samples analysed by Sweco
- Peat sample testing in February 2014
- Pilot Harvesting in September 2014
- Commercial Scale harvesting in 2017

Access Road

(Government Obligation)

- 36 km. required upgrade
- Last 6 km. has been upgraded in early 2014 by the Rwanda Military Engineering Corps
- The road is completed pending punch list items
- The punch list to be completed by summer 2016

Expropriation and Resettlement

- Land valuation done by two independent valuation agency
- Resettlement Action Plan was prepared by Sponsor and approved by the Local authorities in April 2014.
- The relocation of 151 affected people started in April 2014 and was completed in July 2014.

Summary of Technology

Peat Production

- Finnish Equipment (SOUKONE, PEATMAX and VALTRA)
- Finnish Experience for Peat Production Planning (PLANORA)
- Estonian experience for operations auditing and emergency support (STEIGER)

Engineering Procurement Construction

Boiler Risk

Turbine Generator Risk

Peat Handling

Water Treatment, Cooling, I&C etc. (standard)

Operation

- O&M Operator – Finnish National Utility

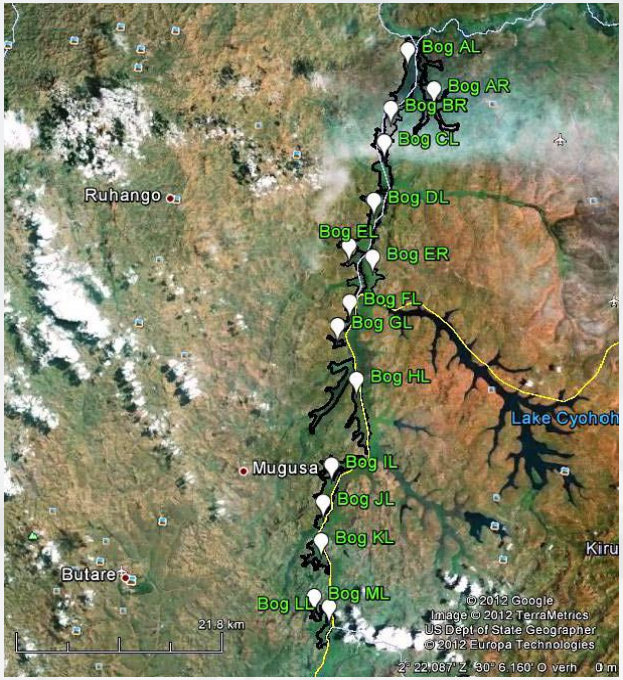
- **Peat Production Risk**
  Mature and simple technology (farming type) + Top 2 European Supplier (Peat Max and Suokone + 6 Swedish peat professionals involved since 2013 + Technical study (2013) + Test Site (2014) + successful Peat Production pilot (September 2014)
- **Boiler Risk**
  Mature technology by Andritz + Peat analysis (780 samples) + Peat Sample analysed by Boiler manufacturer in Finland
- **Turbine / Generator**
  Standard technology + Reputable European Supplier (SIEMENS)
- **Peat Handling**
  Peat handling and conveyor manufacturer from Finland
- **Water Treatment + Cooling**
  Standard Technology + Water analysis
- **Operation**
  FORTUM, Finnish Power Utility (one of the biggest utility companies in Europe with the largest experience on peat power plants) will operate the Plant

Peat Sampling & Analysis

- Purpose: Determination of Peat Specifications to finalize technical design of the power plant
- Scope of Work: 2013-2014: Detailed planning by SWECO

  Sampling and testing of 700 specimen from bogs HL and IL, 1500ha
- Contractor: HICE Consult – Peat Sampling and Peat testing

  BELAB – Swedish Laboratory to verify the analysis by Hice laboratory in Rwanda.



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GEOTECHNICAL LABORATORY

PEAT ANALYSES REPORT

Name of Project: HAKAN PEAT POWER PROJECT - SOIL INVESTIGATION FOR
Client: YUMN LTD
Location: Buye, Gisagara District, Southern Province, RWANDA
Site: HL-B and HL-A

Sample ID: HL-B5-L2-9
Date of Test: 26/11-12/12/2013

Test		Value		Unit	Standard
Moisture, 105°C		89.80		%	CEN/TS 14774:1
Ash, 550°C	DB	18.80		%	CEN/TS 14775
	AR	1.92		%	CEN/TS 14775
Volatile	DB	49.80		%	ISO 562
	AR	5.08		%	ISO 562
Fixed Carbon	DB	31.40		%	Calculated
	AR	3.20		%	Calculated
Carbon (C)	DB	52.50		%	ASTM D5373
	AR	5.36		%	ASTM D5373
Hydrogen (H)	DB	4.49		%	ASTM D5373
	AR	10.51	*	%	ASTM D5373
Nitrogen (N)	DB	0.94		%	ASTM D5373
	AR	0.10		%	ASTM D5373
Oxygen (O)	DB	22.46		%	Calculated
	AR	82.04	*	%	Calculated
Chlorine (Cl)	DB	0.017		%	ASTM D4208
	AR	0.002		%	ASTM D4208
Sulphur (S)	DB	0.81		%	ASTM D4239
	AR	0.08		%	ASTM D4239
Gross Cal. Value Const Volume (DB)		19.09		MJ/kg	ISO 1928
Gross Cal. Value Const Volume (AR)		1.95		MJ/kg	ISO 1928
Net Cal. Value Const press (AR)		-0.35		MJ/kg	ISO 1928
Net Cal. Value Const press (DB)		17.95		MJ/kg	ISO 1928
Net Cal. Value Const press (DB Ashfree)		22.10		MJ/kg	ISO 1928

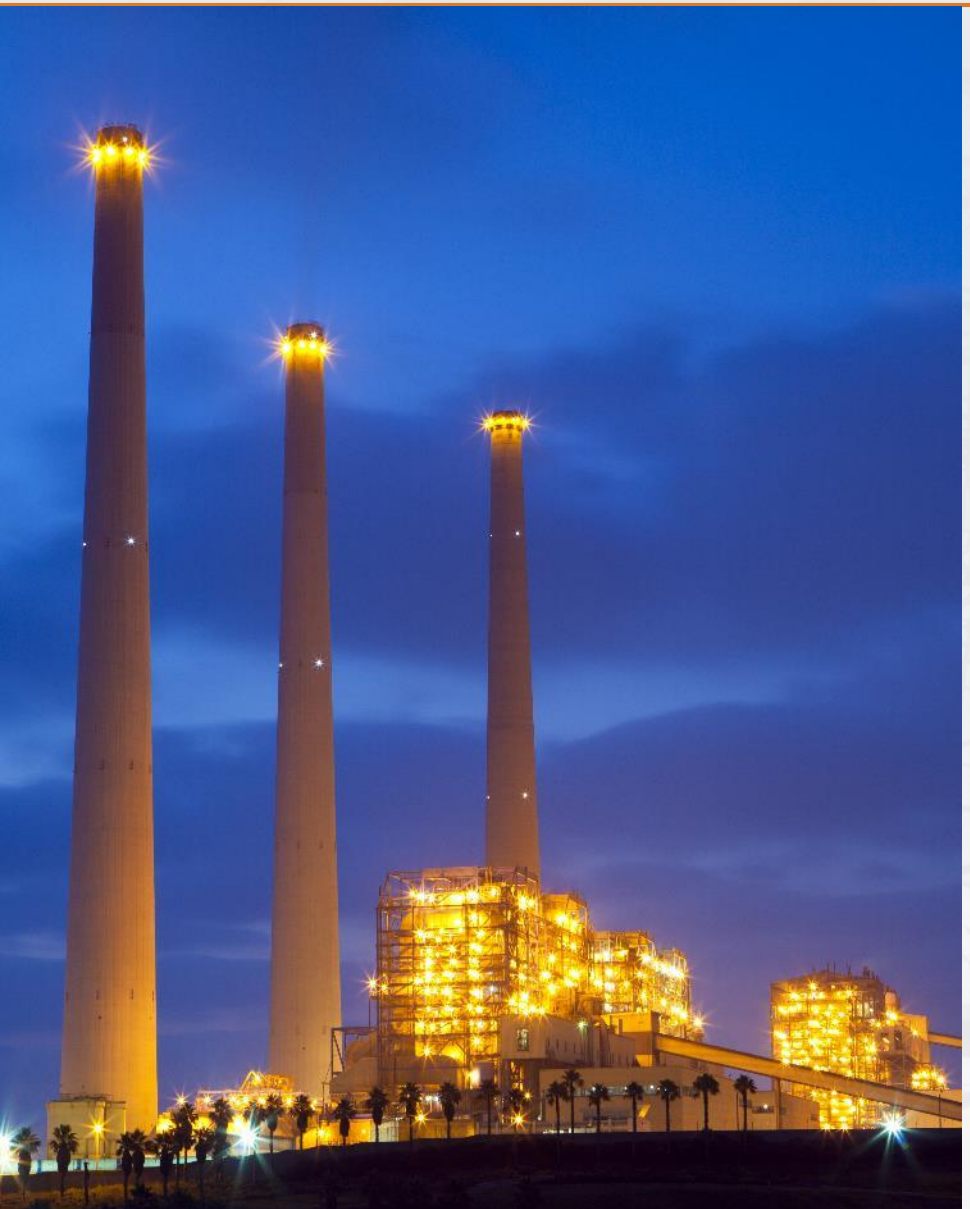
AR = As Received
DB = Dry Basis
* = water included

Peat Extraction Pilot September 2014

Drinking, peat and river water

Milled peat and bricks

Secondary ditches (1.5m deep)



THANK YOU!