

1992-2012 *celebrating 20 years of industry partnership*



Accelerating Action:

Business, Clean Energy Markets & the CTC&N

COP 18 Doha, Qatar

November 30, 2012

About the BCSE

- The Business Council for Sustainable Energy (BCSE) is a coalition of companies and trade associations from the energy efficiency, natural gas and renewable energy sectors.
- The Council advocates for policies at state, national and international levels that increases the use of commercially-available clean energy technologies, products and services.

2012 BCSE Members



www.bcse.org



Follow BCSE on Social Media



Home @ Connect # Discov	ver 👤 Me	Search	 Q Q + I 			
BCSE @BCSECI The Business coth year as efficiency, & r Washington DC	nergy ble Energy: celebrating our ewable energy, energy s.	Edit your profile 1,662 tweets 286 FOLLOWING 558 FOLLOWERS				
Tweets	> Twe	ets				
Following Followers Favorites		BCSE Clean Energy @BCSECleanEnergy RT @naturalgasfik @NARUC passes reso and combined heat and power.ow/ly/fhE9I Expand	3m Slutions promoting #NGVs t #natgas			
Lists Recent images		BCSE Clean Energy @BCSECleanEnergy #California leading the US on clean energy, climate policies, 2x down on investments, carbon auction today: reut.rs/QdnikC Expand				
Gimilar to you	×	BCSE Clean Energy @BCSECleanEnergy BCSE mbrs INGAA, Stella Group on The Art of the Possible: Energy & Environment Policy via @expertsenergy bit.ly/UD3YOW Expand				
Clean Energy Council @NECEC Follow Mark Drajem @drajem Follow Mathias Bell @MthsBell Follow © 2012 Twitter About Help Terms Privact Blog Status Apps Resources Jobs		BCSE Clean Energy @BCSECleanEnergy Global Wind Energy Outlook 2012; #wind electricity by 2020, +1.4M new Jobs: bit.ly/ @GWEC_GlobalWind Expand	7h could = 12% global /UDONGW			
	acy	BCSE Clean Energy @BCSECleanEnergy lowa, Oregon Governors urge extension o credit #PTC via @BW buswk.co/W7o7bg Expand	8h @AWEA			
uvensers Businesses media Develo	pers	BCSE Clean Energy @BCSECleanEnergy Consolidated Solar, @solaronenyc & @sc to help communities after Sandy with mob AX(020 Expand	13 Nov olarcity are partnering ille #solar units: seia.us			
		BCSE Clean Energy @BCSECleanEnergy Johnson Controls @ItsPossibleJCl Opens apps marketplace via @GreenBiz: ow.ly/ff Expand	13 Nov energy-efficiency EkZ			
		BCSE Clean Energy @BCSECleanEnergy MT @SEIA - @SolarCity to install #Solar p homes in New Mexico, Texas via @BW: bu Exeand	13 Nov panels on military uswk.co/RVLyEE			

BCSE & COP-18

- Showcase clean energy technology solutions through industry action around the world
- Share experiences with energy, environmental and sustainability policies worldwide
- Promote the role of the private sector in achieving sustainable development though capital investments and job creation, technology innovation and public-private partnerships

COP 18 Doha: Policy

- Design of 2015 Agreement: Durban Platform (ADP)
- Technology: Launch of Climate Technology Center & Network, private sector engagement, Protection of IPR
- Finance: Role for private sector investment, accounting, Green Climate Fund
- New Market Mechanisms

Follow BCSE events on Twitter: @BCSECleanEnergy

John Christensen Head, RISO Center United Nations Environment Program

Rosemary Bissett

Head of Sustainability, Governance & Risk National Australia Bank

Asset Resilience to Climate Impacts

Dr. Tod Delaney President First Environment, Inc.

Renewable Energy Technology

- Renewable energy involves long-lived, expensive assets
- These assets have vulnerabilities to future climate change that they need to harden against
- Vulnerabilities will vary by location (i.e. coastal plains, flood plains, desert), type of impact (i.e. storm surge, high heat, flooding, high winds) and time period (i.e. 5 yrs, 10 yrs, 20 yrs, 50 yrs)

Adaptation Facts

- Management of future climate risks is required by manufacturers and consumers
- Needs to be considered in design and siting processes
- Cannot rely on history
- Must rely on projections

Case Study: Resilience of NJ Transit Assets to Climate Impacts

- Determine potential risks of weatherrelated events and impacts on stationary assets over
 - -5 year
 - -10 year
 - -20 year
 - -50 year

NJ Transit

- Largest state-wide public transit system in US
- Nation's third largest provider of bus, rail, and light rail transit
- Service area: 5325 square miles
- Links major points in New Jersey, New York, and Philadelphia
- 223 million passenger trips per year

Methodology

- Identified New Jersey/Regional specific Climate Impacts from existing studies
- Applied impacts to classes of assets
- Mapped Assets Potentially at Risk
- Identified Indicators to Assess Severity of Risk
- Identified Resilience Strategies
- Identified Costs to Implement Strategies

Specific New Jersey Climate Impacts

- Increased temperature
- Sea level rise and higher storm surge
- Storm intensity and frequency that involve: -Higher wind velocities
 - -Increased rain and rainfall per event
 - -Increased lightning
 - -Increased snow levels per event
 - -More frequent icing events
 - -Increased flooding frequency and levels

Classes of Assets





Structures (bridges, tunnels, culverts, and retaining walls)

Trenton/Princeton Trains



Buildings (offices, terminals, stations and platform<mark>s, clepo</mark>ts, and cabins)

Mapping Example: Forestation of Catenary Rail Lines



Approach to Assess Severity

- No short-term models (5-20 year models) available to predict NJT extreme weather events
- Used the existing data from long term regional and New Jersey specific models
- Developed short term estimates
- Developed Indicators of Risk of extreme weather events over 5, 10, 20 years and beyond
- Indicators identify the scale of risk associated with each impact on specific assets

Indicators to Assess Severity

- Heat effects % increase in days over 90 degrees Fahrenheit, high emission and low emission scenarios
- Sea Level Rise inches
- Flooding/Storm Intensity % increase in 10 year, 100 year and 500 year flood.

Days over 90 Degrees

Table 1 - Days over 90 Degrees Fahrenheit Indicator



Figure 1. Days over 90 Degrees Fahrenheit Indicator

Identified Resilience Strategies

- Current Literature not robust
- Knowledge of NJT design standards
- Knowledge of Transit Operations
- Industrial Standards used in other climates

Identified Costs to Implement/Prevent Damage

- Cost data presented in literature reviews
- RS Means Cost Works database using 2012 Q1 cost information provided
- (Newark and Vineland were used to provide costing ranges throughout the state)
- Manufacturer cost information
- Historic cost data provided by NJ Transit

Resilience of NJ Transit Assets to Climate Impacts

ASSET CATEGORY	Climate Impact	Effect on Rail System	Assets at Risk	Planning Horizon Timeframe (yrs)			(yıs)	Short-term Operational	Potential Asset Management Strategies	Implementation Cost Estimates per Unit	
				1 to 5	6 to 10	11 to 20	20-50	inputs	ou are brea		
							-			Low	High
Rails	1. Increased Temperature Tempe	Thermal expansion and buckling of rails. Warp and misalignment of tracks due to uneven thermal expansion (when shade cools adjacent sections)	All rails	x	x	x	x	Slowed service or watering of track	Installation of expansion joints/additional expansion joints in frequently buckled areas. Another possible remedy is the installation of anchors and ties to secure the track and prevent buckling.	\$15,000 per mile.	\$20,000 per mile.
		Sagging and snapping of catenary lines	Electrified catenary lines	x	x	x	x	Cancelled and substitute service (bus)	Setting higher rail neutral temperature in new rail lines.	Equip maintenance personnel with neutral temperature monitoring devices and perform periodic inspections (possible short-term adaptation). It is also important to not set the neutral rail temperature too high to the point where it becomes vulnerable to breaking during colder weather.	
		Damage to electrical equipment (switches, gates, signals)	All electrical equipment	x	x	x	x	Upgrade / replace current electrical equipment and install additional ventilation.	Revise specifications for equipment (such as transformers and signals) to withstand higher ambient	5% increase is electrical equipment costs.	
		Sagging and snapping of catenary lines	Electrified catenary lines	x	x	х	x	Cancelled and substitute service (bus)	Replacement of existing catenary line tensioners.	TBD	TBD
		Electric utility brownouts and outages associated with grid demand	All electrical equipment on grid	x	x	x	×	Slowed, cancelled and substitute service (bus)	Reduce electric demand of rail operations or provide supplemental power feeds.	NJ Transit coordination with PJM to increase electric service reliability. May result in additional cost directly but most likely a utility cost.	
	2. Sea Level Rise	Rail systems or components no longer above sea level	NJ coastal zone, Delaware Bay, and Tidal Delaware River				x	N/A	Replacement of existing track above sea level (if feasible or seawall).	\$225,000 per mile	\$1,800,000 per mile
		Rail and rail bed destruction	NJ coastal zone, Delaware Bay, and tidal Delaware River	x	x	x	x	Cancelled and substitute service (bus)	Repair rail, rail bed and embankm <mark>ents</mark>	\$1,500,000 per event	\$3,000,000 per event



Contact Information

First Environment, Inc. **Corporate Headquarters** 91 Fulton Street Boonton, New Jersey 07005 (800) 486-5869 www.firstenvironment.com Tod Delaney: tod@firstenvironment.com

JUPITER OXYGEN CORPORATION

COP 18: BCSE SIDE EVENT

"Accelerating Action" Best Practice Technology for Efficient Industrial Process Heating and Cost Effective Carbon Capture

by Jim Wolf, Consultant to Jupiter Oxygen Corporation

Overview

- I. Clean Technology Solutions
- **II.** High Flame Temperature Oxy-Combustion Process
- **III.** Carbon Capture & CO₂ Utilization from Power Plants

China Project Activities

I. Clean Technology Solutions

- U.S. based clean energy technology company
- High flame temperature oxy-combustion process
- Oxy-combustion technology solutions
- Consulting services
- Licensing agreements

II. High Flame Temperature Oxy-Combustion Process

Jupiter's technology is a...

- patented process for the combustion of fossil fuels with nearly pure oxygen
- using a high flame temperature, but keeping the same process temperatures
- existing furnace materials can mostly be used and the same melting temperatures are maintained



Industrial Furnace Results and Potential

- High flame temperature oxy-combustion technology has a proven record of fuel efficiency, CO₂ emission reduction, and low NOx.
- High potential for multiple applications in industrial process heating [aluminum re-melting; billet steel re-heating]
- Cost savings from efficiency gains, increased melt rate and multiple use of the air separation unit





III. Carbon Capture & CO₂ Utilization from Power Plants

 Results from Jupiter
 Oxygen's test boiler at our US research center indicate approx.
 5% fuel efficiency gains in natural gas or coal fired boilers.

High flame temperature oxy-combustion process is maximizing heat transfer effectiveness in the boiler

► Highly concentrated CO₂ enables cost effective carbon capture in greatly reduced flue gas volume



Jupiter Oxygen in cooperation the U.S. Department of Energy's National Energy Technology Laboratory developed an integrated system based on high flame temperature oxy-combustion process, with a carbon capture train and integrated pollutant removal system.

Results of the Integrated Pollutant Removal (IPR) system are:

- 95%+ carbon capture, low NOx, elimination of SOx, PM and mercury
- Significant amounts of water saved through reuse of condensed water
- Heat recovery implemented in Integrated Pollutant Removal system

Energy Efficiency Gains in Boiler & CO₂ Utilization: Key to Affordable Carbon Capture from Power Plants



CO₂ Utilization Market

- ► ENHANCED OIL RECOVERY: 30 YEARS+ EXPERIENCE IN USA
- ENHANCED COAL BED METHANE RECOVERY [ECBM]: PILOTS IN CANADA, USA, CHINA
- ► ALGAE PRODUCTION FROM CO₂ / ALGAL BIOMASS INDUSTRY
- "FROZEN METHANE": SUBMARINE GASHYDRATES INDIA AND CHINA HAVE IDENTIFIED HUGE RESERVOIRS OFFSHORE

Power Plants

- Jupiter Oxygen technology, when applied to coal or natural gas fired power plants, provides efficiency gains in the boiler and is the pathway for cost effective carbon capture
- Our sustainable strategy to retrofit fossil fuel power plants is addressing CO₂ capture, key air pollutant control, heat recovery and water reuse in an integrated system economically
- Our integrated system addresses emission standards in the U.S. and anticipated future carbon constraints
- CO₂ utilization can in part finance fossil fuel power plant clean up

BUSINESS ACTIVITIES IN CHINA

In May 2011, Guanghui New Energy China and Jupiter Oxygen USA signed a strategic alliance agreement for a Carbon Capture, CO₂ Utilization and Storage (CCUS) project including retrofit of a coal fired power plant and a coal chemical plant in China



Contact Information

Jim Wolf, Consultant

Jupiter Oxygen Corporation 4825 N. Scott St., Suite 200 Schiller Park, Illinois 60176 United States of America

www.jupiteroxygen.com info@jupiteroxygen.com



Accelerating Action: Business, Clean Energy Markets & the CTC&N

Giles Dickson, VP Environmental Policies

& Global Advocacy, Alstom



Alstom = low carbon infrastructure

Thermal Power



Renewable Power



Grid



Transport





C0 Members



ASSTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct on GWFCO and uniting or the Tobol above individuation of the transformed in this document is indicative only. No representation or warranty is and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.

Alstom and innovation



Thermal Power Presentation – September 2012 -ALSTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is by def or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.









IPR protection crucial to combating climate change

 crucial to development and deployment of low carbon technology

 commercial and economic incentive to invest in R&D

..... and to share technology and know-how

 weakened IPR and non-market based acquisition and pricing inhibits "technology transfer" and innovation

Thermal Power Presentation – September 2012 -SASTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.



Technology Transfer: hydro to India



Thermal Power Presentation - September 2012 -

ACSTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.

Technology Transfer: HVDC to China



Thermal Power Presentation - September 2012 -

ArgCTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.

ALSTOM





Thermal Power Presentation – September 2012 -

ASSTOM 2012. All rights reserved. Information contained in this document is indicative only. Near the second of the technical given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.





ASSTOM 2012. All rights reserved. Information contained in this document is indicative only. No represention of warran is on-OECD given or should be relied on that it is complete or correct or will apply to any particular project. This will be the technication of techni

Barriers to technology transfer

- Lack of understanding of what technologies are needed
- Absorption capacity: skills, infrastructure, law
- Absence of free markets
- Lack of IPR protection

Thermal Power Presentation – September 2012 -Over State Contract State State State State State



UN Technology Mechanism

- Help DCs create framework for technology absorption
- Exchange of best regulatory practice
- Help in planning and delivery of clean infrastructure:
 - -needs assessments
 - -financial support, linked to GCF
 - -promote public-private risk-sharing
- Channel industrial expertise to governments
- Channel local firms compete to supply chain
- Exchange information and experience between Centres, esp on MRV, needs assessments, and liability frameworks

Thermal Power Presentation – September 2012 -SAUSTOM 2012. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.



www.alstom.com

