Protecting Renewable Energy Assets

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Protecting Renewable Energy Assets

- Anthony J. Calega, AEGIS Loss Control, *Moderator*
- Robert Green, PSEG Services Corporation
- Doug Klein, AEGIS Loss Control
- David Croom-Johnson, AEGIS Underwriting, London
- Al Caceres, AEGIS Underwriting, New Jersey

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Investments in Renewable Technologies

Robert Green

Senior Consultant, Risk Management

Public Service Enterprise Group (PSEG)

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PSEG Corporate Overview

2009 Operating Earnings:	$1,579 million
Market Cap (11/10/09):	$15.8 billion

PSEG

PSEG

Traditional T&D

Electric Customers:	2.1 M
Gas Customers:	1.7 M

6,300 Employees

PSEG Power LLC

Regional Wholesale Energy

Nuclear Capacity:	3,669 MW
Total Capacity:	15,576 MW

2,600 Employees

Nuclear 1,500

Fossil – 1,000

ER&T – 100

PSEG Energy Holdings

PSEG Global

Domestic/ International Energy

100 Employees

PSEG Resources

Leveraged Leases

Service Corporation – 1,250 Employees

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PSEG Position on Climate Change

"Global warming is the most significant environmental issue of our time."

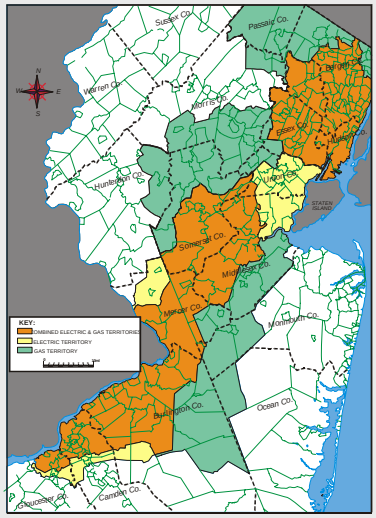
— Ralph Izzo, PSEG President, Chairman and CEO

PSEG believes in an integrated approach that

- Maximizes energy efficiency
- Invests in renewable energy, where it makes sense
- Supports clean, low and zero carbon central station power, including nuclear

PSEG

Public Service Electric and Gas Company



PSE&G Investments

Renewable energy

Benefits to ratepayers

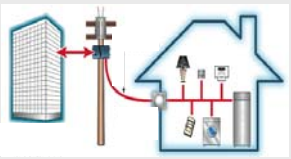
Benefits to PSE&G

Benefits to state

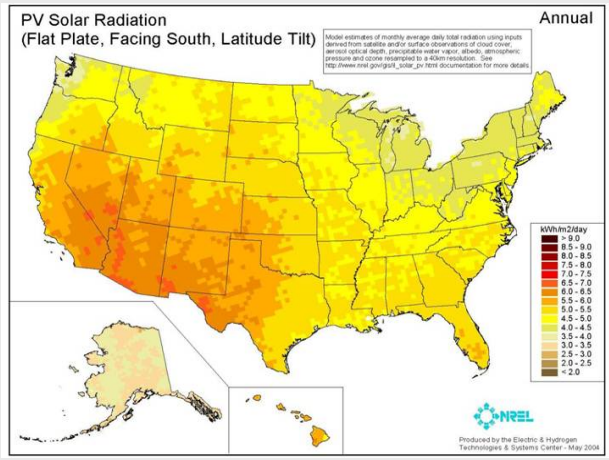
NJ Energy Master Plan Goals

PSE&G committed to state goals

PSE&G exploring disciplined investments to address NJ's state goals

Reduce energy consumption by 20% by 2020	Reduce peak demand by 5,700 MW by 2020	30% of energy supply will come from renewable sources by 2020
		
Energy Efficiency	**Demand Response**	**Renewables**
Consumption back to 2005 levels	**Placing information and control with customers**	**Wind, biomass, solar** **1800 MW in solar** ***2,518 Gwhr solar by 2021**

NJ Has Less Photovoltaic (PV) Solar Radiation than Other States…



Yet NJ is #2 in the US for total solar capacity!

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PSE&G's Solar Energy Initiatives

Solar 4 All™
$515 million investment, 80 MW
Construct, own and operate grid-connected solar installations

Solar Loans
$250 million in loans, 81 MW for homes and businesses repaid with SRECs

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Solar 4 All

PSE&G-owned solar – 80 MW

$515 million investment over next 2-3 years

Up to 40 MW of pole-attached neighborhood solar

Another 40 MW on PSE&G properties and third party sites

- >30,000 pole-attached units installed; ~6 MW
- In construction: four projects, 4.4 MW
- Under contract: eight projects, 15.2 MW

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Solar Loan Program

81 MW ~ $250 million

Loan: 40 to 60% of project's total cost

- Repay: in SRECs with floor price guarantee
- 15-year term for businesses
- 10-year term for homes

- Closed - 98 projects, $55 million in loans, 14.7 MW
- Pipeline - > 256 projects, >18.4 MW

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PSEG Solar Source

PSEG Solar Source LLC

Is the unregulated solar subsidiary of PSEG focused on developing, owning and operating reliable, safe, economical utility scale solar plants outside the PSE&G service territory.

Currently owns 30 MW of utility scale solar in New Jersey, Ohio, and Florida and has been recognized as a leader in large scale solar photovoltaic development in the US.

Solar Source Project Management

- Objective is to deliver a safe, reliable, economic and green project
- Full time “owner’s representative” responsible for construction monitoring including safety, contract compliance, environmental compliance, monitoring QA / QC, monitoring productivity
- Regular reporting reviewed by project team

Mars – Start of Construction May 15, 2009

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Mars – Site Completion September 15, 2009

- 2 MW AC thin film, ground mounted system
- 28,680 panels; eight inverters; one transformer
- 18 acre site
- Located in Hackettstown, NJ
- 2,650 MWh / year
- Completed ahead of schedule

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Mars Module Installation

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Mars Completed Array

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A Utility Scale Solar Plant – Modular Design

- 15 MW Jacksonville Electric Authority (JEA), solar plant
- 75 Watts per panel (200,000 panels)
- 10 panels per string (40,000 strings)
- 5 strings per array (4,000 arrays)
- 400 arrays per power station (10 power stations)
- 2 inverters per power station (20 inverters)
- 1 transformer per power station (10 transformers)

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Jacksonville Florida Project

- 15 MW DC thin film, ground mount
- 100 acres
- 200,000 panels;
  10 power stations;
  20 inverters;
  10 transformers
- Located in Jacksonville, FL
- Production 24,300 MWh / year
- 30 year off-take with JEA, the municipal utility for all energy, capacity and renewable energy attributes

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Wyandot Solar Project

- 12 MW DC thin film, ground mount
- 80 acres
- 159,200 panels; 8 power stations; 16 inverters; 8 transformers
- Located in Wyandot County, Ohio
- Production 15,800 MWh / year
- 20 year off-take agreement with AEP for energy, capacity and renewable energy attributes
- The facility achieved full commercial operation on May 26, 2010

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Wyandot Power Station

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Wyandot Power Station and Inverters

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Wyandot – Site Completion April 19, 2010

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PSEG Solar Source Projects

Completed

- PSEG – Mars solar garden for Mars Chocolate factory – 2 MW

Summer 2010

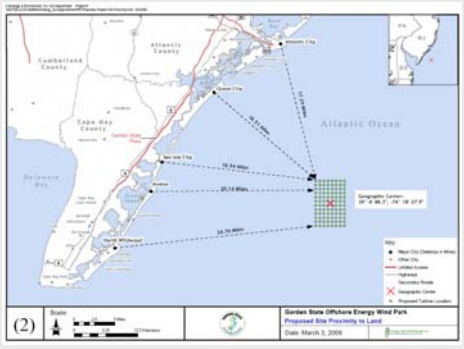
- PSEG – Jacksonville Electric solar field – 15 MW
- PSEG – Wyandot solar farm – American Electric Power – 12 MW

PSEG Solar Source LLC

PSEG Is Developing Wind Energy …

Garden State Offshore Energy LLC

- 50 / 50 joint venture between PSEG Renewable Generation and Deepwater Wind, LLC
- 350 MW offshore wind farm



PSEG Is Developing Wind Energy …

Garden State Offshore Energy LLC

- Energy to power 110,000+ New Jersey households
- Between 16.5 miles to more than 24 miles from nearest shore in water depths ranging from 75 to 110 feet
- Can displace approximately 595,000 tons of CO_2 annually (equivalent to 103,000 cars)
- Can create several hundred manufacturing supply chain jobs, port redevelopment opportunities, ~300 temporary construction jobs and 30-50 permanent operations jobs
- Earliest in-service date could be 2015 depending on efforts to streamline federal permitting process

… which could help launch the offshore wind industry

Benefits

- Create green jobs
- Attract and retain businesses in NJ
- Provide all customers access to solar energy
- Support the development of clean renewable energy technology
- Reduce pollution / carbon footprint
- Support State policy and NJ energy master plan targets

Protecting Renewables

Doug Klein, PE, CFPS, ARM

Senior Account Engineer

AEGIS Insurance Services, Inc.

Renewable Energy Occupancies

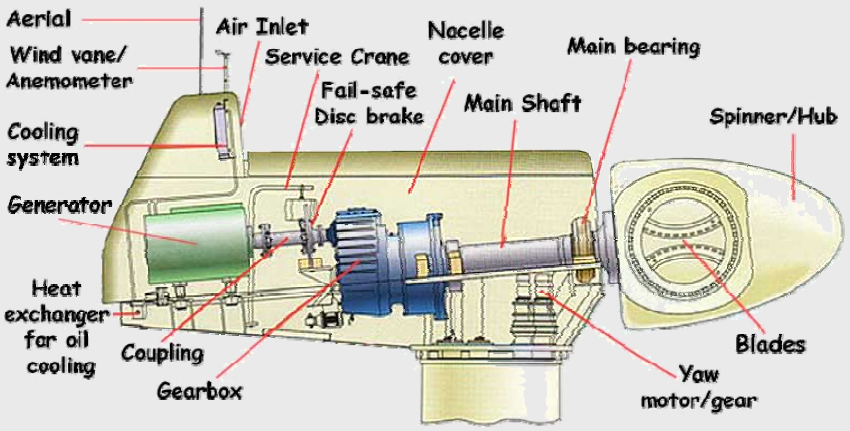
- Wind turbine / generators
- Solar photovoltaic
- Concentrating solar
- Biomass
- Geothermal
- Wave and tidal

Energy Storage Occupancies

- Hydroelectric pumped storage
- Batteries
- Compressed air storage
- Capacitors
- Flywheel energy storage

Wind Turbine Generation

Klein 2004



Google Images

Wind Turbine Loss Events

- Fire in nacelle
- Blade fire
- Fire at the substation step-up transformer
- Generator failures

Wind Turbine Loss Events

- Gearbox failures
- Blade failures
- Foundation failures

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Nacelle Fire Causes

- Lightning
- Generator insulation failure – arcing
- Electrical connection overheating – resistance
- Overheated brakes

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Nacelle Fire Causes

- Overheating of lubricating oil
- Cooling system failure
- Bearing friction
- Hot surfaces
- Work-related causes

Lightning Damage

- The risk of loss from lightning increases when the lightning protection system is not maintained or installed properly
- If the resistance of the lightning conductor path is too high thermal damage is likely to occur in the case of a lightning strike

Electrical Faults

- Failures in the electrical installations of wind turbines are among the most common causes of fire
- Fire is caused by overheating following overloading, shorting or arcing

Examples of Electrical Failures

- Failure of switches
- Failure of control electronics
- High contact resistance due to poor connections
- Transformer surges; voltage spikes

Combustible Materials in Wind Turbines

- Internal foam sound insulation
- Plastic nacelle parts and housing
- Hydraulic system oil
- Lubricating oil
- Transformer oil
- Electrical insulation, cable insulation

Fire Fighting

- Fire brigades have very little chance to fight most WT fires
- Prevention of secondary fires on the ground becomes the focus

WT Foundation Failures

- Recent event in Fenner, NY
- Root cause still under investigation
- Still a rare event

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Considerations Prior to Breaking Ground

- Is the planned foundation design suited to the soil conditions?
- Is the general contractor experienced in WT project management?
- Is the component transportation contractor experienced?
- Who will service and maintain the WTs after commissioning?
- Is there redundancy or a spare step-up transformer? (BI consideration)

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AEGIS Loss Prevention Inspections

Recommendations to lessen fire exposure

- Use non-combustible materials when possible
- Early detection systems
- Frequent and professional maintenance
- Automatic disconnection from power sources if fire is detected
- Training employees in hot work

Automatic WT Fire Extinguishing Systems

- According to GL Wind only 20 wind farms worldwide have fire suppression systems
  - Gaseous systems
  - Water mist systems
  - Combined systems offer the best of both worlds

Other Fire Prevention Measures

- Use only closed-cell foam insulating materials with washable surfaces so that impurities, oil, etc. cannot permeate the material
- Use cables with low flame-spread insulation
- Leaking fluids should be collected and removed effectively
- Do not store combustible materials within nacelles or towers
- Remove oil-soaked cleaning cloths

Solar Photovoltaic

Photovoltaic (PV) Loss Events

- Fire in supporting structures
- Hail damage
- Wind damage
- Vandalism, theft
- Lightning damage to diodes

PV Loss Mitigation

- Strengthening of outermost rows
- Choosing suitable cover pane for the expected hail diameter
- Adequate lightning protection systems

Concentrating Solar Generation

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Concentrating Solar Power (CSP) Loss Events

- Hail or wind damage
- Vandalism
- Molten salt solidification
- Heat exchanger issues
- Leaks in heat transfer oil operating above the flash point

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Renewables – Opportunities and Challenges for AEGIS

David Croom-Johnson
Chief Underwriting Officer
AEGIS London

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Contents

- Current landscape
- Insurance drivers
- Opportunities
- AEGIS capabilities
- Challenges

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Current Landscape

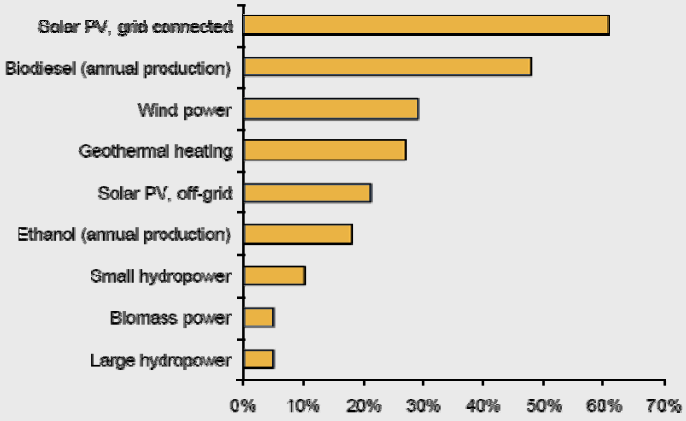
- The renewable energy insurance market has been growing at an average rate of between 25-40% since 2004
- Aon estimated worldwide premiums to be in the region of $400 million in 2009
- Estimated aggregate capacity in 2009 was $2 billion
- With government directives and commitments to produce a percentage of energy through renewable sources means an increased demand for insurance of new build plants

Current Landscape

- The primary drivers for this insurance demand will partly be led by lending conditions
- The insurance of renewable energy is developing aggressively as an increasing number of insurers are entering the market
- AEGIS has been providing capacity for renewables for many years both in the mutual and in London

Annual Growth Rates for Renewables

Annual growth rates of renewables 2002 – 2006



Source: Ren21, Renewables 2007 Global Status Report

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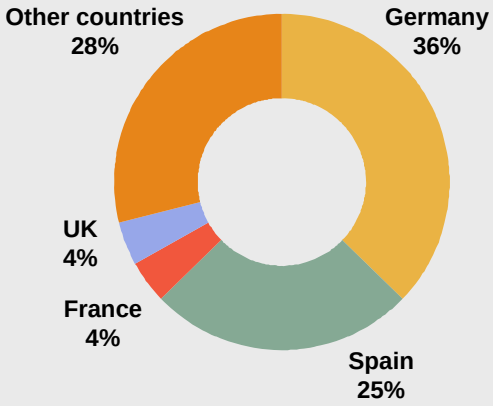
Wind Capacity in Europe

European installed wind power capacity 2008 – 65.9 GW



Source: EWEA

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The Projected Growth of Wind

World Wind Energy – Total Installed Capacity (MW) 2001-2010

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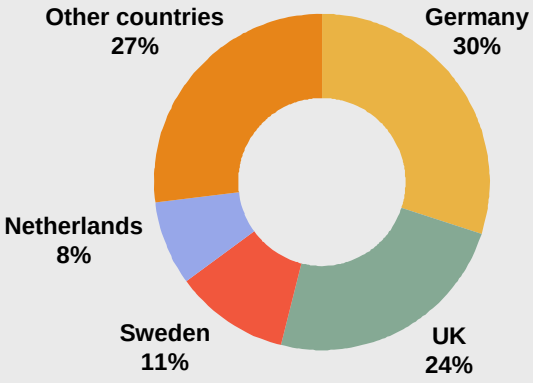
Planned Offshore Wind Projects

Offshore wind power planned for 2015 – 30.9 GW



Source: EWEA

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Renewables – Opportunities and Challenges for AEGIS

Al Caceres

Senior Property Underwriter

AEGIS New Jersey

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Introduction

- The renewable energy sector has been actively publicized the past few years, mainly due to the increased cost of oil and greenhouse gas emissions
- AEGIS New Jersey property currently writes over 13,000 MW, more than 40%,of alternate energy in North America
- In response to the heightened attention on renewable energy, AEGIS has made the strategic decision dedicate resources to underwrite the renewable energy segment

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Strategy

- Underwriting approach consistent with philosophies used on traditional book of business
- Focused on both construction and operational risks primarily for wind and solar
- Ability to successfully underwrite this class of business by
  - In depth understanding of the technologies involved
  - Risk selection based on
    - Best practices and strong engineering principles
    - Sound program with sustainable terms, conditions and pricing

Strategy

- Ability to successfully underwrite this class of business by
  - Dedicated loss control and underwriting resources
    - Doug Klein – Loss Control Div.
      - OEM and Member liaison
      - Will compile database of technical information letters (TILs) to share with underwriting and members
    - Al Caceres – Property Underwriting Division
  - Focused to write 100% of smaller, stand alone projects
  - Lead quota-share on large projects
  - Provide capacity for onshore risks in North America

Underwriting Exposures

Differ from traditional power plants

- Traditional coal and gas
  - Concentration of heavy machinery
  - Each prime mover creates large amount of MW's
  - Each machine has high dollar value
  - Low frequency of loss / large value of loss
- Renewables
  - Large spread of many small units of machinery
  - Each unit produces small amount of total output
  - Relatively small dollar value associated with each machine
  - Greater frequency of loss / smaller value of loss

AEGIS New Jersey Property Capabilities

- Policies for construction, operational and combined construction and operational
  - Wind
  - Solar
  - Geothermal
  - Biomass
- Property coverage
  - Up to US $200 million
    - Full limit available and non-cancelable for construction projects, term up to five years
    - Periods longer than five years available on case by case basis

New Jersey Property Capabilities

- Single policy can cover
  - Initial construction
  - Hot testing
  - DSU (delay in start up)
  - First full year of operation
  - All time element coverages
  - All traditional extension of coverages – sublimits will apply
- Separate policies providing same coverages available
- Property program credits available for eligible policies

Excess Liability

- Renewable operational risks
  - Excess liability coverage
    - US $35 million limit
    - Excess over a minimum underlying insurance or a self-insured retention of $200,000 each occurrence
    - Coverage is written on a claims-first-made basis with flexibility on the policy form
    - For US members, AEGIS policies will be issued on a surplus lines basis. For Canadian members, AEGIS policies will be issued on a Canadian licensed basis.
    - Continuity credits available for eligible policyholders

Excess Liability

- Renewable construction risks
  - Excess liability coverage - construction risks
    - US $25 million limit
    - Coverage is written on an occurrence basis
    - Policies will be issued on AEGIS non-admitted paper
    - Multi-year policy options can be tailored to each construction project
    - Continuity credits available for eligible policyholders

AEGIS London Capabilities

- Property
- Construction
- Casualty
- Offshore
- Cargo

Challenges

- Technology
- Positioning of assets in catastrophe regions
- Tax credits
- Green energy v. fossil fuels
- Everyone wants to be part of it
- Blowing in the wind!