P21 – Power for the 21st Century

Holland Board of Public Works

Communications Plan

John Van Uffelen

Holland Board of Public Works

Communications Plan Scope and Purpose

- Provide information and encourage open dialogue on generation options for Holland through a schedule of various open meeting events and topics.

Holland Board of Public Works

Communication Plan Desired Outcomes

- A community that has an educated and balanced perspective of the options available for electric generation
- A wide range of community input

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Schedule of Events

Historic

- **Wednesday, September 28, 7:00pm HDR RAP Session #1.**
- **Thursday, October 6, 7:00pm:** Topic – Fuels
- **Thursday, October 13, 7:00pm:** Topic – Generation Types
- **Thursday, October 20, 7:00pm:** Topic – Regulations
- **Thursday, October 27, 7:00pm:** Topic – District Heating
- **Thursday, November 3, All day -**9am – 4:30 **HDR RAP Session #2.**
- **Thursday, November 10, 7:00pm:** Topic – Electric Transmission

Holland Board of Public Works

Schedule of Events

Upcoming

- **Thursday, November 17, 7:00pm:** Topic – Conservation & Energy Optimization
- **Tuesday, December 13, 7:00pm:** – John N. Doggett is a Senior Lecturer of International Entrepreneurship, Management and Sustainability at McCombs and a Senior Research Fellow at the University of Texas at Austin's (UT) IC2 Institute
- **Mid-January –** Preliminary results – SROI and economic costs
- **February 8**- Charrette

Fuel Discussion Highlights

Dave Koster

Fuels

Coal

- EIA Forecast World Coal Consumption Increases 50% from 2008 to 2035
- United States holds 29% of Worldwide Recoverable Reserves
- US Reserves are well over 200 times the current annual production of 1 Billion tons
- 2010 US Exports up 36% from 60 to 81 Million Tons: 2011 Forecast 100-105 MT. US suppliers are investing in additional export port capacity
- Coal makes up 43.5% of the Net Generation in US for 2011
- Coal-based kWh increased 180% from 1970 to 2010 while emissions of NO_x and SO_x have decreased over 60%

Fuels

Natural Gas

- Pro's: Large US Resource, Burns Cleanly, Gas Generation relatively easy to site and construct
- Con's: Fracking Issues, Gas Price Volatility, Delivery Space Concerns
- If all coal switched to NG, US Consumption would climb from 23 Tcf to 37 Tcf
- Significant shale gas supply and resulting low prices due to producers focus on oil-associated liquids
- "Fracking" uses 4.5 MG of fluid per well (98% water) and is currently exempt from Clean Water Act
- Gas as a "base-load" fuel requires firm delivery of gas

Fuels

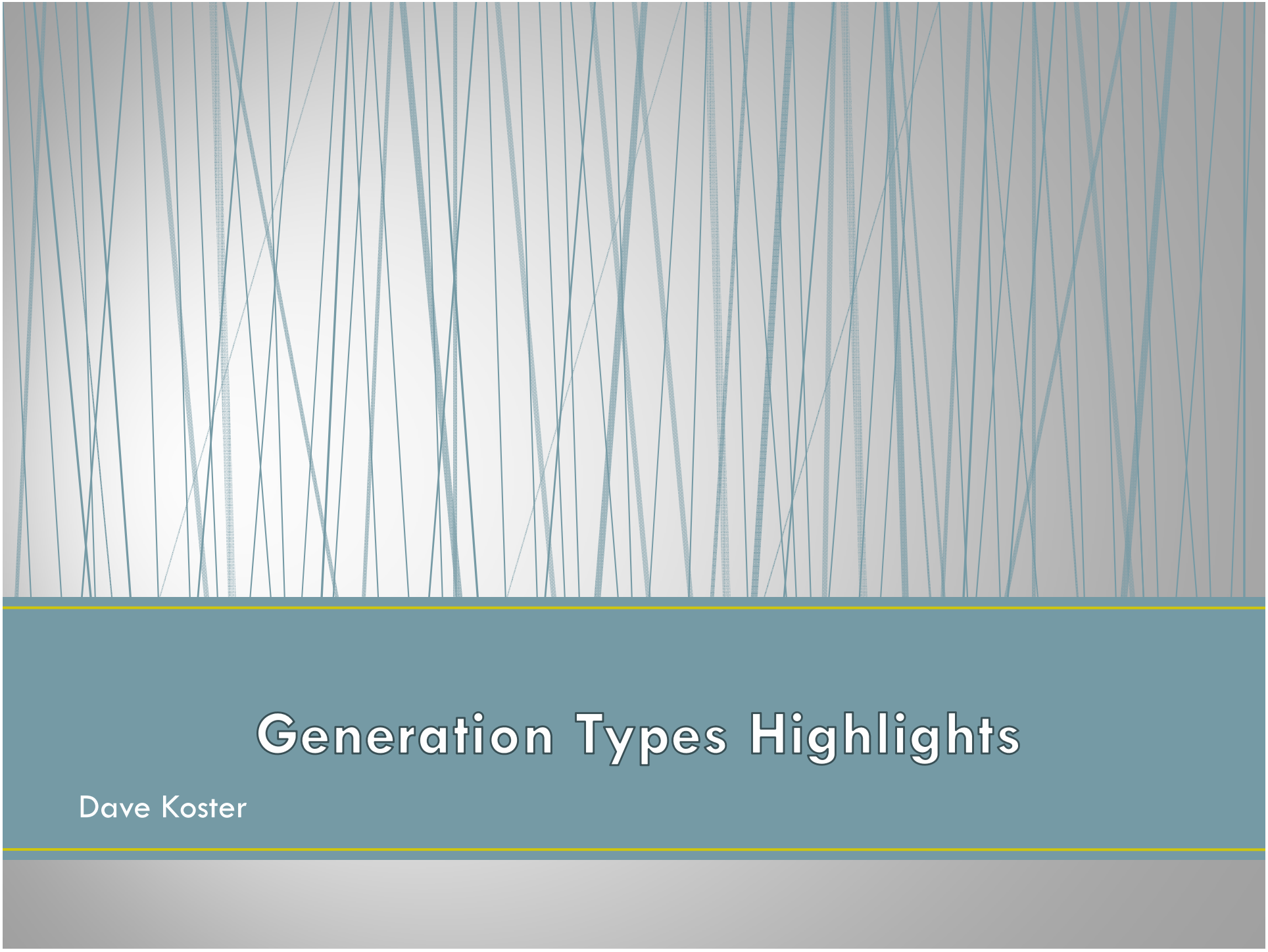
Biomass

- 94 Million Tons of timber within “woodshed” (100 mile radius)
- Demand has reduced with the closure of paper mills in the area
- 489,000 annual tons Whole Tree Chip, Sawmill Chip and Saw Dust identified around $30 to $35 per ton

Fuels

Renewable Fuels

- Public Act 295 of 2008 calls for all Michigan electric suppliers to provide 10% of sales from renewable sources
- Qualifying sources must be located in Michigan
- Four Wind Energy Resource Zones in Michigan – Allegan County is one of those
- Allegan potential ranges from 249 MW of capacity and 748,000 MWh of annual production to 445 MW of capacity and 1,338,000 MWh of annual production
- 966 MW of wind contracts expected to be operational in Michigan by 12/31/2012
- Levelized cost of renewable contracts falling steadily from over $110 per MWh in 2009 to around $70 per MWh in 2011
- Solar: DTE 20 MW, CE 5 MW through Feed-In Tariffs



Generation Types Highlights

Dave Koster

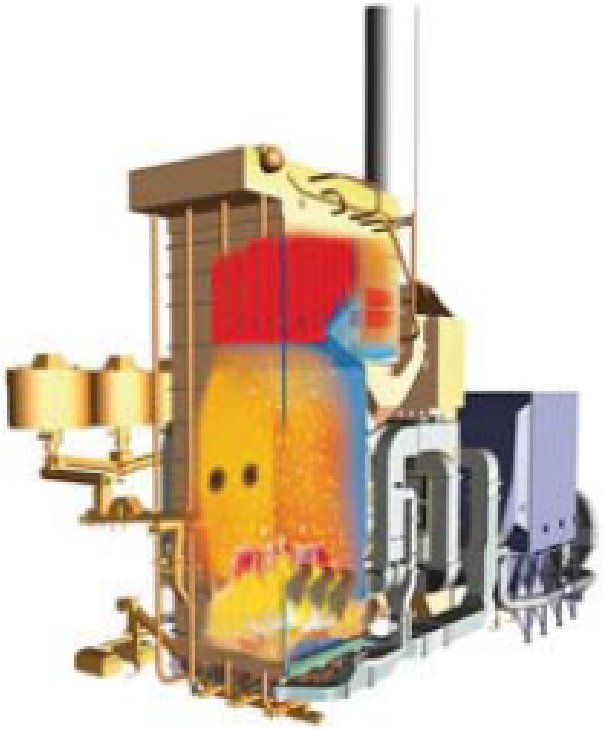
Generation

Steam Power Plants

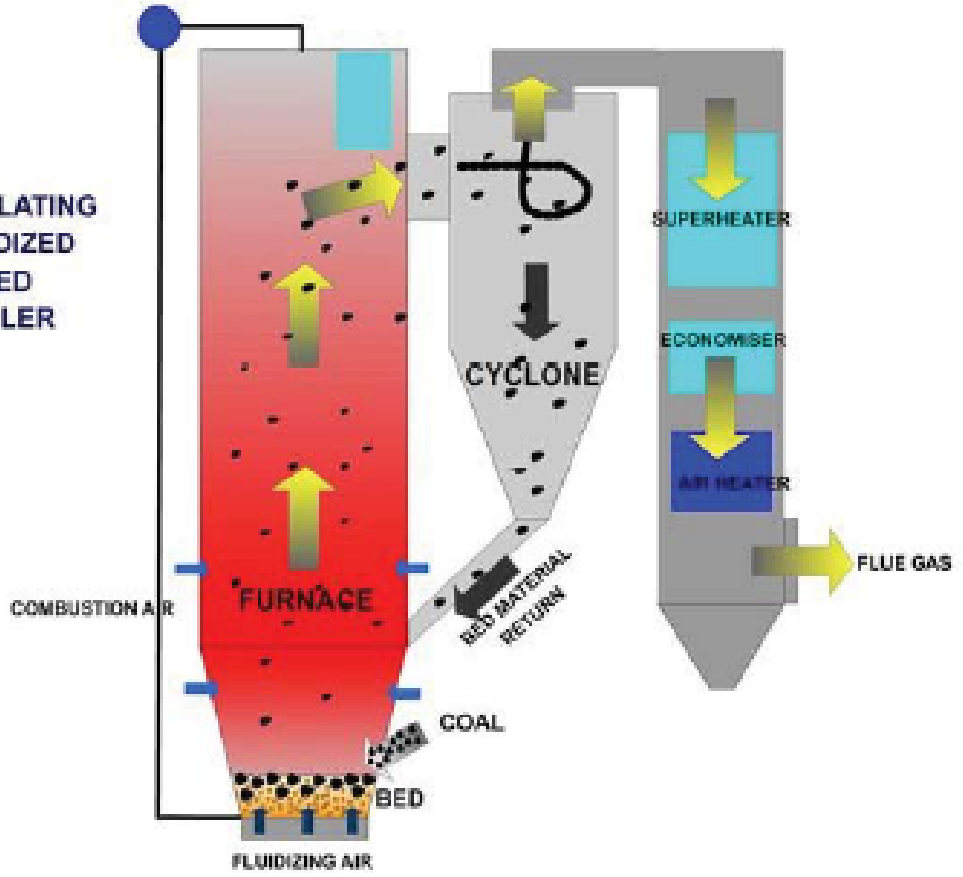
- All use “Rankine Cycle”
- Typical Thermal Efficiency of 30-40%
- Current De Young plant is pulverized coal technology
- Proposed Unit 10 is Circulating Fluidized Bed

Solid Fuel Boiler Types
Fluidized Bed Combustion

Bubbling
Fluidized
Bed
Boiler



CIRCULATING
FLUIDIZED
BED
BOILER



Generation

Steam Power Plants

- Pros: Fuel Flexibility, inherent emission controls, can be used for CHP
- Cons: Capital Intensive, less efficient than natural gas plants, higher emissions than gas, wind, solar

Generation

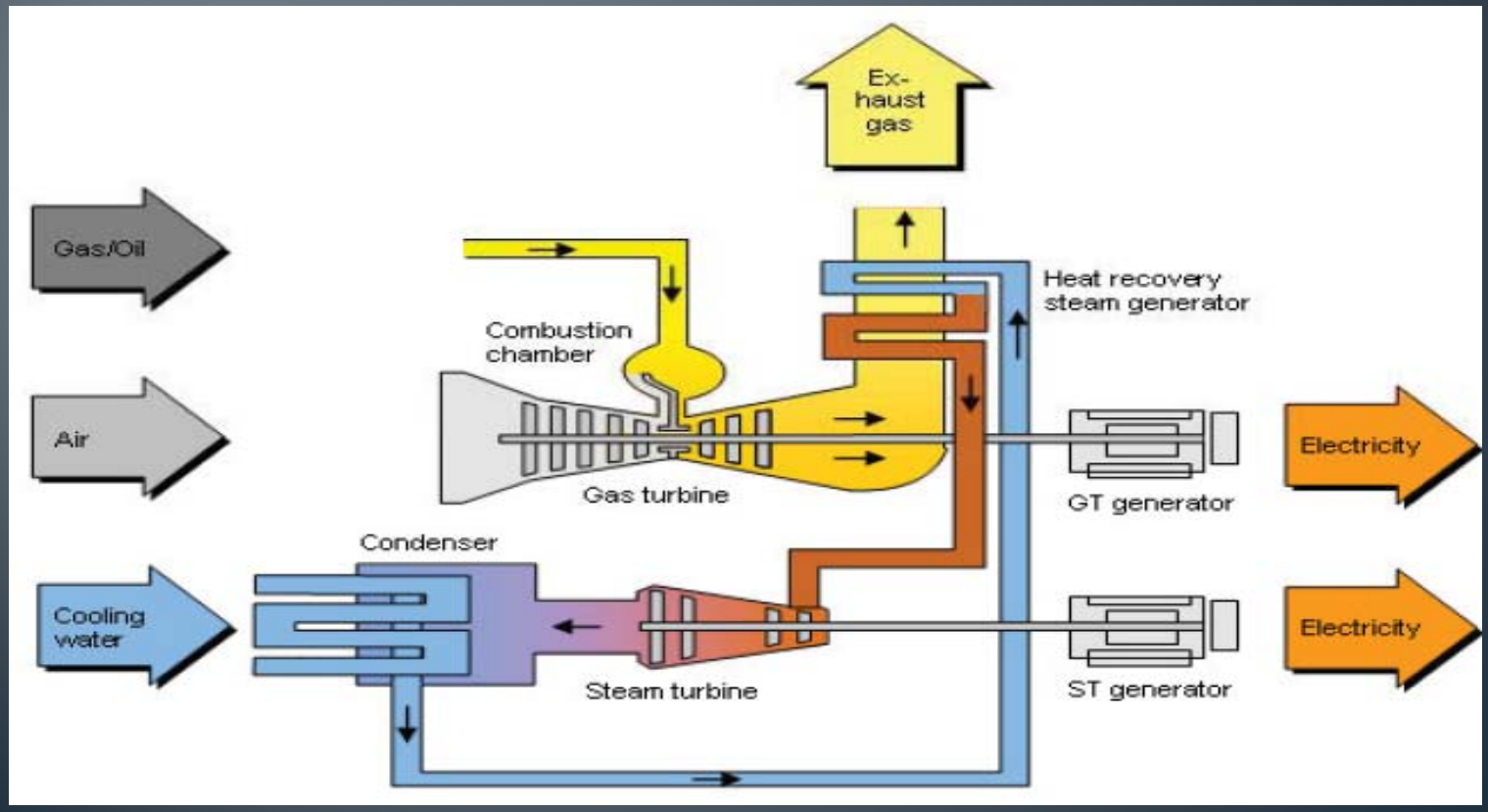
Combustion Turbines

- Use "Brayton Cycle" – Like a jet engine
- Typical Thermal Efficiency of 35-45%
- Current operations at 6th and College as well as on 48th Street use simple-cycle combustion turbines

Generation

Combined Cycle Plants

- Use both Rankine and Brayton Cycle by capturing heat loss from simple-cycle unit and making steam with it.



Generation

Combined Cycle Plants

- Typical Thermal Efficiency of 50-60%
- Pros: Quicker and less expensive to construct, higher efficiency, better emissions
- Cons: Higher fuel costs and no fuel diversity, output dependent on ambient temperatures
- Existing equipment can be retrofitted to become part of a combined cycle plant
- Combined cycle and simple cycle plants can also be used in CHP applications

Generation

Wind Turbines

- No emissions
- Intermittent Resource (25-35% capacity factor)
- Land-Use 20-80 acres per MW (but can support multiple use)
- Environmental impacts include noise, avian mortality, aesthetics, shadow flicker

Generation

Solar Power

- Photovoltaic: 10-20% efficient depending on type
- Concentrated Solar Power: sun redirected to heat water 400 to 1000 ^F

Regulations Highlights

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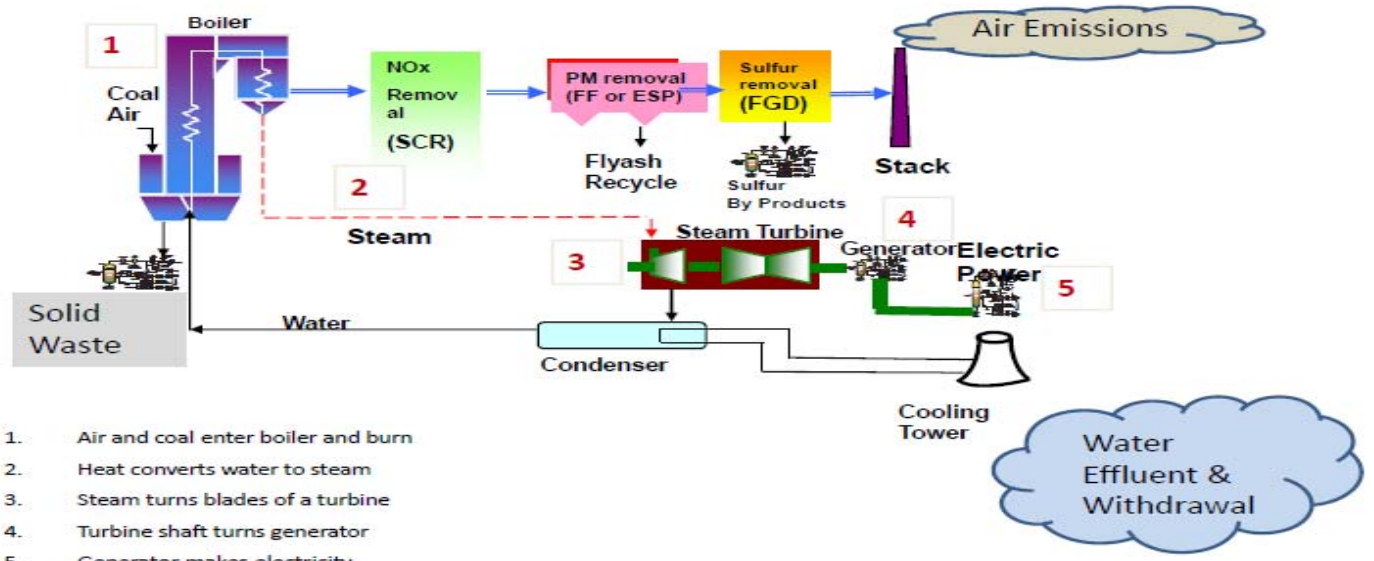
Regulations

- Significant new regulations affecting the electric industry
- Categories include Air, Water, Solid Waste and Climate

Everything leaving a power plant is regulated



1. Air and coal enter boiler and burn
2. Heat converts water to steam
3. Steam turns blades of a turbine
4. Turbine shaft turns generator
5. Generator makes electricity

Regulations

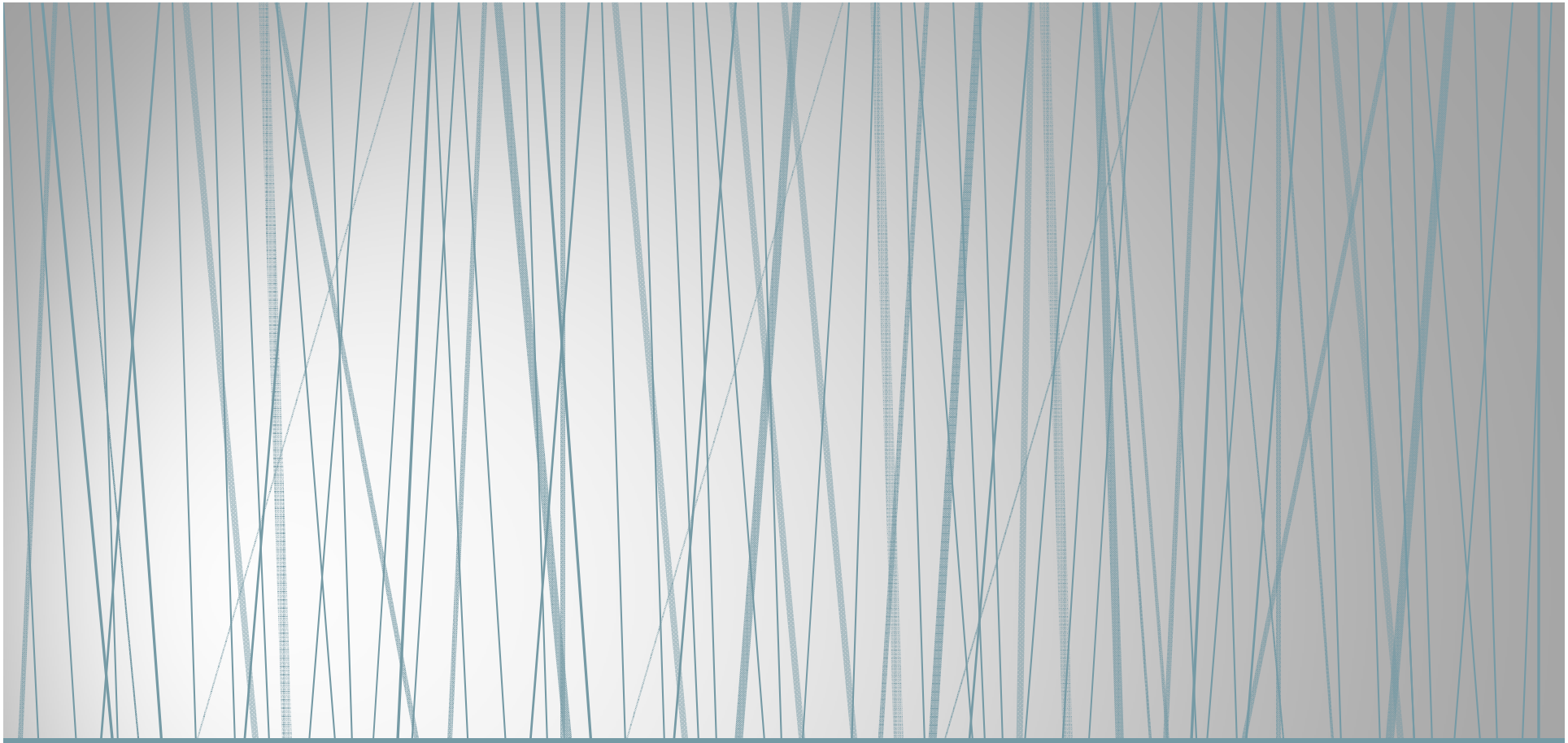
- Air regulations are intended to ensure National Ambient Air Quality is met
  - Michigan is currently in attainment for all standards except PM 2.5 in Southeast Michigan
  - Cross-State Air Pollution Rule: Seeking Reductions in NO_x and SO_2
  - New Source Performance Standards
  - Hazardous Air Pollutants – MACT Rule addressing Hg, PM and HCl

Regulations

- Water Regulations deal with both withdrawals and discharges
  - 316B to address impingement and entrainment of aquatic species
  - Effluent guidelines to address wet ash storage a scrubber wastewater
- Solid Waste
  - Significant rule concerning classification of coal combustion residuals (ash)
  - Decision pending whether to regulate is a hazardous material
  - Currently it is considered a “low-hazard industrial waste” and can be placed in a Type III landfill or recycled for use in cement, road aggregate or wallboard

Regulations

- Climate
  - As of January 2011, EPA is regulating CO_2 as a pollutant.
  - New plants have to demonstrate use of Best Available Control Technology for GHG controls
  - New Source Performance Standard pending for GHG as well



District Heating Highlights

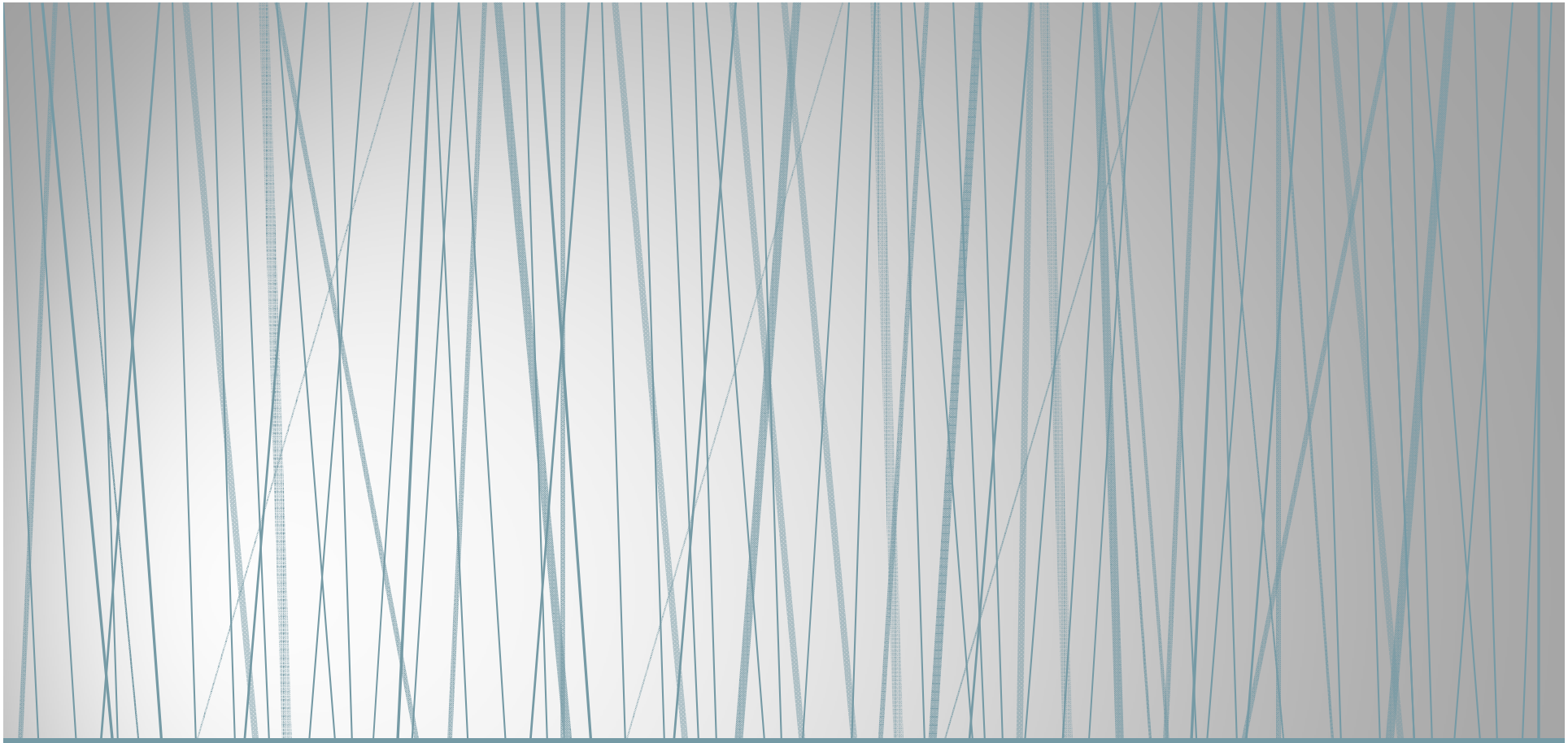
Dave Koster

District Heating

- Various ways to use waste heat from a generation process
  - Condenser cooling water discharge
    - Low temperature (95 ^F) water for snow melting
    - 70 ^F return water from snowmelt for heat pumps
    - Lower temp allow HDPE pipe
    - Larger diameter piping
    - Geothermal integration
  - Low pressure extraction steam from turbine
    - Provide either steam or 200-250 ^F pressurized hot water
    - Smaller piping
    - Direct connection for buildings with hot water systems
  - Boiler steam either from flue gas of a CFB or from the heat-recovery steam generator in a combined cycle unit
    - Can provide same conditions as extraction steam

District Heating

- Typical office energy uses: 7% for heating and 28% for cooling
- Typical Single Family Home: 40% heating and 17% cooling
- Opportunities exist between various energy users independent of power generation decision impact



Transmission

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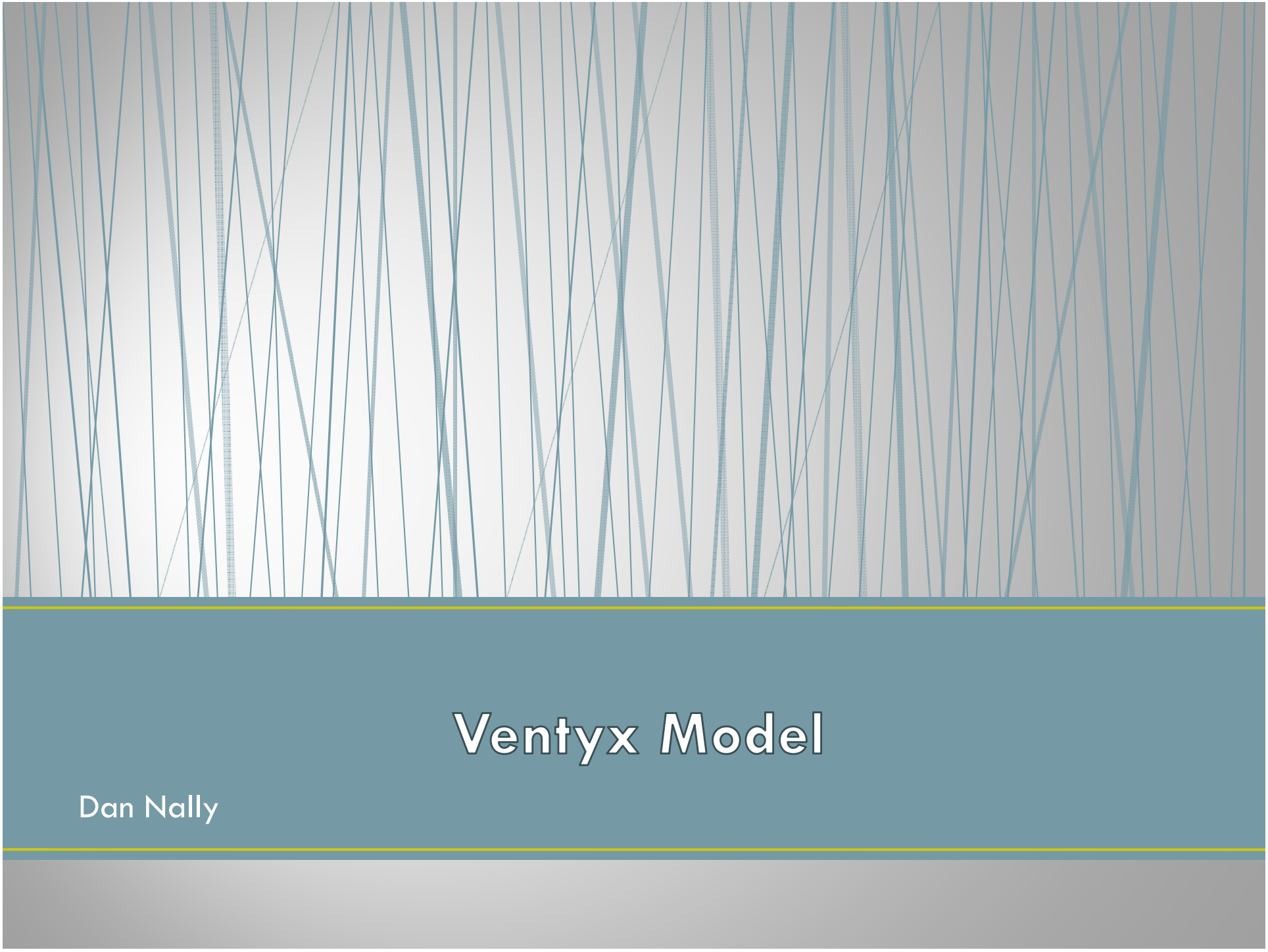
Transmission

- While a consideration in the decision in new generation not likely to be a major factor.
- Lower risk involved with generation being close to the load.
- Significant investments in transmission likely to drive up cost of use of the system.



Ventyx Model

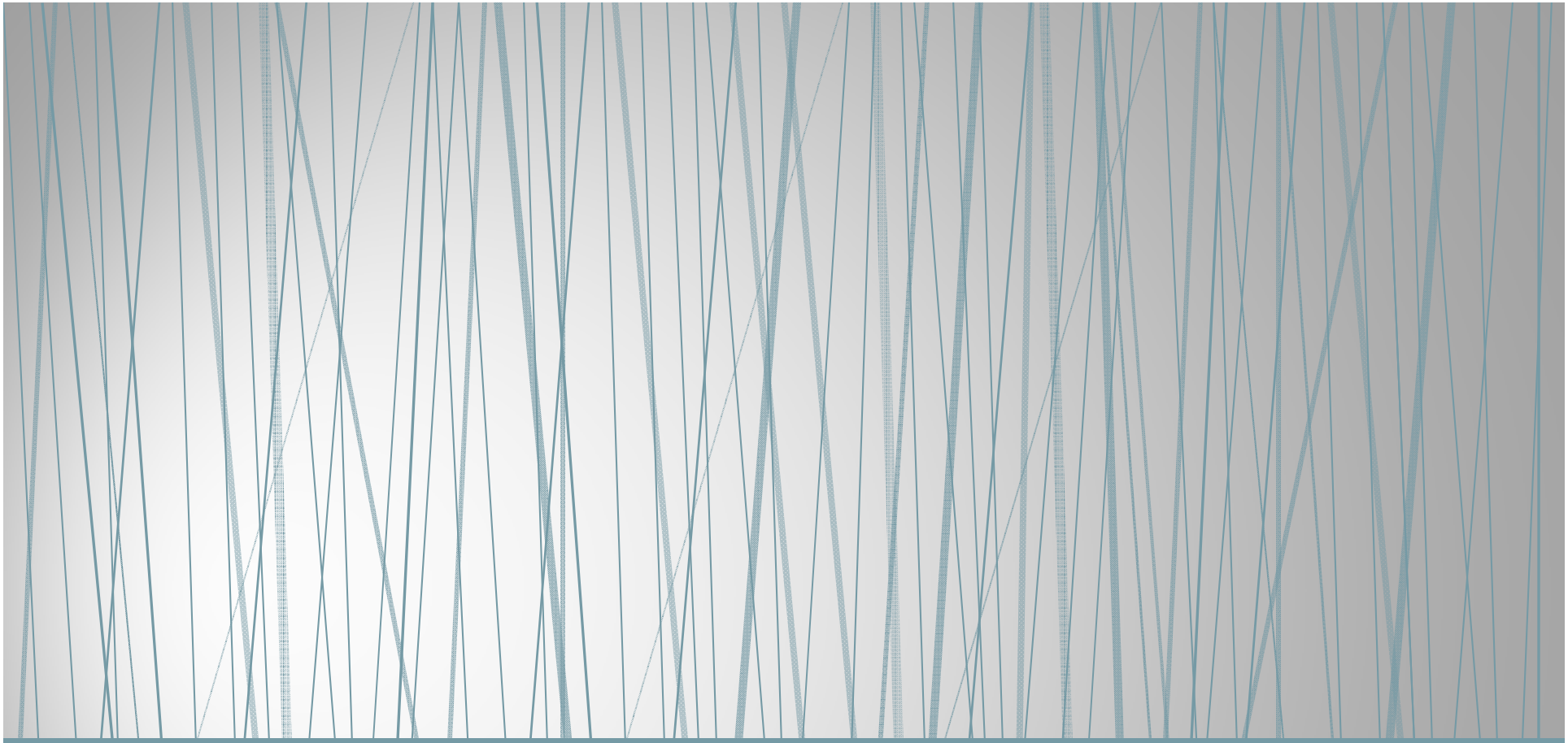
Dan Nally

Table 2 - Investment Scenarios

Item	Base Case $M	Scenario A $M	Scenario B $M	Scenario C $M	Scenario D $M
70 MW Solid Fuel	$270			$270	$270
20 MW Industrial CHP		$40	$40	$40	$40
55 MW CCGT		$90	$90		
Industrial DH Network		$10	$10	$10	$10
Downtown DH Network		$10	$10	$10	$10
SFH Retrofit - Toal Investment		$125	$125	$125	$125
SFH Retrofit Owner Share		-$63	-$63	-$63	-$63
Refrigerator Incentives	$0	$1	$1	$1	$1
AC Buyback (7,500)	$0	$2	$2	$2	$2
Industrial Efficiency		$0	$0	$0	$0
Solar PV (8 of 24MW)			$32	$32	
37 MW_{nom} Wind			$111	$111	
Additional Snow-Melt					
Total 2030 Investment	**$270**	**$215**	**$358**	**$538**	**$395**
Total Additional Capacity	**70MW**	**55MW**	**100MW**	**170MW**	**125MW**
Investment / Capacity	**$3.86/MW**	**$3.91/MW**	**$3.58/MW**	**$3.16/MW**	**$3.16/MW**

Ventyx Model

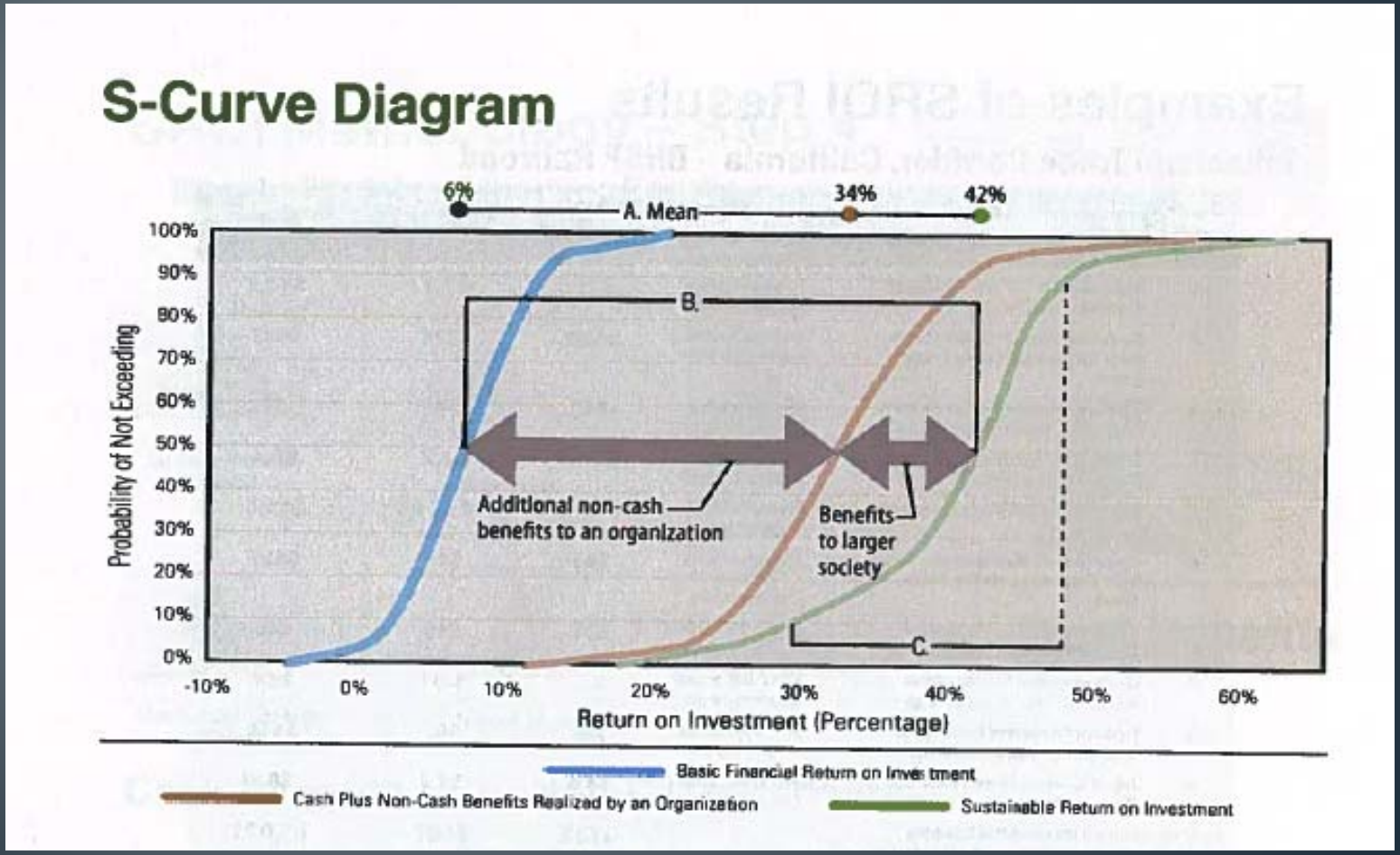
- HDR updates costs for options:
  - Capital
  - Financing
  - Operations and Maintenance
- Updated costs used as input for Ventyx Strategist model to ultimately provide COE
- Output from Ventyx modeling used as input for SROI process



Sustainable Return on Investment (SROI)

Dan Nally

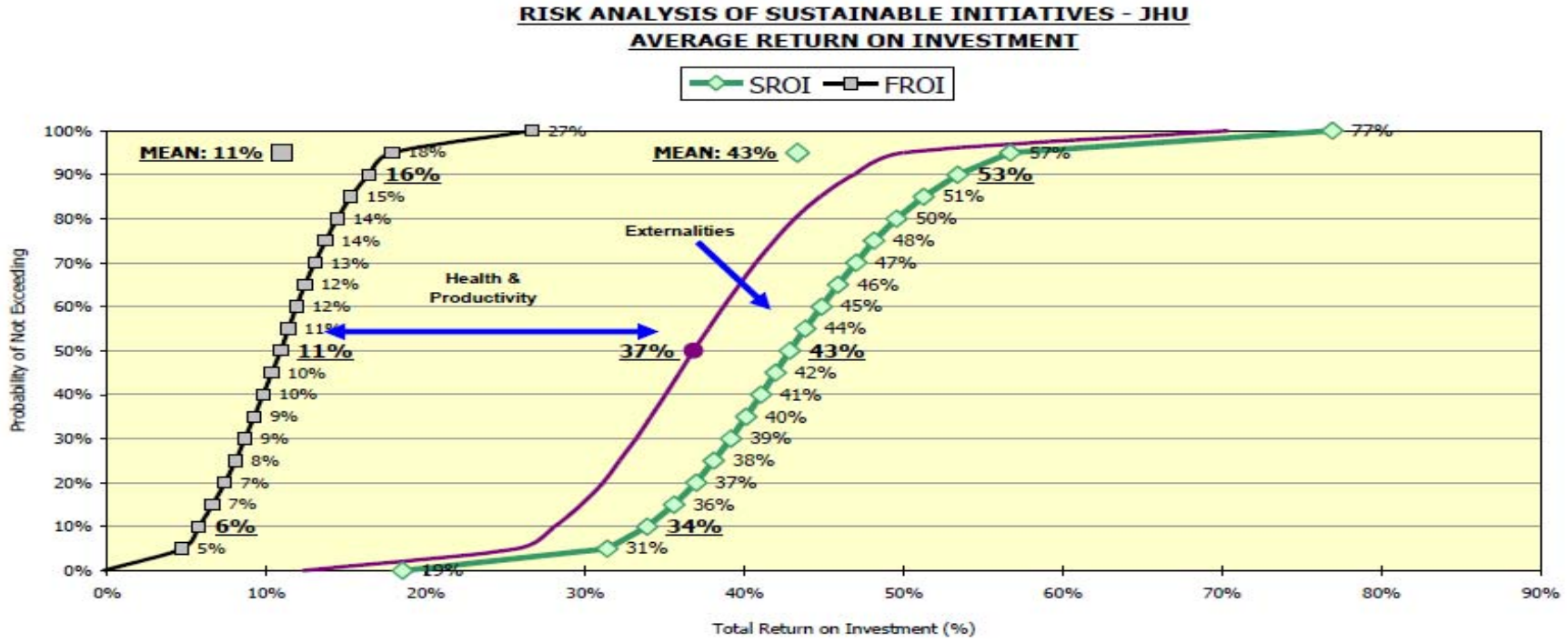
SROI


S-Curve Diagram
6%
A. Mean
34%
42%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Not Exceeding
B.
Additional non-cash benefits to an organization
Benefits to larger society
C.
-10%
0%
10%
20%
30%
40%
50%
60%
Return on Investment (Percentage)
Basic Financial Return on Investment
Cash Plus Non-Cash Benefits Realized by an Organization
Sustainable Return on Investment

SROI

Examples of SROI Results

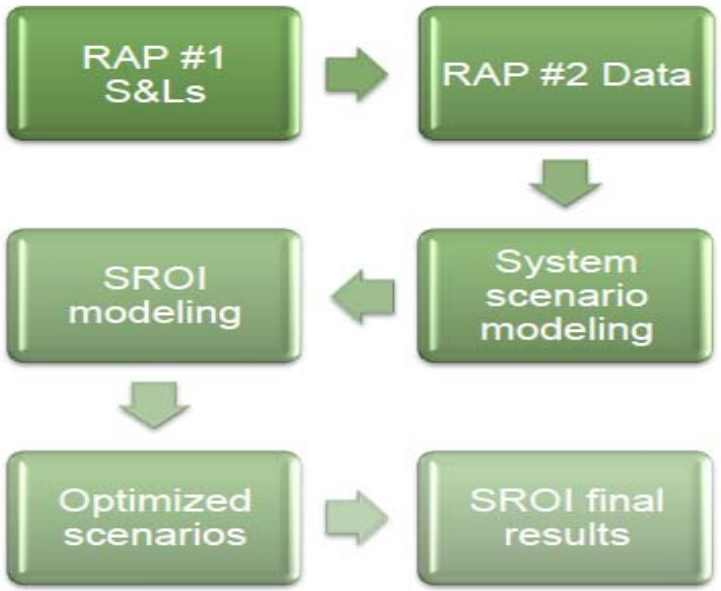
Campus Sustainability Initiative, Baltimore - John Hopkins University



SROI

SROI Process for Holland BPW

- **RAP Session #1 (Today) – Review Structure and Logic**
- **RAP Session #2 (Nov. 10) – Consensus on Data Inputs**
- **Other public meetings:**
  - Fuel prices
  - Regulatory matters
  - Generation types
  - Transmission
  - Holland BPW Board
- **SROI modeling (Nov.-Dec.)**
- **SROI Results (New Year)**
- **Public Meeting on Results**



HDR

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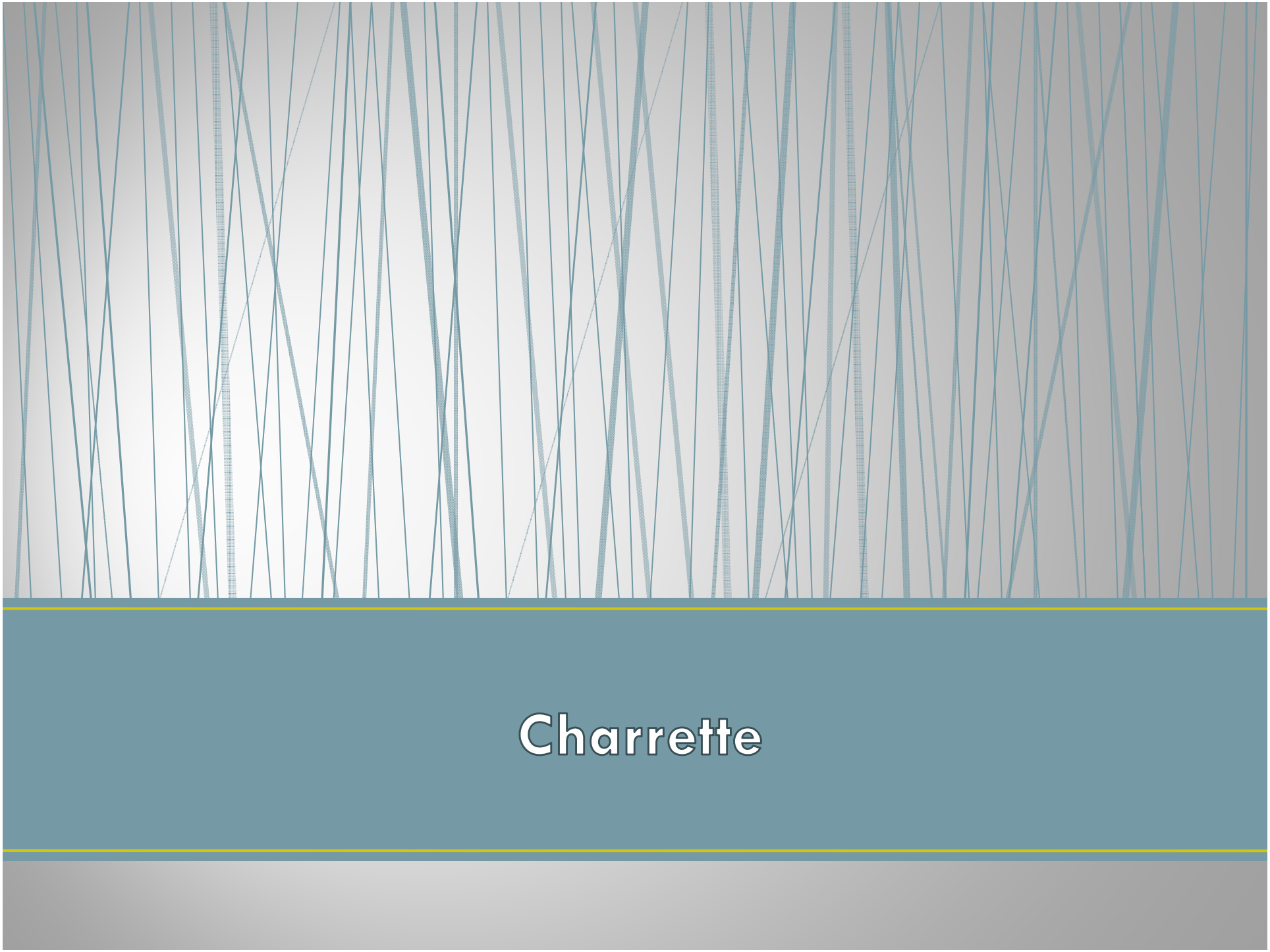
Charrette

Charrette

- Tentatively scheduled for February 8, 2012
- Location TBD
- 7am – 5pm proposed, details to follow
- Full Board of Directors, City Council, RAP session participants.
- Base load generation recommendation is expected to be made as an outcome of this meeting.

Questions ?

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