RIMS CANADA™

Proudly Presents…

Future Plans and Future Risks of Going Green

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Solar Growth – Public Policy Context

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Outline

- Current and Future Policy context
- Green Energy Act
- Public Sector projects

Sustainability Goals

Social Well-Being

Healthy Environment

Economic Prosperity

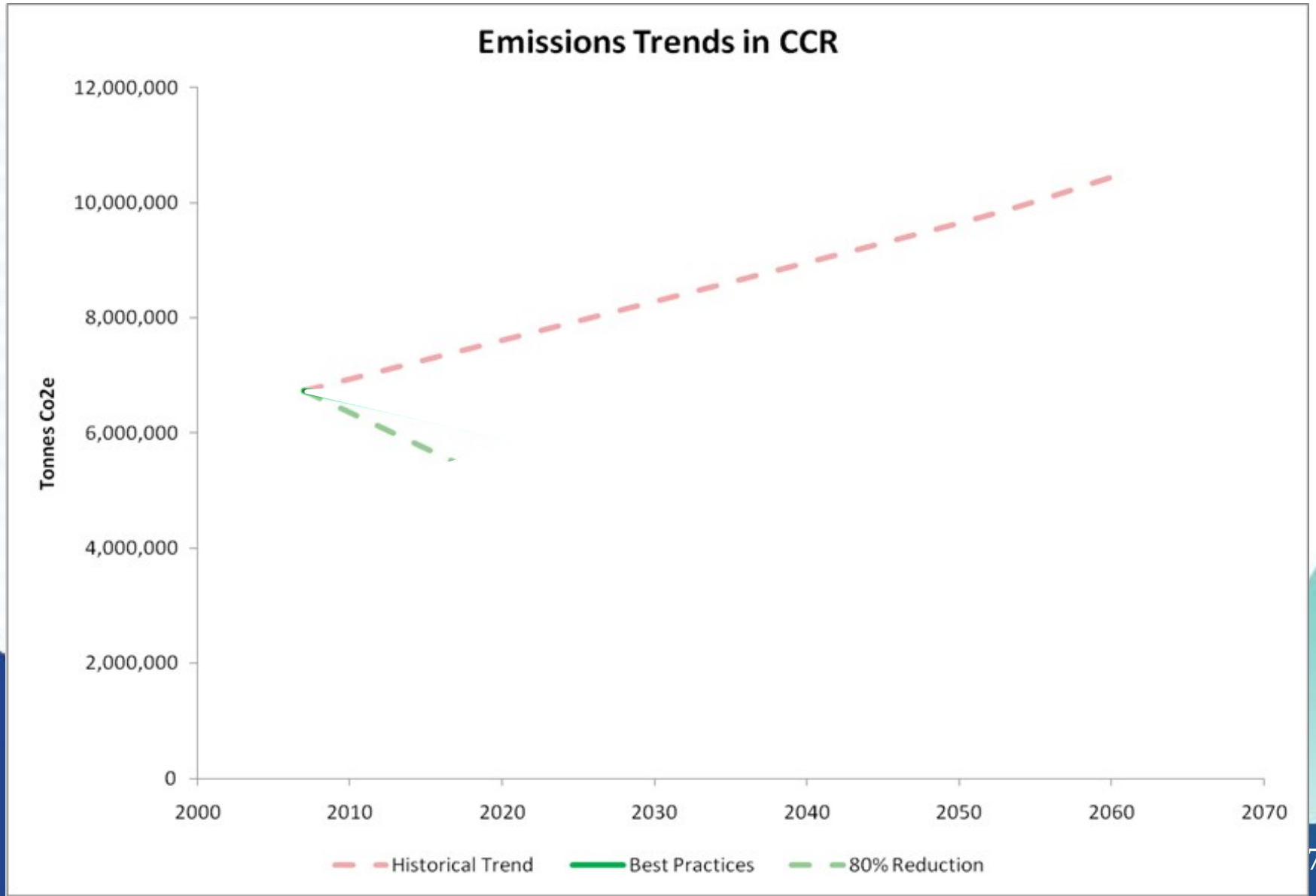
Culture & Identity

Energy & Emissions

Emissions by Sector in CCR (2007)

rgy Use by Sector in CCR (2007)

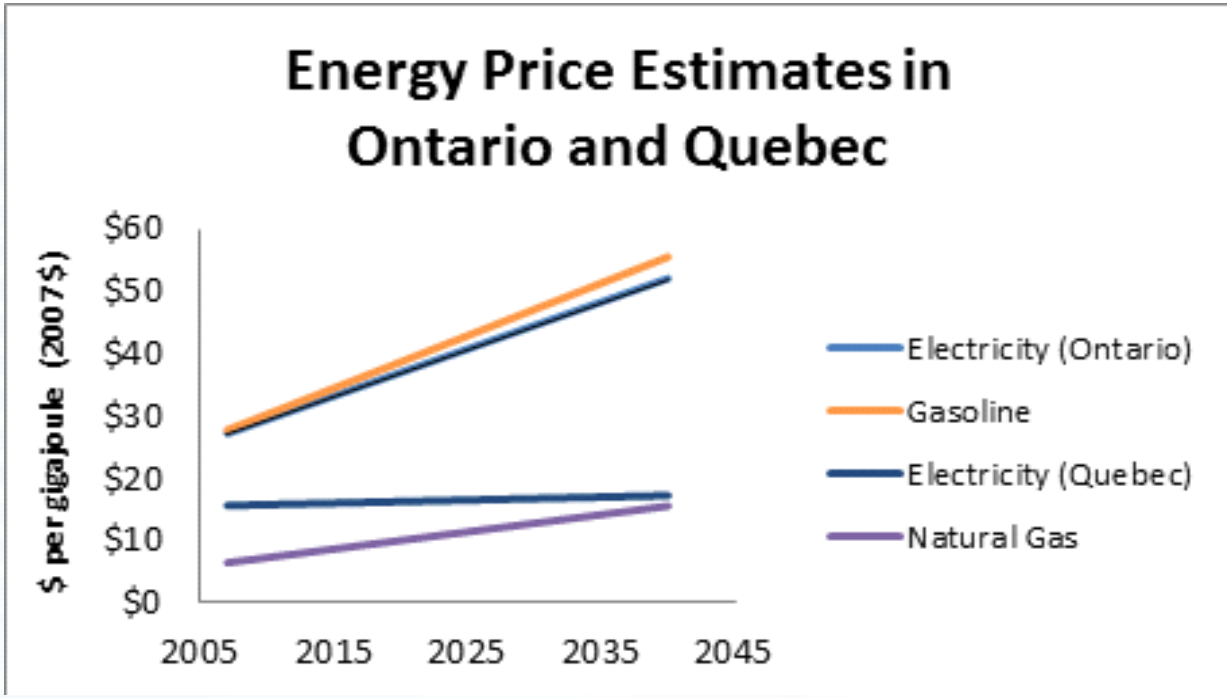
GHG Projection: Historical Trend



Rising, Volatile Energy Prices

Resource Scarcity

Der



Land Use, Growth & Urban Form

1. Connected, compact, complete communities
2. Retrofit the suburbs
3. Sustainable greenfield development

4. Mixed use redevelopment of federal office nodes
5. Rural growth in villages
6. Good design
7. Education

Mobility

1. Integrated land use and transportation systems
2. Complete streets
3. Alternative goods movement
4. Transition to electric vehicles

Materials & Solid Waste

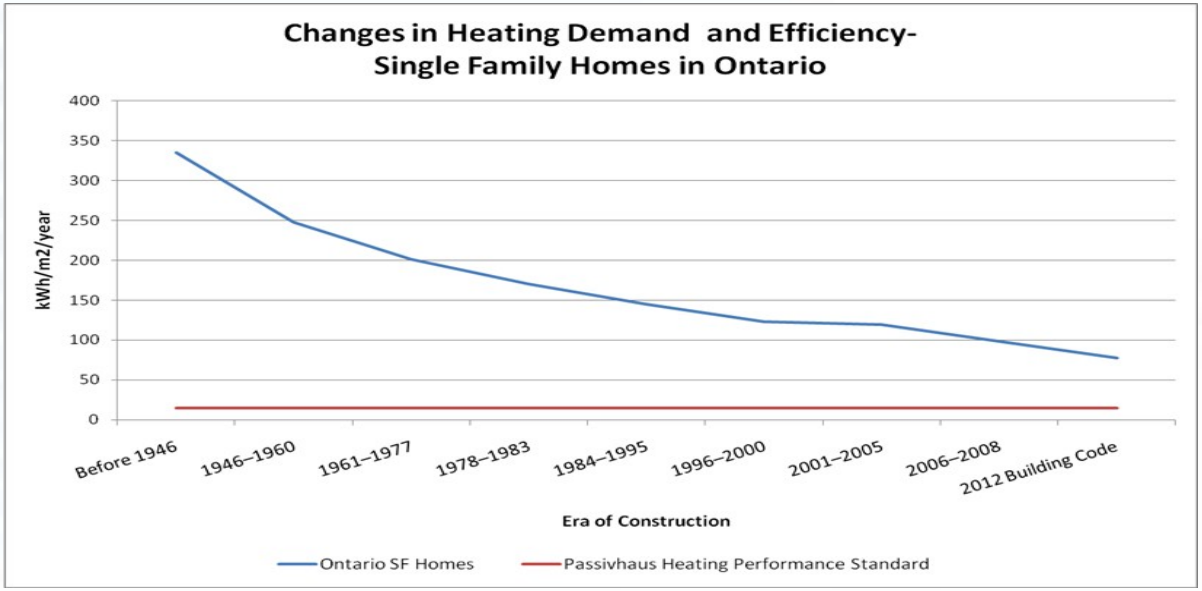
1. Cradle-to-cradle
2. Aggressive waste reduction
3. Transition from fossil fuel dependency

Residential Building Energy Use

Ontario

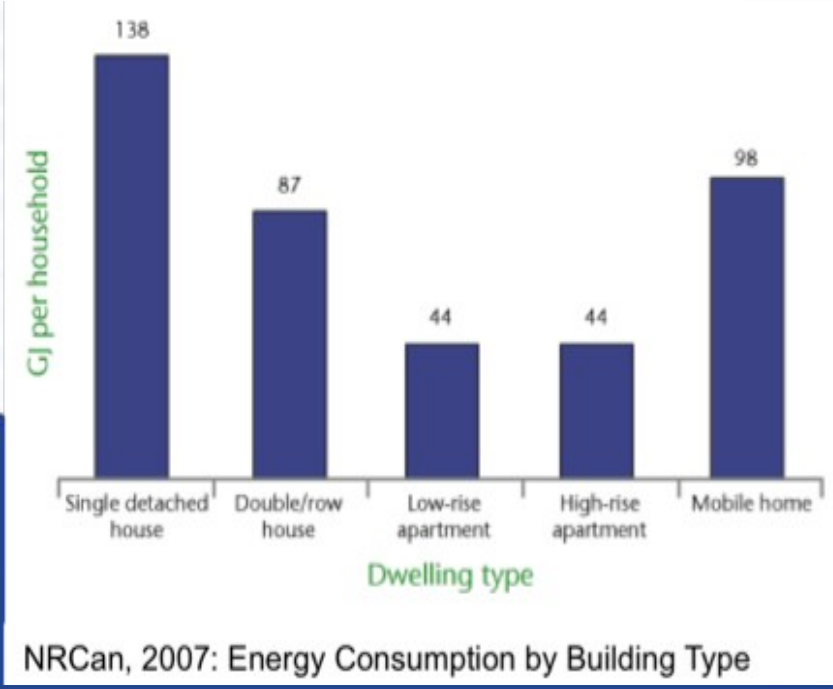
Buildings

1. Energy-efficient buildings
A. building retrofit program

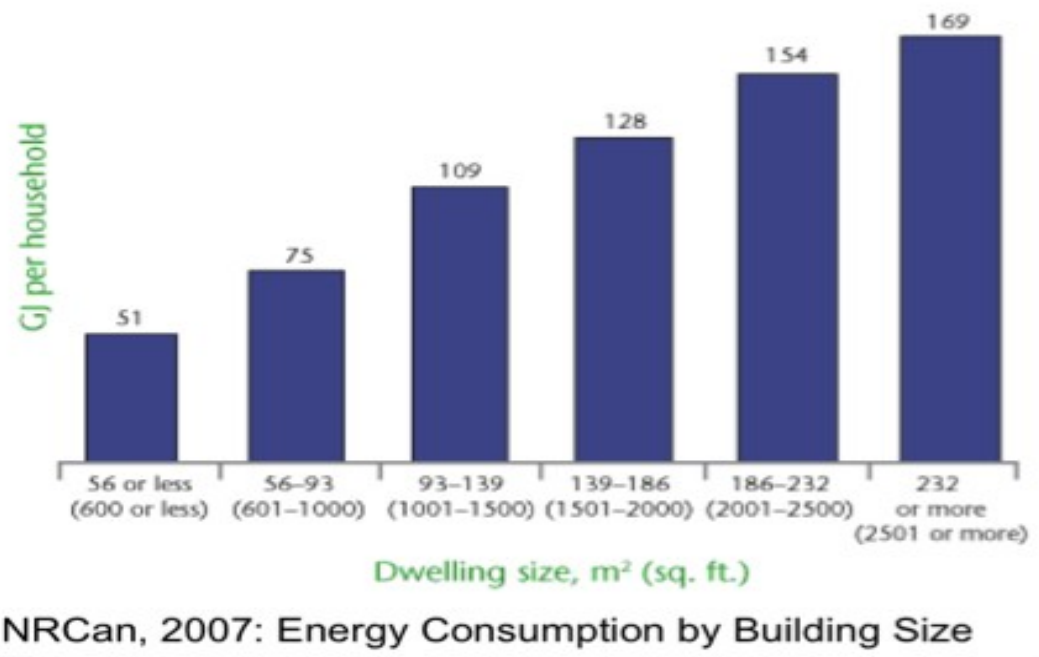


Buildings

1. Energy-efficient buildings
B. energy-efficient new buildings



NRCan, 2007: Energy Consumption by Building Type



NRCan, 2007: Energy Consumption by Building Size

Figure 4: NRCan, 2007: Energy Consumption by Building Type

Figure 3: NRCan, 2007: Residential Home Energy End Use by

Buildings

1. **Energy-efficient bui**
   C. building-scale renewa

Energy Supply

2. **Low-carbon energy supply**
   renewable electricity

Provincial Context

- **Aggressive conservation targets**
  - **Ottawa hydro has a 10% reduction target by 2014**
- **Increase in the share of renewables from less than 3% in 2003 to 13% by 2030**
  - **Solar**
  - **Wind**
  - **Bioenergy**

Green Economy and Energy Act

- **Removed planning control from Municipalities**
- **Other regulations (e.g. tree cutting bylaw, building permits) may still apply**
- **Established a Provincial Renewable Energy Approvals Process (larger projects)**
  - **Municipal consultation (infrastructure issues)**
  - **Impact on the grid assessment**
  - **Regulations for siting (protect natural areas, etc.)**

Feed In tariff Program

- **Established FIT which pays premiums for green energy being fed to the Grid**
- **Amount varies depending on source**

Feed-In Tariff Prices for Renewable Energy Projects in Ontario August 13, 2010			
Renewable Fuel	**Size tranches**	**Contract Price ¢/kWh**	**Escalation Percentage[5]**
Biomass[1,2]			
	≤ 10 MW	13.8	20%
	> 10 MW	13.0	20%
Biogas[1,2]			
On-Farm	≤ 100 kW	19.5	20%
On-Farm	> 100 kW ≤ 250 kW	18.5	20%
Biogas	≤ 500 kW	16.0	20%
Biogas	>500 kW ≤ 10 MW	14.7	20%
Biogas	> 10 MW	10.4	20%
Waterpower[1,2,3]			
	≤ 10 MW	13.1	20%
	> 10 MW ≤ 50 MW	12.2	20%
Landfill gas[1,2]			
	≤ 10MW	11.1	20%
	> 10 MW	10.3	20%
Solar PV			
Rooftop	≤10 kW	80.2	0%
Rooftop	> 10 ≤ 250 kW	71.3	0%
Rooftop	> 250 ≤ 500 kW	63.5	0%
Rooftop	> 500 kW	53.9	0%
Ground Mounted	≤ 10 kW	64.2	0%
Ground Mounted[2, 4]	> 10 kW ≤ 10 MW	44.3	0%
Wind[2]			
Onshore	Any size	13.5	20%
Offshore	Any size	19.0	20%

FIT cont'd

- Right to connect for smaller projects <10Kw
- Some issues in Ottawa for larger systems (grid capacity
- Generated community and public agency interest
- Solar issues
  - Lack of site guidelines for micro projects
  - Right to light

Community Solar

- Significant interest
- Solar farms
  - Arnprior Solar Farm – 20 MW with 312,000 panels
  - Other enquiries
- 1000 Solar rooftop project
  - Community based effort to promote rooftop solar
- Community Energy Cooperatives
  - Provincial Grants

Community Solar

- **Solar Domestic Hot Water**
  - **Grants available which makes it attractive**
  - **Requires building permit (meet building code standard or sign-off from a P.Eng – Ottawa Process)**

Public sector

- Interest driven by FIT
- Different models
  - Direct procurement
  - Energy performance/partnership
  - Simple lease of space

Solar Energy – City Context

Smart Energy Program

- Range of projects and initiatives designed to improve City's energy performance
- $2.4M approved in 2010 for
  - Building efficiency ($2.2M)
  - Rooftop solar pilot ($0.2M)
- Since 2003, more than $9.3M invested in energy efficiency initiatives

Existing City Solar Initiatives

Solar Energy Park (near Trail Rd.)

- **12 MW on 2 sites (planned)**
- **Powers approx 1,500 homes**
- **Energy Ottawa acts as 'owner/operator'**
- **FIT application submitted**

Existing City Solar Initiatives (cont'd)


Transit Services Integrated Control Centre

Rooftop Solar Pilot

- Two 10 kW sites
- Powers 2.5 homes
- $200k investment
- Revenue of $19k /yr (est. 10-12 year payback)
- Completed December 2010
- FIT revenue now flowing

Existing City Solar Initiatives (cont'd)

Large Rooftop Solar Program

- Approved by Council January 2011
- Leverages up to 20 City buildings for rooftop solar
- Project in partnership with Energy Ottawa
- When fully implemented electricity generated will power more than 300 homes
- Creates new revenue stream - $200k - $250 annually

Sample of Potential Sites

Ray Friel Complex

Kanata Rec. Complex

Nepean Sportsplex

Jim Durrell Rec. Centre

Other public agencies

- **Ottawa Carleton District School Boards**
  - **13 schools with 10Kw systems (micro)**
  - **Lease space on 69 schools for larger systems (50-250 kW)**
- **Ottawa Housing Corporation**
  - **29 10 kW systems**
  - **2 solar thermal systems**

Conclusion

- Solar is expanding
  - Energy Security and GHG emissions
- Community and Public interest
- Driven by FIT in Ontario (feeds grid, not the building systems)
- Still evolving in terms of issues

Thank you

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Green Energy Technology Trends

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- Distributed Energy Resources
- Virtual Power Plants
- Advanced Metering Infrastructure
- Electric Vehicle Charging Infrastructure

New Paradigm in the Distribution Networ

Substation

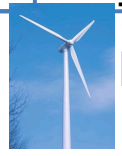
Distribution feeders

Originally one way

Substation

Distribution feeders

Now two way

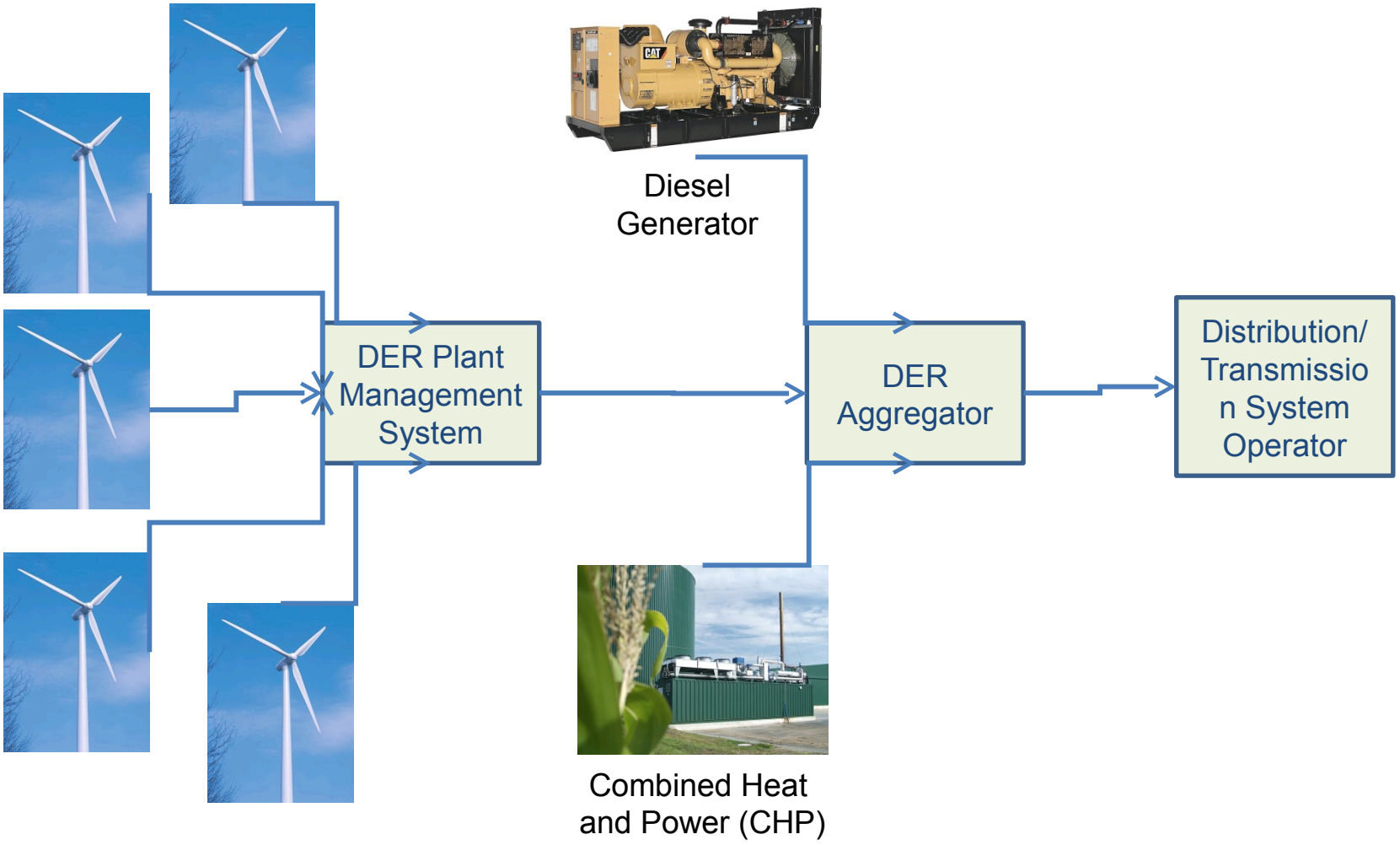


Maintenance crews need to disconnect from all sources of power, not just from the substatio

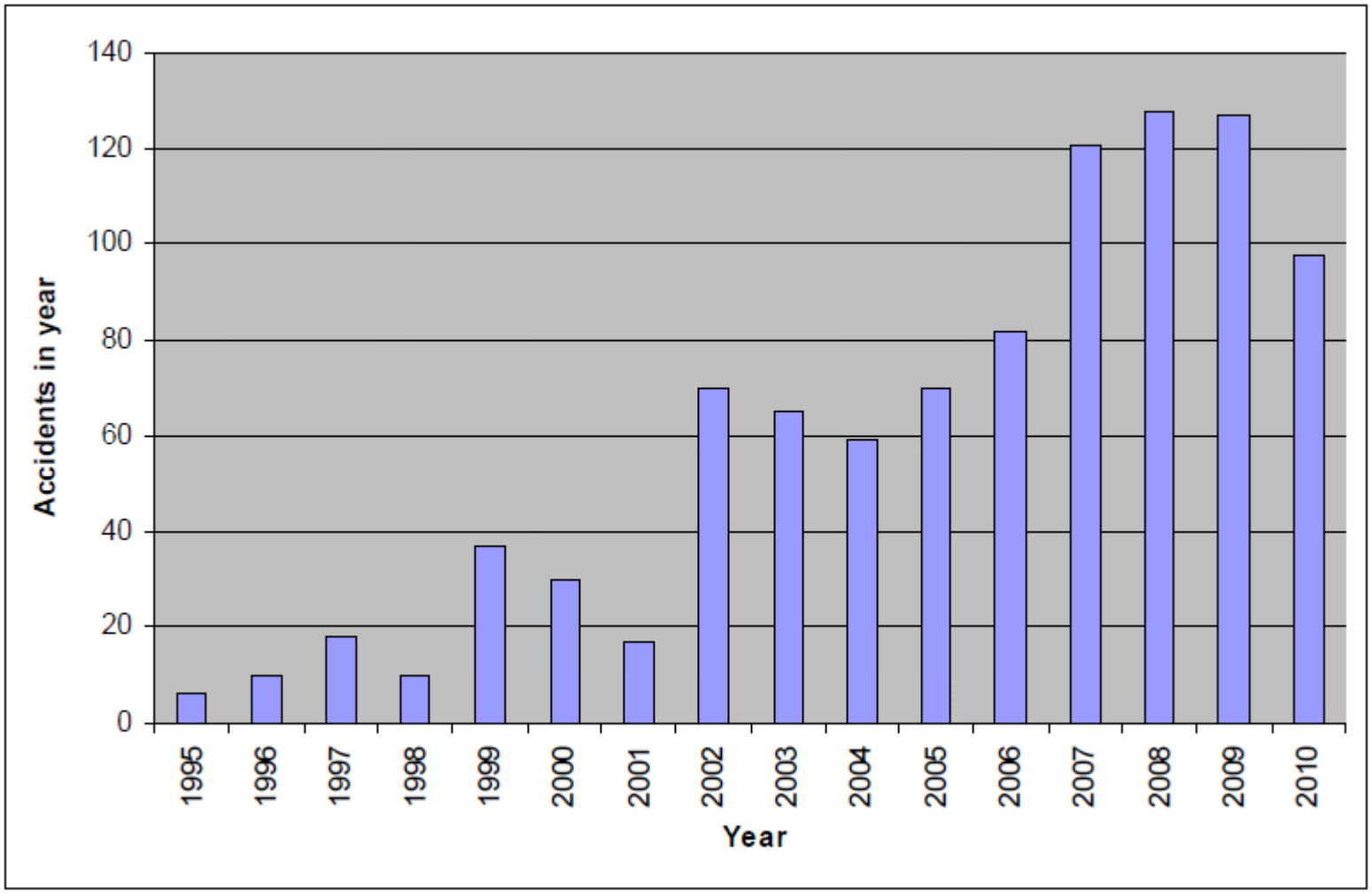
Companies Involved in DER

- DER Owner (small Generating Company)
- DER Operator
  - Control power output of DER
  - Provide real time data on status of DER
- DER Maintenance
- Distribution System Operator (DSO)

DER Aggregation



Wind Turbine Accidents (Global)



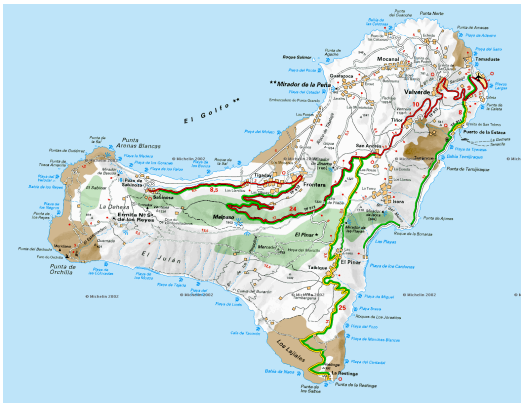
Source: http://www.caithnesswindfarms.co.uk/index.htm

Different Accidents from Different Technologies

- 1970-2010
  - Fatal accidents: 75
  - Fatalities: 83
  - Blade failure: 208 (caused damage at a distance up to 1300m)
  - Fire: 159 (too high for fire department)
  - Ice throw: 31 (up to

Source: http://www.caithnesswindfarms.co.uk/index.htm

Zero Carbon Island

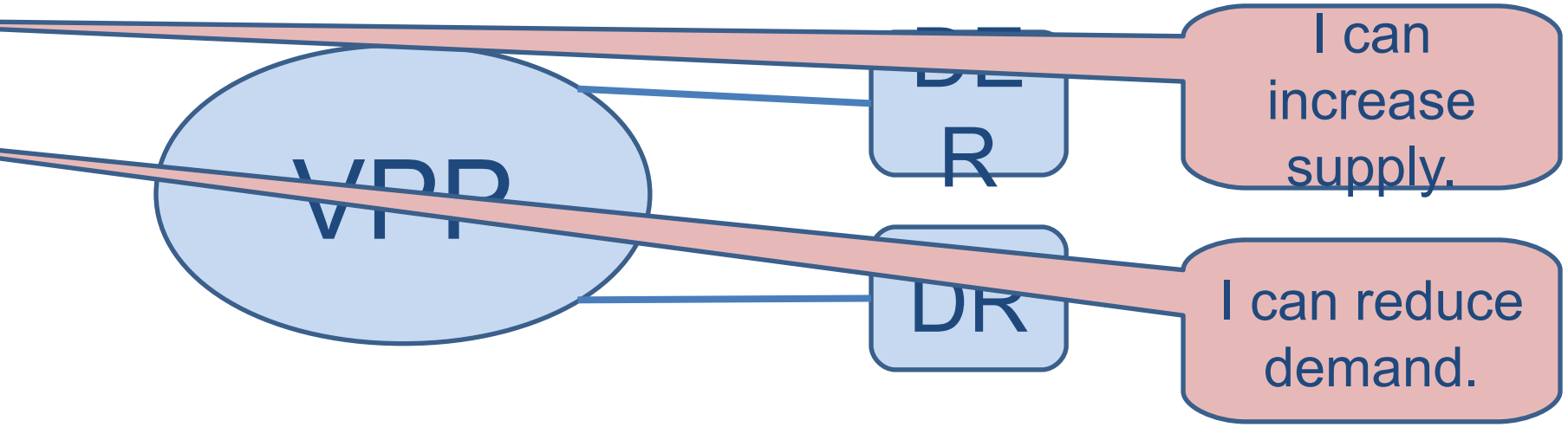


- El Hierro in the Canary Islands 1,500 miles off the coast of Spain.
- World's
  first island to run off of 100 percent renewable energy.
  - 11.5 MW wind farm
  - 11.3 MW hydroelectric plant
  - 5.7 MW solar thermal collectors and photovoltaics.

GreenStar Network – World's First Zero Carbon Network & Cloud

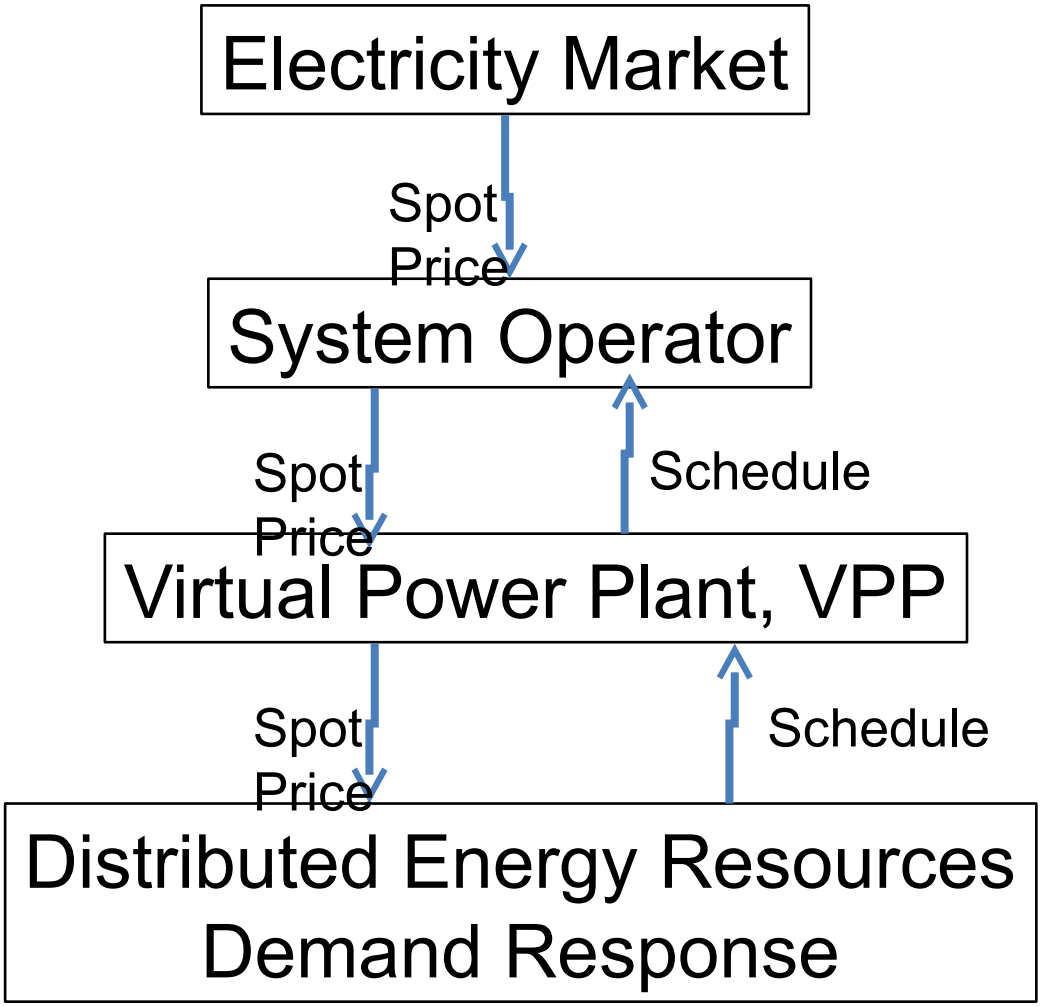
- Distributed Energy Resources
- **Virtual Power Plants**
- Advanced Metering Infrastructure
- Electric Vehicle Charging Infrastructure

Virtual Power Plants



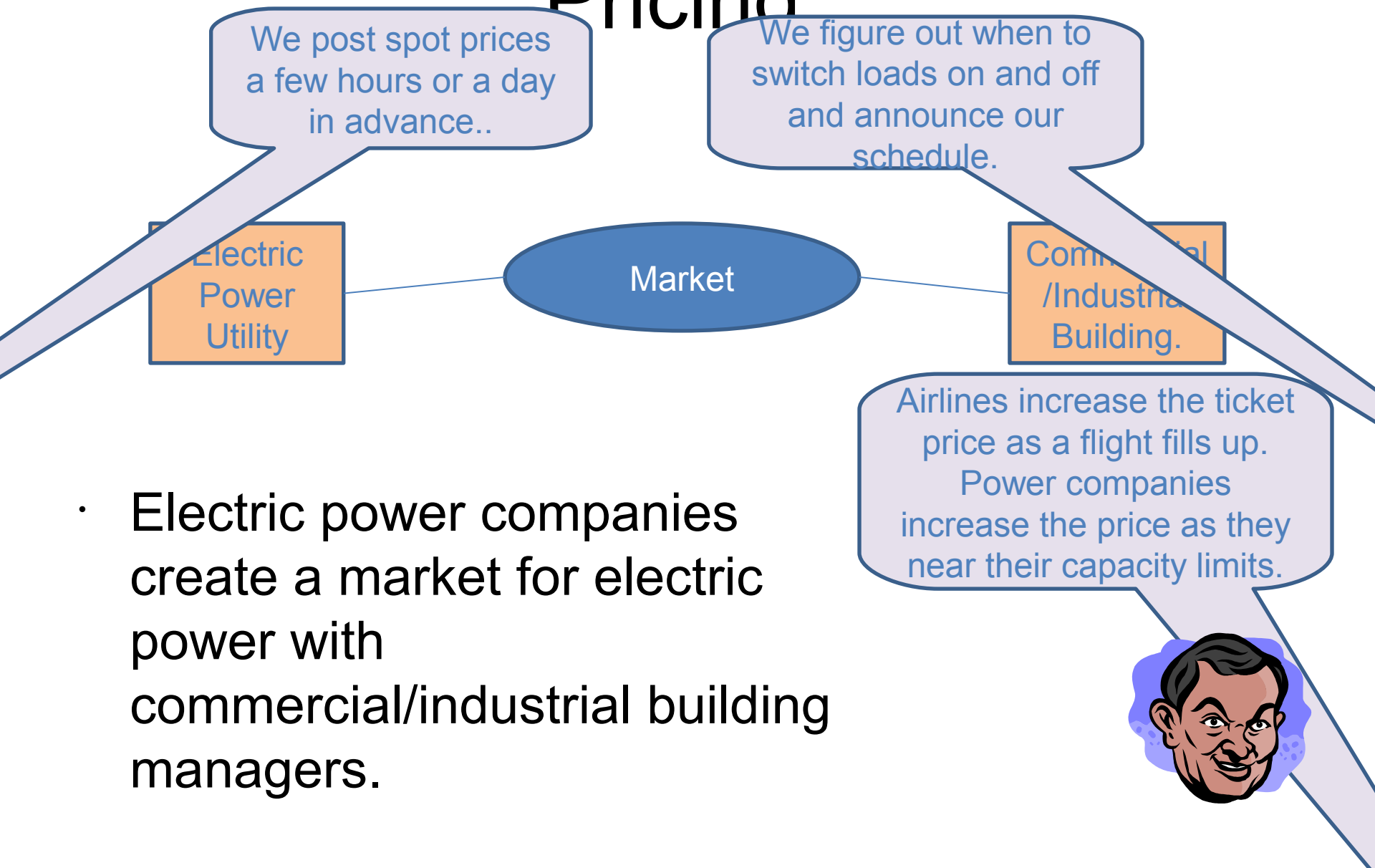
- Virtual Power Plants
  - Distributed Energy Resources, DER
  - DER Aggregators
  - Demand Response, DR
  - DR Aggregators

Spot Pricing



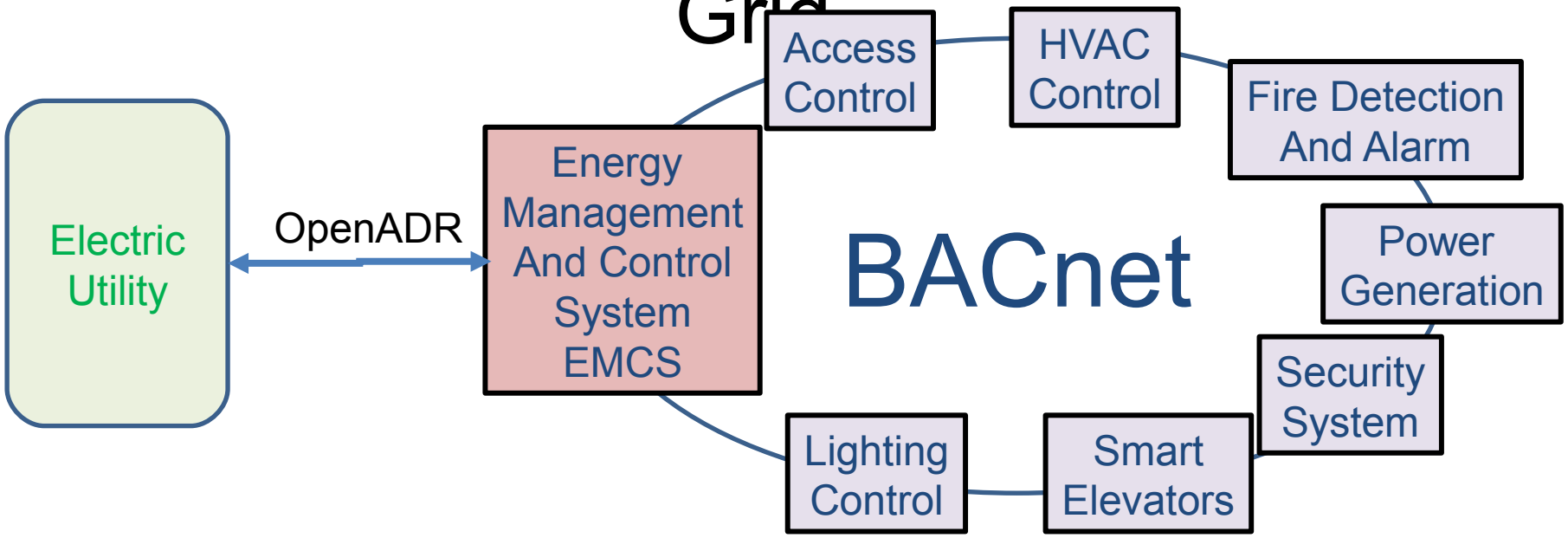
- Spot prices may be announced days or hours ahead

Demand Response: Dynamic Pricing



- Electric power companies create a market for electric power with commercial/industrial building managers.

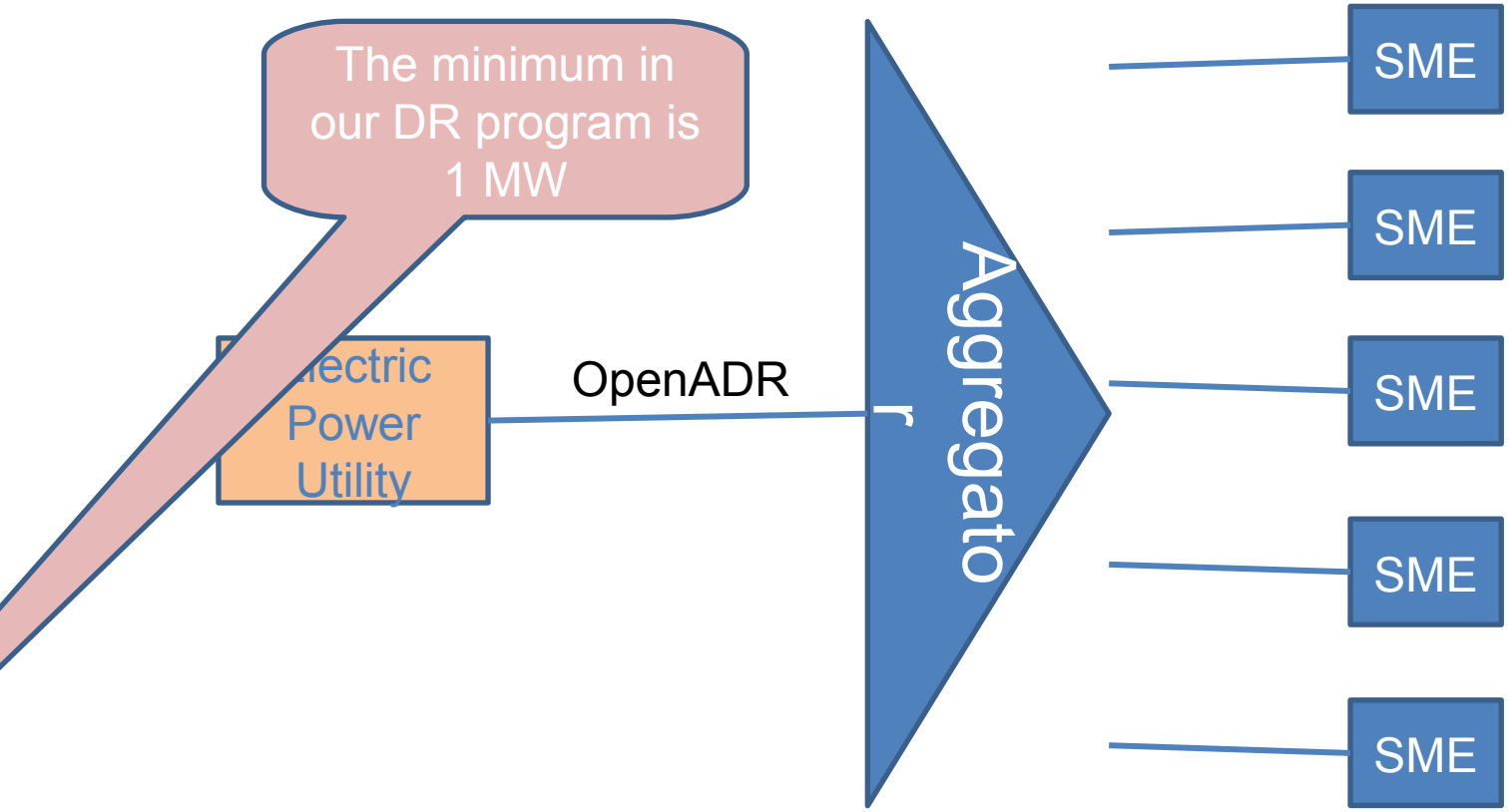
Commercial/Industrial Customers Smart Building Connection to the Smart Grid



- Technology trends
  - IP-addressable lighting
  - EMCS becoming available for smaller buildings

BACnet: Building Automation Control NETwork
"BACnet/WS Web Services Interface," ANSI/ASHRAE Addendum to ANSI/ASHRAE Standard 135-2004.

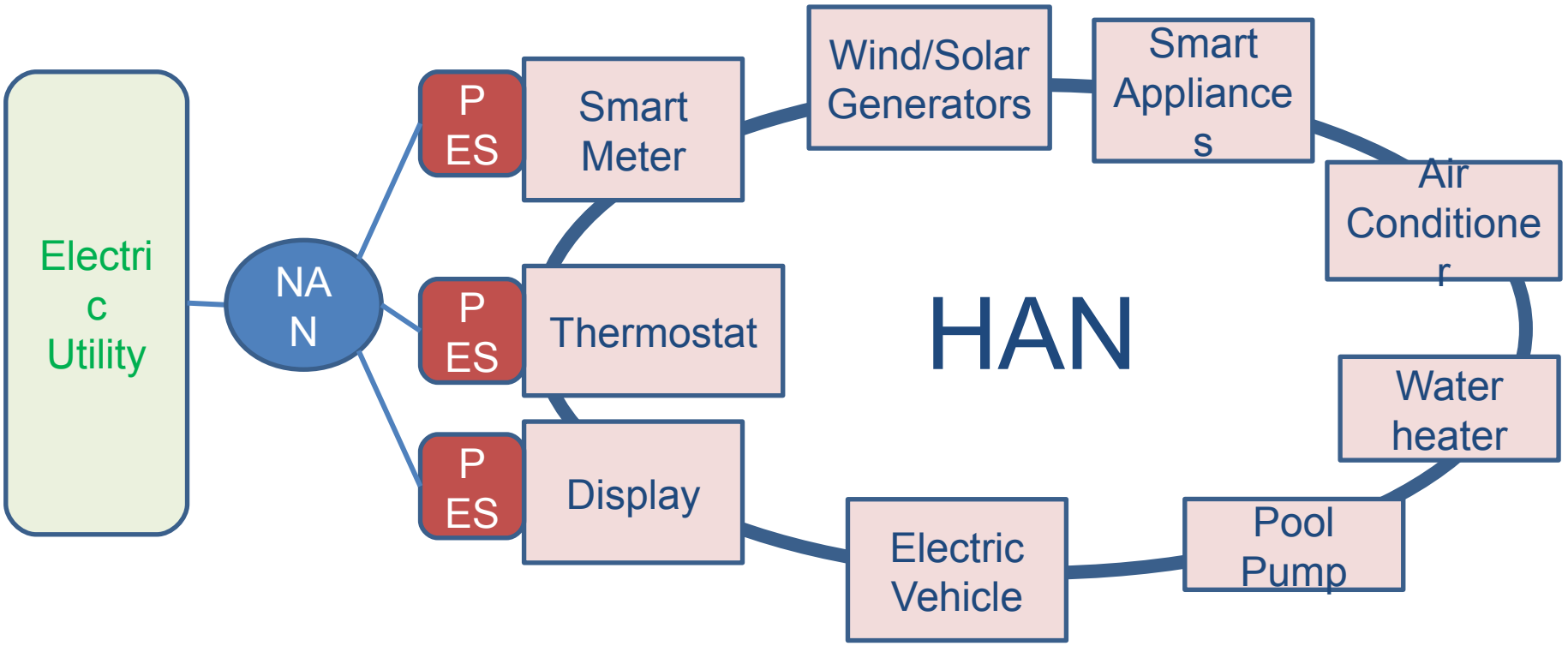
Aggregators



- Aggregator
  - Deals with many small/medium sized companies

- Distributed Energy Resources
- Virtual Power Plants
- **Advanced Metering Infrastructure**
- Electric Vehicle Charging Infrastructure

Residential Customer Network for Demand Response



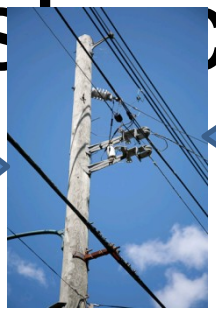
NAN/HAN Gateway
ESP: Energy Services Portal: Zigbee terminology
ESI: Energy Services Interface: OpenHAN terminology

AMI: Advanced Metering Infrastructure
HAN: Home Area Network
NAN: Neighbourhood Area Network

AMI: Advanced Metering Infrastructure

Substation

Electric power



Feeders

Electric power

Residential Customer

Utility Control Center

Ethernet
GPRS/CDM
AWiMAX
BPL/N-PLC

Aggregation Device

Wireless Mesh Network
3G Cellular
BPL/N-PLC

Neighbourhood Area Network, NAN

Smart Meter

Hourly meter reading; Local generation measurement; Outage notification; Water/Gas/Heat readings; Voltage, current, phase for load analysis

Real time prices; Load Control; Load limits for non-payment of bill; Software update

Security

Source of photos: Aggregator, MCIS; Smart Meter, Pike Research House; buildsolarpanelenergy.com

BPL: Broadband over Power Line
N-PLC: Narrowband Power Line Carrier

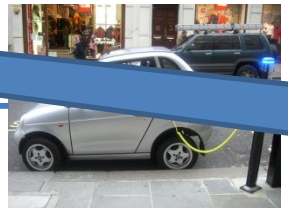
- Distributed Energy Resources
- Virtual Power Plants
- Advanced Metering Infrastructure
- **Electric Vehicle Charging Infrastructure**

Charging Options

		Driving Distance per hour of charge (km)	Charge Power (KW)
Slow	Sleep/Work	7.5	1.5
		18	3.6
Medium	Shop/Play	34	6.8
		55	11
		110	22
Fast	Coffee	220	44
		250	50

Vehicle to Grid Communications

Grid



I need recharging to 70% by 8am. I'll accept more charge if the price is below 5c/kwh

I'll sell power to the grid if the price is above 25c/kwh

Electric vehicles are a buffer that I can use to balance supply and demand

- Vehicle Controls
  - Real time pricing
  - Recharging
- Spot pricing announced hours/days in advance

- Grid Controls
  - Schedule for each vehicle
    - Within capacity of distribution feeders
    - Taking account of

Car image source: http://www.environment-green.com/Green_Cars.html

Green Energy Technology Trends

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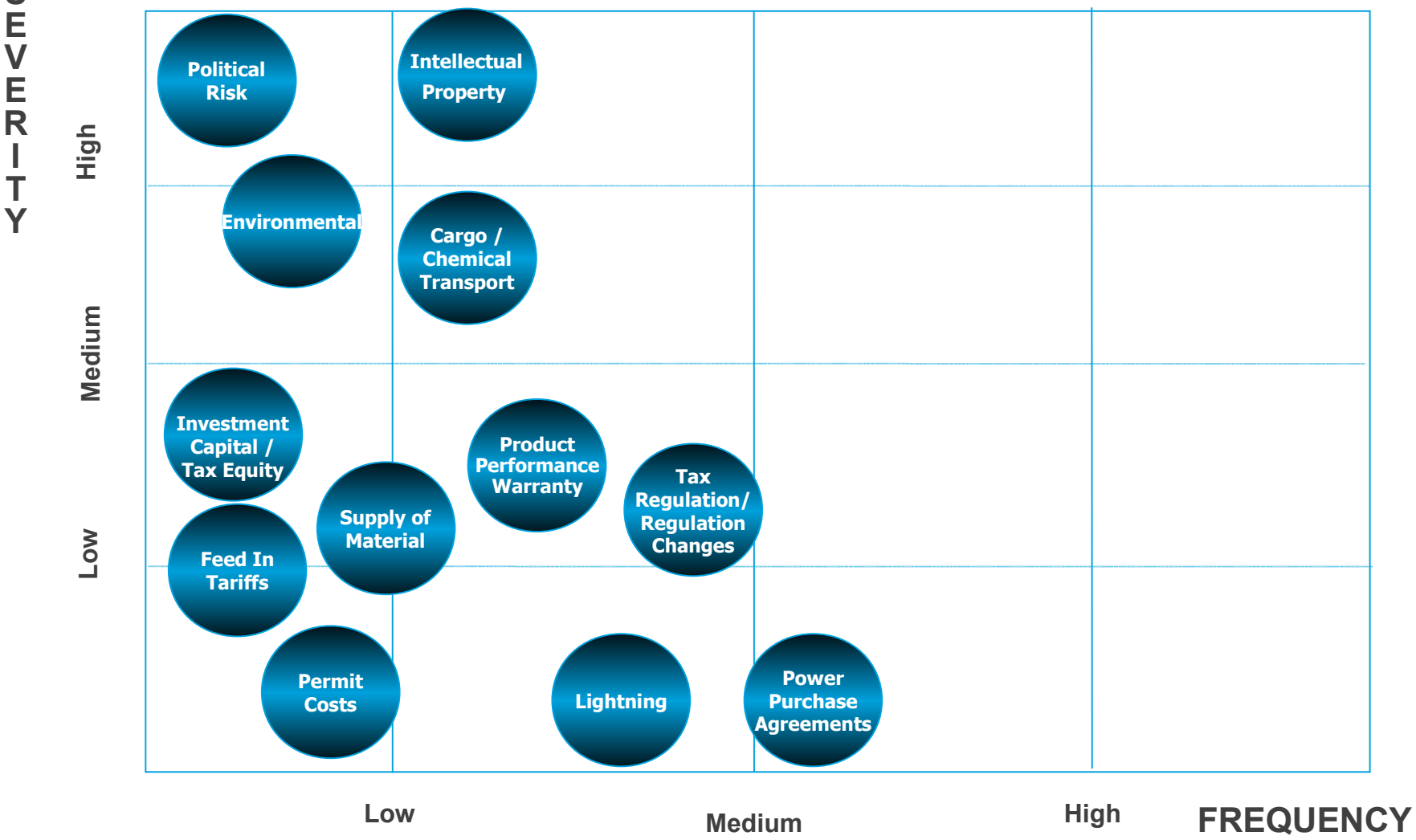
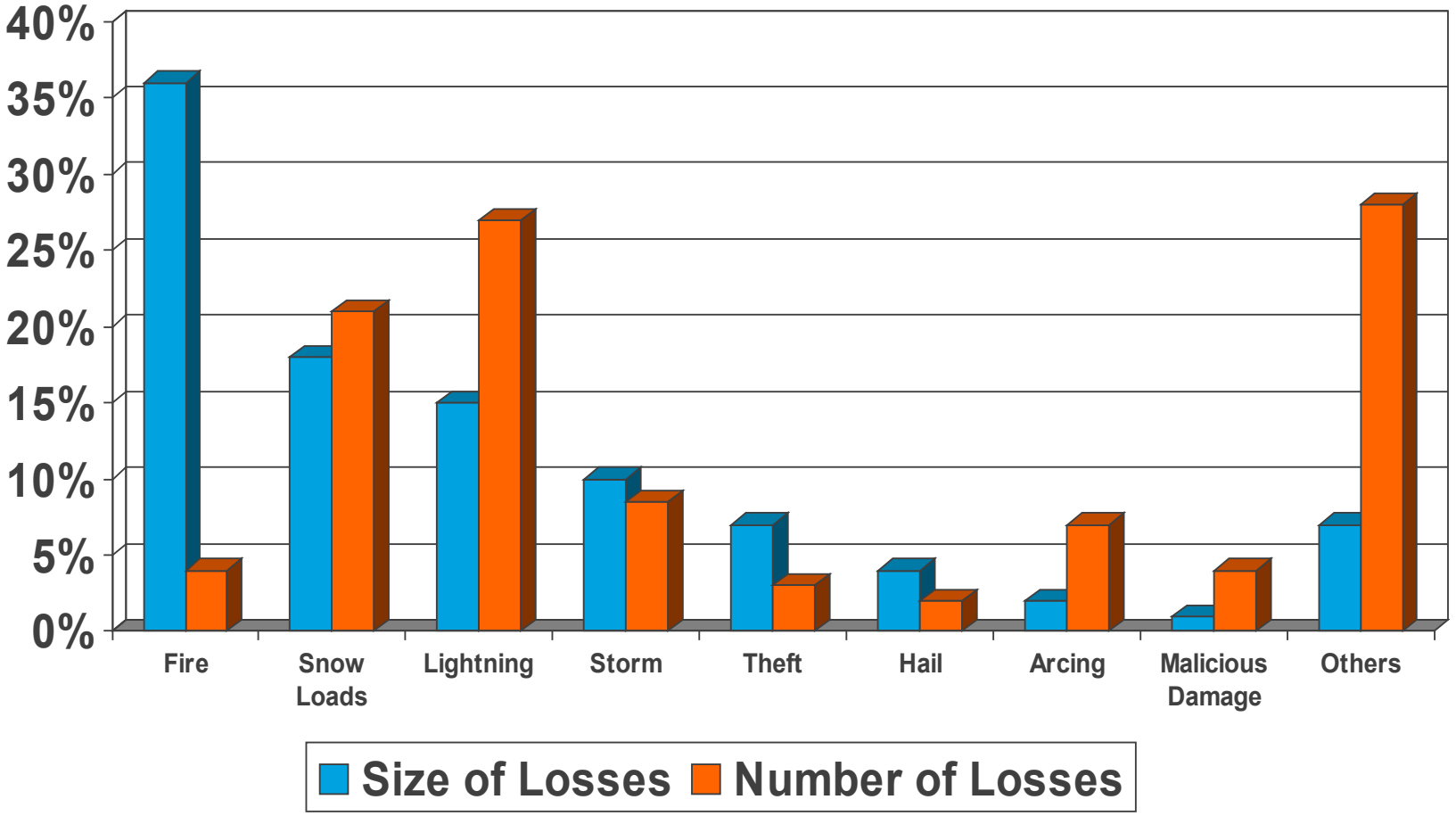
DRAFT Renewable Energy - Solar

The following is intended to present a broad, baseline overview of risks inherent to businesses in your industry. It in no way depicts the entire risk profile of your firm, nor does it represent the risks of any one specific firm. The ability to transfer or mitigate risk is subject to change based on market availability.

Baseline Risk Map



Risk of Loss – Severity and Frequency Loss Distribution



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