

Alternative and Renewable Energy Policy Framework Initiative

External Expert Information Gathering Session Report

September 16, 2011

Introduction

Alberta Energy, in coordination with a cross Ministry Working Group, is in the process of developing an alternative and renewable energy policy framework. The first step in the developing the framework is to research the potential for various alternative and renewable energy resources and technologies within Alberta and to develop an inventory of barriers faced by the various industries involved. To this end, Alberta Energy issued an Industry Expert Questionnaire on September 7 and conducted an External Expert Information Gathering Session on September 16. Together, the information gathered along with internal Alberta Energy research will be used to frame a broader public consultation that will be conducted prior to the development of the policy framework.

Purpose of Report

This report is intended for internal Government of Alberta use and for those who participated in the external Expert Information Gathering Session on September 16, 2011.

This report transcribes notes verbatim from the day's proceedings and the information gathered from individual breakout groups does not necessarily reflect the views of the individual participants, their organizations or the Government of Alberta. The intent of the day was to gather information from industry experts on the key opportunities and challenges for alternative and renewable energy. Information gathered at this stage will be used to inform a discussion paper that will form the basis of a subsequent consultation that will engage a broad cross section of Albertans. Although ideas to overcome barriers were recorded, the goal of the session (and this report) was not to debate the pros and cons of various policy options. Thus, this report does not represent Government of Alberta policy, nor does it anticipate or imply any future policy direction of the Government of Alberta.

In addition to providing a session overview and summary of the plenary conversations, this report summarizes the content of four strategic conversations pertaining to five broad categories of alternative and renewable energy resources and technology. Through conversation, the plenary identified the following five broad categories of alternative and renewable energy resources and technology to evaluate further during more-focused breakout conversations:

1. Solar
2. Wind & Hydro
3. Geothermal

4. Bioenergy (Biofuel, biomass, biogas)
5. Other (Nuclear fusion & fission, enabling technologies such as district energy)

For each category, the breakout conversations focused on:

- identifying the potential of the alternative and renewable energy resource and technology within Alberta;
- framing the benefits to Albertans of pursuing the resource and technology;
- identifying the barriers to achieving the potential and benefits associated with the resource and technology; and
- developing ideas to overcome the barriers for the resource and technology.

If you have any comments on the report, please direct them to Greg MacGillivray of Scenarios to Strategy Inc. at gm@scenarios2strategy.com or 403.270.0232.

Session Overview

The External Expert Information Gathering Session involved a number of highly participatory conversations among individuals from industry, government, non-governmental organizations and academic institutions. Both generalists and specialists attended to ensure that Alberta Energy would receive the broadest possible information and the most complete picture.

The session was opened and closed by two senior Alberta Energy representatives: Ian Mackay, Executive Director, Infrastructure and Alternative Energy and Susan Carlisle, Director, Alternative Energy. Jeff Bell, Alternative and Renewable Energy Specialist, made a brief presentation framing overall process timelines, strategic drivers and research objectives as well as session expectations. Ten volunteer moderators and recorders from Alberta Energy and Alberta Environment attended a training session and played an important role in the success of the September 16 session.

In addition to welcoming participants and thanking them for their contribution, Alberta Energy was successful in asking participants to take a step back from their professional advocacy positions in order to actively participate in a constructive and strategic conversation on the future of alternative and renewable energy in Alberta. In addition to providing their perspectives, participants shared important ideas and built important relationships in the plenary, breakout and networking sessions through the course of the day.

Breakout Session Overview

For the purposes of the day's discussion the terms "renewable and alternative energy" were intentionally left undefined. The intent was to allow the experts to brainstorm "alternative and renewable energy" options. The participants then worked collaboratively to refine the list to the five strategic topics discussed in five breakout groups.

Each of the five resource and technology-focused breakout groups addressed the following questions through the course of four strategic conversations:

Conversation 1: *What is the resource potential of the alternative and renewable energy resource and technology group we are evaluating? Of all the ideas put forward, what are the top 4-5 key ideas that we would like to report back to the plenary?*

Conversation 2: *What are the benefits (economic, environmental, social, other) if the resource potential identified in Conversation 1 is realized? Of all the ideas put forward, what are the top 4-5 key benefits ideas that we would like to report back to the plenary?*

Conversation 3: *What are the barriers (economic, regulatory, policy, other) to realizing the resource potential and benefits identified in Conversations 1 and 2? Of all the ideas put forward, what are the top 4-5 key barrier ideas that we would like to report back to the plenary?*

Conversation 4: *What are some ideas for overcoming the key barriers identified in Conversation 3? Of all the ideas put forward, what are the top 4-5 key ideas for overcoming barriers that we would like to report back to the plenary?*

The following section summarizes these four strategic conversations for each of the five broad categories of alternative and renewable energy resources and technology identified by the plenary.

Group 1 – Solar

All Resource Potential Ideas

- 830 Million GWh/year (Solar radiation): Total resource
- 250 Million GWh/year – (Practical solar radiation resource): Accessible resource
- Data source: RETSCREEN
- Solar electricity 7 Million GWh/year (Production factors are defensible): recoverable resource
- Solar thermal 3 Million GWh/year (Production factors are defensible) : Recoverable resource
- Comparatively: AB solar resources is one of the best in Canada – Data Source NR Can
- 830 Million GWh/year (Solar radiation): Total resource – 240X more than all the coal, oil and gas, and bitumen extracted in 2007.
- Source: Solar Vision 2025: Forecast
 - Solar PV – 2050: 4.4 GW installed (5.3 TWh/year)
 - Solar Thermal – 2050: 3.8 GW installed (11.3 TWh/year)

Key Resource Potential Ideas

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All Benefits Ideas

- Reference the report on “Shaping Edmonton’s Renewable Energy Future”
- Stabilizes energy cost
- Rapidly declining technology costs
- Low operating cost provides lower electricity cost once capital is paid back
- Proven “shovel ready” technology – Gateway to other renewables
- Minimum Environmental Impact (Air-GHG/water/soil/land/Habitat)
- Local, distributed (urban, rural)
- Broad scale application (residential, community, commercial, municipal, industrial, utility, transportation, consumer products)
- Job creation: more jobs per dollar invested than fossil fuels
- Electricity peak shaving potential.
- Economic diversification
- Rural revitalization – engagement by citizens, small businesses, etc.

Key Benefits Ideas

- Minimum Environmental Impact (Air-GHG/water/soil/land/Habitat)
- Economic diversification:
 - Rural revitalization – engagement by citizens, small businesses, etc.
 - Job creation: more jobs per dollar invested than fossil fuels
- Long term low energy:

- Stabilizes energy costs
- Rapidly declining technology costs
- Low operating cost provides lower electricity cost once capital is paid back
- Proven broad scale application (residential, community, commercial, municipal, industrial, utility, transportation, consumer products)

All Barrier Ideas

- Unequal economic playing field
 - True cost of electricity is not reflective in the price
 - Existing fossil fuel subsidies
- Lack of project financing options
 - High upfront equipment costs
- Education and awareness
- Regulatory
 - Utility rate structure
 - Permits and approvals
- Policy: Lack of continuity of government support

Key Barrier Ideas

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- Education and awareness
- Regulatory
 - Utility rate structure
- Policy: Lack of continuity of government support

All Ideas to Overcome Barriers

- Economic:
 - Pricing structure to reflect environmental impacts
 - Pricing structure to reflect proximity of generation to load (cost of transmission and distribution systems)
 - Eliminate subsidies for mature technology
- PACE: Property assessed clean energy – synonymous with Local improvement charges:
 - Ultra low interest loans
 - 20 year government backed contract
- Putting in place demonstration programs, courses, capacity development, workforce development training, and research and development
- Regulatory:
 - Time of use billing
 - Tiered rate billing
 - Converting grid connection fee into electricity prices
 - Standardization of approvals and permits across costs, requirements – streamlined application process
- Policy
 - Continuous long term commitment and program stability

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 - Continuous long term commitment and program stability

Group 2 – Wind & Hydro

All Resource Potential Ideas

- Wind Potential 5000~65000MW (Additional)
- Hydro:
 - Small Hydro (Run of river) ~500MW
 - Large Hydro (Storage and Dams) 3000~5000MW
 - Ref. Canadian Hydro Association 11600MW (Combined)
 - Ultra Low Head Hydro (Less than 5m uptake) May be included in Can Hydro Association estimate
- Pump Storage : There are two types:
 - Self Contained
 - Building off reservoir type
- Wind and hydro best together with pump storage - hydro can provide storage but wind cannot
- Wind:
 - Transmission connected
 - Distribution (large scale)
 - Distribution (small scale)
- Imported wind and Hydro

Key Resource Potential Ideas

- Small and large hydro

- Pump storage
- Wind
- Imported resources: wind and hydro

All Benefits Ideas

1. Jobs – Across all resources, but there are tradeoffs between sectors. Alberta is an energy centre, jobs taken away by Renewable energy.
2. Contribute towards climate protection plan
 - Benefits of reduction air pollutions
 - Long term cost certainty (know upfront cost)
 - Insulates against environmental regulatory uncertainty (Carbon)
3. Regional economic
 - Diversity – wind in particular
 - New market - as opposed to coal and gas
4. Commercially available technologies (wind and hydro)
5. Operational knowledge is available (wind and hydro)
6. Small scale generation benefits
7. Energy return on investment as compared to the other business cases
8. Social benefit is “green energy image” – political
9. Health benefits - less emissions and pollution
10. Alberta is a global energy centre - unique knowledge base and leadership and integration of wind
11. Wind jobs - more preferable locations
12. Diverse energy portfolio:
 - Energy, economic, supply, jobs, regional, etc.
13. Hedge against uncertainty:
 - Regional economic development, arbitrary decisions, fuel cost, environmental cost

Key Benefits Ideas

- Green energy image - political

- Alberta as a global energy centre
- Diversity
- Carbon reduction - contributing towards climate change objectives
- Hedge against uncertainty

All Barrier Ideas

- Cost - current market price is \$70/MWh
 - Pulverized coal plant \$100~ \$140/MWh
 - Wind farm \$85~\$115/MWh
 - Large hydro \$70~\$120/MWh
 - Nuclear \$100-\$140/MWh
- Transmission - location, costs, landowners
- Land - land claims (hydro), landowner rights, land use framework (uncertainty), First Nations
- Integration - reliability of electric grid
- Current electricity market - volatility
- Regulatory process - municipal, provincial and federal - too layered
- Environmental (hydro)
- Federal regulatory process and uncertainty
- Hydro - water rights (municipal and irrigation)
- No incentives on low carbon – environmental “cost” of emissions is not internalized
- Interest groups: transmission (both sides), landowners, best available technology (BAT) advocates, bird concerns, etc.
- Social fabric of Alberta may not see this as a big issue
- Availability
- Energy awareness and education
- Political risk - what if we can't achieve a target - Flip flopping on the How - uncertainty

Key Barrier Ideas

- Regulatory and political uncertainty and complexity

- Economics
- Cost uncertainty and revenue uncertainty
- Land access - First Nations, interest groups, policies, scale
- Integration and reliability
- Transmission
 - Interties
 - Import/Export
 - Integral
 - Energy awareness and interest

All Ideas to Overcome Barriers

- Public awareness campaign
- Increase carbon cost to increase revenue
- Regulatory review
 - Streamlining and consolidating process
- Review compensation and land use framework
- Land use corridors
- Incentives
- Financial
- Re- Regulation
- Keep current investors/ investment whole
- Government invests / researches in integration
- Reliability
- Enabling technologies
- Diversify energy portfolio
- Storage
- Investing in transmission infrastructure and research
- Funding Research
- Local participation/ Partnership

- Like German municipalities and Ontario

Key Ideas to Overcome Barriers

- Economics
 - Increase carbon cost (increase revenue)
 - Financial incentives
 - Re-regulate
- Regulatory review
 - Streamline and consolidate
- Government Investment
 - Enabling technologies
 - Diversify provincial energy portfolio and knowledge
 - Evolving infrastructure
- Comprehensive long-term strategies
 - Provincial energy, economics and environmental
 - Land use corridors
 - Transportation, utility and communication
- Public awareness and education partnership

Group 3 – Geothermal

All Resource Potential Ideas

- Availability of geology - presence of aquifer - flowing of water – permeability - coal seams a good opportunity
- Schools (large footprint, playground for pipes, central infrastructure planning)
- Seniors housing, housing complexes
- Any new infrastructure development
- Retrofits versus new builds – at start or end of lifecycle
- Buildings with big footprints - large land use relative to height
- Existing market conditions - displace cost to upgrade gas or power grid

- Geoexchange potential is unlimited
- Abundant, safe, versatile
- Large scale potential (commercial and residential)
- Geoexchange is enabler of other technologies (e.g., solar thermal)
- Training programs
- District energy potential is unlimited
- Community energy systems
- Industrial applications that use a lot of heat (e.g., mining)
- Geopower potential is unlimited
- Western Canada to foothills is underutilized – there is existing infrastructure, well-defined resources where unlike other jurisdictions, we have well data, existing subsurface knowledge and water well data
- Areas where we can look at grid extension (e.g., areas where you have heat but requirement to upgrade infrastructure)
- Need to mandate that operators cannot waste heat in oil sands operations
- Geoexchange potential is unlimited - underutilized
- District heat potential also unlimited (huge horizontal geoexchange opportunities)
- Geothermal power potential is limited - heat resource in western Canada from existing oil field applications
- Market availability is limited
- Resource potential is better understood in Alberta than in other jurisdictions
- High district energy potential
- Open source aquifer potential

Key Resource Potential Ideas

- Geothermal potential is everywhere and infinite (market potential varies)
- Existing subsurface knowledge (e.g., well data) - better understand resource
- Buildings with large land footprints (suitable land base)
- Buildings high heating and cooling requirements, also industrial systems with high heat loads
- Using existing oil and gas wells and infrastructure

All Benefits Ideas

- Lowest levelized cost of geothermal
- Drastically reduce carbon emissions
- Reduced eco-footprint
- 24/7 availability, baseload renewable, stability to system
- Geopower – provides stability to the utility
- Ability to follow - also applies to heat for industry
- Commonly available to market - mature technology
- Existing skills and technology – transferable skills - transferability of skills from oil and gas sector may reduce risk of losing skills due to underperforming natural gas sector
- Existing associations
- Existing training
- Existing codes and standards at least for geoexchange
- Maintenance costs reduced - less frequent maintenance required
- Extremely stable operating costs
- Ability to offer a long-term (e.g., 20 year) price – can offer certainty to customers in the longer term
- Stable, long-term infrastructure – useful life warrantied for 50 years – infrastructure will likely last for 700 years
- Ability to take advantage of Section 42.1 of Accelerated Capital Cost Allowance (ACCA) program – applies only to geoexchange - e.g., tax breaks
- LEED points, BOMA Green, BOMA Best
- Comfort
- Integrates into and with other renewables
- Reduced visual footprint
- Able to emphasize and reinforce the prominence and importance of “greening the grid”
- Public relations value of greening Alberta’s energy production (e.g., oil sands environmental concerns)
- A local resource, distributed resource - potential to reduce infrastructure costs (e.g., transmission and gas lines)

Key Benefits Ideas

- CO2 reductions, decreased environmental footprint
- Public relations win
- Stability and sustainability - both pricing and energy deliverability
- Existing skills and infrastructure that can be leveraged - mature industry
- Reduced maintenance costs
- Existing tax support via Section 42.1 of Accelerated Capital Cost Allowance (ACCA) program (applies only to geoexchange)

All Barrier Ideas

- Marketing challenges and awareness challenges - non-visual - hard to put on a brochure
- Hard to frame economics - what's the payback – payback is very project specific
- High initial capital costs – “pay now to get later” problem (opposite of “buy now and pay later”)
- Lack of sufficient skills to implement
- Lack of skills to understand within client base – lack of familiarity with industry and project development
- Regulatory void for geothermal heat or power (e.g., not property rights defined)
- Problem with geoexchange when systems are close together – “steal” heat from one another
- Longer term payback (e.g., 7 years) makes financing difficult
- Geological and drilling risks create project uncertainty
- Long-term risk - uncertainty of continued, long-term production - if you are paying now to get later, you need to make sure you get value later
- Unlimited resources for all three (geoexchange, district energy and geothermal) - price point different for each technology
- Competing against existing technology - cost of gas versus cost of power (e.g., if cost of gas infrastructure is not included in costs then geothermal cannot compete)
- Subsidies provided to existing technologies (e.g., gas)

- Cannot compete with incumbent technologies that do not internalize environmental externalities
- Are existing technologies being given an unfair advantage by low royalties?
- If green power is used as part of the factor then GHG benefits are good
- Cost of infrastructure upgrades are not included in cost calculations
- Geoexchange: lack of education and awareness in industry, throughout government, with regulatory boards and with water stakeholders
- Risk due to limited current accountability framework - no one to turn to for quality control or warranties
- Project risk (e.g., cannot access financing) in absence of regulatory certainty
- Regulatory burden of interconnection procedure (e.g., high proportion of legal fees, involved grid connection processes)

Key Barrier Ideas

- High initial capital cost – “pay now get later” - long term payback makes financing difficult
- Upfront project risk due to geologic uncertainty
- Regulatory void
- Lack of knowledge and awareness among potential clients, regulatory institutions, trades, financiers, others
- Competitiveness barriers - competing against existing infrastructure that has been amortized and markets that don't bear cost of externalities

All Ideas to Overcome Barriers

- Leverage existing industry creativity expertise and knowledge
- Review existing regulations for geothermal:
 - Oil and gas
 - Water well
 - Property regulations
 - Land use framework
- Work with Alberta Utilities Commission (AUC) to overcome permitting of power facility - familiarize AUC staff with geothermal technologies - give Energy Resources Conservation Board (ERCB) regulatory authority to permit geothermal leases either separately or together (e.g., if you get an oil and

gas lease and you get geothermal rights automatically or they are permitted together but separate rights)

- Government-backed green energy bonds - spread risk over portfolio of green projects that can access financing from same pool - would work for geoechange and geopower
- Market incentives:
 - Renewable portfolio standards for heat and power
 - Support/buy-in from existing industry who have cash for investing
 - Put price on hot water and waste heat - especially in context of produced water
- Help industry associations develop (e.g., provide seed capital)
- Document/map resource and pursue technology road maps
- Support demonstration projects

Key Ideas to Overcome Barriers

- Review existing regulations to address regulatory void - grant regulatory authority to permit geothermal leases and exploration
- Build awareness (e.g., technology roadmaps, mapping, demonstration projects)
- Create market mechanisms like renewable portfolio standards or whole cost accounting
- Leveraging existing industry skills and resources and help them diversify into geothermal
- Programs to reduce project risk (green bonds, database for geothermal, drilling insurance)

Group 4 – Bioenergy

All Resource Potential Ideas

- Algae biofuel:
 - Emerging, close to commercial
 - Ethanol production from algae
- Forest products:
 - Electricity and heat

- Lots of waste available
- Landfill gas:
 - Existing and waste diversion composting
 - Already in use
 - Upcoming regulation requiring capture
- Agricultural products waste:
 - Plants or animal waste
 - Purpose grown bioenergy crops
 - Potential in “feedlot alley” (Taber area)
- Biofuels:
 - Can be achieved from waste products (agricultural and forest)
 - Purpose grown potential as well
- Sewage treatment:
 - Active treatment, passive treatment (capturing methane)
- Syngas:
 - Waste gasification
 - Heat, electric or bio-fuel
 - City of Stockholm powered by syngas from power plant
- Advanced integrated bioenergy systems:
 - Grow algae on CO2 steam from fuel plant etc
 - Industrial process integration (e.g., pulp mill, black liquor)
- Capture methane from waste streams (e.g., sewage, landfill, animal waste, etc.)

Key Resource Potential Ideas

- Biofuels:
 - Can be achieved from waste products (agricultural and forest)
 - Purpose grown potential
- Agricultural products waste:
 - Plants or animal waste

- Purpose grown bioenergy crops
- Potential in “feedlot alley” (Taber area)
- Forest products:
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- Advanced integrated bioenergy systems:
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 - Industrial process integration (e.g., pulp mill, black liquor)
- City of Stockholm powered by syngas from power plant
- Capturing methane from waste streams (e.g., sewage, landfill, animal waste etc.)

All Benefits Ideas

- Environmental:
 - Limited water resources
 - Reduces waste impacts – protects water resources
 - Reduces reliance on non renewable resources
 - Reduce GHG emissions
 - Displaces waste from landfills
 - Diverts waste from entering landfills
 - Reduces hazardous waste production:
 - Animal waste
 - Reduce need to transport hazardous waste
- Economic:
 - Turns waste into resource
 - Decentralize energy production-production and consumption close together (e.g., cogeneration, methane capture)
 - Regional economic stimulus – new jobs - potential for exports
 - New revenue stream for municipalities
 - Reduces cost and liabilities for municipalities

- Value-added potential for any industry particularly forest and agriculture
- Social:
 - Improved relationships with communities
 - Reduces land use conflicts
 - Improves Alberta's image
 - Reduces health impacts and risks

Key Benefits Ideas

- Protects water resources
- Decentralizes energy production - production and consumption of energy is closer together (e.g., cogeneration, methane capture)
- Diverts and displaces waste from landfills and other areas
- Value-added potential for any industry - particularly forestry and agriculture
- Reduced health impacts and risks

All Barrier Ideas

- Economic:
 - Price of energy (\$/hr, \$/Mwh, \$/GJ)
 - Cost of infrastructure
- Regulatory:
 - Permitting and licensing of generation projects
 - Time, cost and duplication of costs
 - Uncertainty of process requirements and outcomes
 - "Unstreamlined" regulatory approval process
 - Requirements for facilities do not account for individual situations
 - Standards are written to reflect status quo technologies
 - Lack of flexibility to allow for innovation
- Policy:
 - Lack of incentives
 - Lack of recognition of innovative approach

- Lack of a level playing field across resources (e.g., natural gas rebates discouraged alternative and renewable development)
- Lack of a level playing field among different alternative and renewable energy resources and players
- Lack of “true cost” of energy (e.g., production, delivery, environmental impacts, etc.)
- Environment and Social:
 - Land use impacts (e.g., food vs. fuel)
 - Can impact uptake of bioenergy
 - Albertan attitudes:
 - “Alberta's bread and butter is fossil fuel”
 - Alberta’s economy relies on fossil fuel development
- End use infrastructure compatibility (e.g., cars not designed to run on biofuels)

Key Barrier Ideas

- Price of Energy (\$/hr, \$/Mwh, \$/GJ)
- Regulatory process is cumbersome and non-inclusive-standards written to reflect status quo
- Lack of a level playing field - consequence of attitudes that “Alberta bread and butter is fossil fuels”
- End use infrastructure compatibility (e.g., cars not designed to run on biofuels)
- Land use impacts (e.g., food vs. fuel)

All Ideas to Overcome Barriers

- Economic diversity policy:
 - Targets, sector or performance
 - Economic analysis of benefits of diversification
- Government leading by example
 - Procurement process (e.g., fleet fuel policies)
- Grants and regulations that encourage bioenergy projects
 - Target landfill and/or sewage gas captures
- Economic analysis of alternatives to determine best “bang for the buck”

- Streamlining the regulatory process (e.g., application process for Alberta Environment and AUC combined)
 - Recognize different scales of projects and develop different regulations for different sizes of projects
 - Review regulatory process for “common sense”
- Increase research and development into bioenergy projects
 - Includes funding
 - More pilot projects
- Barrier discovery
 - Requests for Proposals (RFPs) for bioenergy projects
- Maintain and or expand the price of carbon, potential increase the \$15 ton price
- Education
- Economic analysis
- Ensure a comprehensive Environmental Impact Assessment (EIA) is done

Key Ideas to Overcome Barriers

- Develop grants and regulations that encourage bioenergy projects
- Target landfill and/or sewage gas capture
- Economic diversity policy
 - Frame targets, sector or performance
 - Conduct economic analysis of benefits of diversification
- Streamline the regulatory process (e.g., application process for Alberta Environment and AUC combined)
 - Recognize different scales of projects, develop different regulations for different sizes of projects
 - Review regulatory process for “common sense”
- Increase research and development into bioenergy projects
 - Includes funding
 - More pilot projects
- Maintain and/or expand the price on carbon

- Potential increase \$15 +?

Group 5 – Other

All Resource Potential Ideas

- “Other” includes:
 - Nuclear
 - Fission (small scale)
 - Fusion
 - Cogeneration, hydro and district
 - Also includes “smart grid” and information and communications technology (ICT) and transmission in the context of ICT
- Nuclear fusion:
 - Fusion plant capable of 5,000-10,000 megawatts based on current thinking
 - Feedstock is virtually unlimited
 - Technology can be scaled - smaller scale is 10-100MW - no restriction to the number of plants that could be built in Alberta
- Nuclear fission:
 - Technology is the future
 - Large-scale operation is not yet viable
 - Feedstock material (uranium) must be imported
 - Feedstock potentially limited by geology and economics
- Cogeneration/Combined Heat & Power (CHP):
 - All electric power generation in Alberta with cogeneration would increase electrical output 30% - 12,000 MW achievable according to Pembina’s *Greening the Grid* Report
 - Requires dense population and users
- District Energy:
 - Dense urban areas having a source of thermal energy
 - Distributes it throughout the city
 - Improves the efficiency of whatever energy is being used.

- Enabling technology is important in order to use alternative energy
 - For now, it's important in order to use current energy sources more efficiently
 - Provides flexibility to systems – both existing and future
- Energy storage (also an enabling technology)
 - Drake Landing has a thermal storage facility to balance the load pressure in winter
 - Enables use of alternative and renewable energies
 - Potential is at industrial and neighborhood levels – see Pembina *Power Storage Primer 2008*
 - Needed to make solar and wind more effective and viable
- Transmission and ICT use in context of resource potential
 - 5-10% loss in electric power transmission using current technology

Key Resource Potential Ideas

- Many enabling technologies are interrelated, and when deployed together, have a large impact
- Ranked by potential:
 - Note: Many, and particularly items 2-5, are highly interrelated and enable each other.
 - 1. Fusion: Virtually unlimited future potential but lead time is large
 - 2. District Energy & CHP
 - 3. CHP & District Energy
 - 4. Energy Storage
 - 5. Transmission & ICT
 - 6. Small scale fission

All Benefits Ideas

- Nuclear Fusion:
 - Zero GHGs plus other environmental benefits
 - Virtually unlimited potential electric output

- Could be highly economically disruptive – both good and bad - depends on whether Alberta gets “in on the game”
- Large social & political benefits – safety, particularly
- Small-scale fission:
 - Minimized direct GHGs
 - Scale-able
 - Known technology
 - Fuel switching – frees up natural gas for other uses
- Combined heat and power:
 - Environmental - reduced emissions, fewer other contaminants
 - 30-40% more efficient than current electrical generation
 - Economically more efficient for smaller players (not the large producers)
 - Easily located and approved to install
 - Socially acceptable
- District energy:
 - Effective use of local resources
 - Better maintenance and upkeep
 - Fuel flexibility and fuel security
 - Proven in places with high density
 - Enables other alternative and renewable technologies and resources
- Energy storage:
 - Enables all other alternative and renewable resources - particularly those that are variable (e.g., solar, wind and others)\
 - Reduce variable power generation making it more efficient and eliminating redundancies
 - Economic advantages: reduced capital costs as systems are designed for lower, consistent generation and transmission
- ICT/Smart Grid:
 - Another enabler
 - Reduces capital costs and redundancies

- Reduces right-of-way problems and social impacts
- Makes more efficient use of existing resources
- Increases viability of alternative & renewable technologies
- Broadens the reach of energy generation
- Social benefits: engages more people in the process - reduces NIMBYism

Key Benefits Ideas

- Nuclear fusion would be highly disruptive on all levels (economic, social, political, safety)
- Nuclear fission allows resource conservation, frees up natural gas for other uses
- Cogeneration/CHP reduces GHGs, provides for more efficient use of current resources (30-40% more efficient)
- District energy allows local fuel generation and fuel security
- Energy storage enables other, more variable alternative and renewable resources to be used also enables better-designed systems which reduce capital costs and improve efficiency
- ICT/Transmission enables use of various, variable and vast energy sources - addresses public concerns while managing cost

All Barrier Ideas

- Nuclear fusion:
 - Scientific knowledge and technology
 - Cost is unknown
 - Innovation (research), incubation, commercialization, financing and economics
 - "Hard sell" – Alberta sees itself as an oil and gas province
 - Alberta has minimal current involvement in fusion development or partnerships
 - Marketplace barriers
 - No regulatory environment
 - Association with "nuclear" can be viewed as very negative
- Small-scale fission:

- Procurement of fuel and management of spent fuel storage
- Public perception – perceived and actual risk.
- Safety and security - extremely difficult to ensure
- Lead time to establish plants - Environmental Impact Assessments (EIAs), public consultations, regulatory compliance, permitting, etc.
- Water impacts
- Technology not currently in commercial use - now used in military but not civilian purposes
- Combined heat and power (cogeneration)
 - Energy agreements and power purchase agreements (PPAs) are usually on a small scale (25-50MW units)
 - Heat hosts beyond large industrial operations needed
 - Regulatory blocks – small-scale operators have to be considered a “utility” in order to transmit electricity across a road - this could be alleviated by changes to the transmission system
- District energy:
 - Thermal and electrical purchase agreements needed
 - Sunk costs in existing infrastructure
 - Capital intensity and risk
 - Overcoming the status quo while natural gas prices are so low
- Energy Storage:
 - Technology for electrical storage is still under development for large scale uses – still early days
 - Capital, installation and area needed are intensive – difficult to fit into downtown cores
- ICT/Transmission:
 - Technology - more for transmission than ICT
 - Grid is highly risk-adverse
 - High costs associated with any sort of change
 - Regulatory environment uncertain
 - Education needed (e.g., operators, government, others)

Key Barrier Ideas

- Technology and innovation
- Financing and costs – requires stability and risk-minimizing incentives
- Policy and regulatory environment
- Uncertainty
- Policy and regulatory environment
- Public knowledge, acceptance and perception

All Ideas to Overcome Barriers

- Overcoming financial and investment barriers:
 - Government incentives (tax incentives, subsidies, tariffs, offering memorandums - see Nova Scotia)
 - Loan guarantees - government providing support to reduce insurance or financing rates
 - Extend local improvement charges to the inside of a building to pay for district insurance
 - Purchase agreements through mandatory connections or through municipal control
- Regulatory and jurisdictions:
 - Allow for more municipal authority over regulation of energy transmission, housing development, etc.
 - Comprehensive regulatory review of existing regulations & leg in order to enable and promote alternative and renewable energies
- Technology:
 - Need to connect the people working in this field
 - Need a vehicle for testing and incubating new ideas and technology – work with the new innovation system targeting mid-sized companies
 - Better linkages between people and industries to educate stakeholders on who the players are
- Public knowledge:
 - Improve knowledge, acceptance and build market demand
 - Teacher and professional education incorporated into the school system

- Knowledge channel to the general public to inform the public on important issues

Key Ideas to Overcome Barriers

- Financial incentives - government incentives
- Regulatory - comprehensive regulatory overhaul to enable and encourage use of alternative and renewable energy
- Establish required purchase agreements – produce guidelines and templates for energy purchase agreements
- Public knowledge - education of this and the next generation
- Support innovation system in Alberta

The breakout groups reported their key findings to the plenary through the course of five 10-15 minute presentations, each followed by a brief Q&A session.

Integrating Conversation: Common Barriers & Solutions

Prior to hearing the breakout group reports, the plenary was asked to note any common barriers and common ideas for overcoming barriers that cut across more than one alternative and renewable energy resource and technology area. At the conclusion of the breakout group presentations, plenary participants were asked to refer to their notes on common barriers and common ideas for overcoming barriers that cut across more than one alternative and renewable energy resource and technology area. They were then asked to share their ideas with their table neighbors by self-organizing into table groups of 3-4 people. After a few minutes of conversation, the table groups reported the following ideas to the plenary on common barriers and solutions:

Common Barriers

- Electrical energy pricing model
- Public education and awareness
- Cumbersome regulatory processes
- Lack of full cost accounting – not pricing environmental externalities
- Financial risk and financing
- High upfront costs
- Lack of examples and demonstration projects
- Lack of policy leadership and program stability

Common Solutions

- Vision with consistent follow-through over time
- Improve regulatory clarity
- Streamline the regulatory process
- Price carbon and other environmental externalities (e.g., impacts on water, air, land, soil, habitat and human health)
- Full cost accounting for alternative & renewable, fossil fuel and power resources
- Lend support to demonstration projects
- Champion financing mechanisms and incentives
- Increase education and awareness
- Improve workforce training
- Increase research capacity of academic institutions, government and industry
- Work to assure continuity of government support

Key Learnings & Insights

In response to an open question whether there were any key learnings or insights that surfaced through the course of the day, participants touched on the following ideas:

- Wind and hydro sectors have completed a great deal of work on barriers and have executed many projects – there is an opportunity to apply learnings gained in those sectors to emerging sectors (e.g., solar, geothermal, others)
- A 20th century regulatory system is insufficiently nimble, flexible and resilient to meet the needs of alternative and renewable energy resource and technology development in the 21st century
- Alberta and Albertans are not alone in the alternative and renewable energy world nor are Alberta's alternative and renewable energy experts
- Green jobs are more than manufacturing jobs – the advancement of alternative and renewable energy resources and technologies is an excellent place to apply Albertan skill sets – let's not sell our capabilities short
- Alberta has a pioneering spirit and can be pioneers of emerging alternative and renewable energy resources and technologies

Session Closing

In addition to touching on next steps in the process and confirming that a session report will be completed and distributed to participants, Ian Mackay and Susan Carlisle thanked participants for their valuable contribution.

Session Participants

To keep the session manageable only a very small group of diverse experts were invited to share information. Because alternative and renewable energy is such a broad topic, inviting representatives from individual companies was deemed impractical. As a result industry associations were invited to provide information on behalf of the individual companies in their respective industries. It was made clear that all the participants and others who were not able to participate will have opportunities to provide input when the subsequent consultation stage is reached.

The following organizations and representatives were invited to the September 16 session:

Alberta Association of Municipal Districts and Counties

Tasha Blumenthal
AAMDC Board of Directors & Vice-President

Alberta Clean Tech Industry Alliance

Rus Matichuk
President

Alberta Direct Connect

Colette Chekerda
Executive Director

Alberta Economic Development Authority

Robert Fernandez
Executive Director

Alberta Electric System Operator

Jacques Duchesne
Program Manager Wind Integration

Alberta Electric System Operator

Miranda Erickson
Director, Market Services

Alberta Geothermal Energy Association

Dean Turgeon
Chair

Alberta Innovates

Axel Meisen
Chair of Foresight

Alberta Urban Municipalities Association

Jason Wayward
Director of Policy and Advocacy

Canadian Bioenergy Association

Douglas Bradley
Director

Canadian District Energy Association

Mary Ellen Richardson
President

Canadian District Energy Association

Robert Doyle
Alberta Representative

Canadian Geoexchange Coalition

Denis Tanguay
President and CEO

Canadian Geothermal Energy Association

Craig Dunn
Alberta Representative

Canadian Solar Industries Association

Brent Harris
Alberta Caucus Chair

Canadian Solar Industries Association

Wes Johnston
Director of Policy and Research

Canadian Wind Energy Association

Brian Murphy
Western Canada Policy Manager

Clean Air Strategic Alliance

Robyn Jacobsen
Project Manager, CASA Secretariat

Climate Change and Emissions Management Corporation

Kirk Andries
Chair

Climate Change Central

Simon Knight
Director

Independent Power Producers Society of Alberta

Ewan Bahry
Executive Director

Industrial Power Consumers Association of Alberta

Sheldon Fulton
Executive Director

Industrial Power Consumers Association of Alberta

Vittoria Bellissimo
Policy and Regulatory Consultant

Municipal Climate Change Action Centre

Bob Hawksworth
Director

Pembina Institute

Tim Weis
Director of Renewable Energy and Efficiency Policy

Solar Energy Society of Alberta

Rob Harlan
Director

Southern Alberta Alternative Energy Partnership

Bev Thornton
Director

University of Alberta

Andrew Leach
Assistant Professor, University of Alberta School of Business

University of Calgary

David Keith
Canada Research Chair in Energy and the Environment

Venture Capital Association of Alberta

Rebecca Giffen
Director of Investments

WADE Canada

Elizabeth Huculak
President