indicators

The following indicators were derived from the discussions at Workshop 1 and previous indicator research undertaken by the Design Centre for Sustainability and its partner research groups.*

The proposed Energy Indicators are:

Solar Orientation Intensity

Infill Intensity

Modal Diversity

District Energy Proximity

Heat Capture Connectivity

Energy Demand Distribution

Waste to Energy Capture Intensity

Ron Kellett, Sara Fryer & Isabel Budke. 2009 Specification of Indicators and Selection Methodology for a Potential Community Demonstration Project. Report for CMHC/NRCan.

Solar Orientation Intensity

energy

INDICATOR

Solar Orientation Intensity reveals the degree to which the aspect of the lot enables passive solar design to reduce heating, cooling, and lighting requirements throughout the year. A southern orientation of the parcel and building footprint enables even traditional home designs to take advantage of sunlight.

DESIGN METRICS

- % of buildings oriented towards the south
- % total parcel frontage within 25º of south
- % of roofs that are flat or have one primary south-facing slope

SUPPORTING STRATEGIES

- Mandate passive solar architectural details.
- Add to the building code pre-piping for future additions of solar energy capture technologies (i.e. solar hot water or photo-voltaics)
- Control building heights to prevent over-shadowing neighbouring buildings

Infill Intensity

energy

INDICATOR

Infill Intensity reveals the optimization of existing energy infrastructure through densification. A focus on increased density in areas serviced by existing infrastructure reduces demand for new energy infrastructure, shares maintenance costs among more consumers, reduces transmission losses, and enables other forms of energy efficient behaviours.

DESIGN METRICS

- % of new developments served by existing energy infrastructure
- Population per hectare
- Jobs per hectare

SUPPORTING STRATEGIES

- Reuse existing buildings
- Focus on energy conservation efforts to minimize need for additional energy production
- Employ green building rating certification
- Produce a % of building energy requirements using microgeneration technologies
- Reallocate density from areas at risk from natural hazards to reduce energy required for protection (i.e. pumps, dikes, and slope stabilization)
- Implement a 7 to 10 story maximum height in dense nodes and 4 to 8 stories along corridors for optimum balance between energy efficiency and building turnover to accommodate new technologies.
- Develop neighbourhood waste-to-energy plants
- Include 1 hour consultations on energy efficiency as part of of building permit process

Modal Diversity

energy

INDICATOR

Modal Diversity reveals the available forms of transportation and respective energy use. By enabling a variety of transportation options and energy types to be used for a resilient mobility network, reliance on importing energy from outside sources is reduced.

DESIGN METRICS

- Number of different designated lane and path types
- Ratio of total route kilometers between all mobility options
- Number of different mass transit options

SUPPORTING STRATEGIES

- Enhanced electric vehicle use
- Speed limits based on vehicle efficiency with appropriate road design
- Improved amenities for self propelled and non-combustion vehicles
- Distributed mobility network rather than high-speed corridors
- Greater emission restrictions
- Include actual complete costs of GHG emissions in oil pricing
- Subsidize greener mobility options using carbon taxes
- Reduced, or no, minimum parking requirements
- Include requirements for charging stations in design guidelines for public and private spaces

District Energy Proximity

energy

INDICATOR

District Energy Proximity reveals the proportion of development serviced by district energy systems. By centralizing heating on a block or neighbourhood scale, buildings are more efficiently and reliably served than through employing individual building-based HVAC systems.

DESIGN METRICS

- % of population and jobs within the service area of a district energy system

SUPPORTING STRATEGIES

- Monitor building skin area intensity and relationship to heat loss
- Encourage green energy jobs
- Increase residential and employment density
- Shift density from areas prone to natural hazards
- Use low grade energy sources for low grade uses (i.e. heating)
- Build neighbourhood waste-to-energy plants
- Mandate passive solar building design

energy

Heat Capture Connectivity

INDICATOR

Heat Capture Connectivity reveals the degree of connection with alternative heating sources. Heating and cooling needs can be addressed through heat transfer with natural and man-made sources and processes. Waste heat is a resource that can be reused by clustering complementary heating/cooling requirements, exchanging heat with outgoing waste, or tapping into natural sources.

DESIGN METRICS

- % of buildings connected to a district heating system, ground-source heat pump, or sewage/surface water heat exchange.
- % of wastewater treatment facilities capturing energy content of wastewater

SUPPORTING STRATEGIES

- Monitor the % capacity of neighbourhood heating/cooling facilities employed by adjacent land uses.
- Use smart growth patterns
- Create disincentives to use electric heat
- Mandate passive solar architectural design
- Use low grade energy sources for low grade uses
- Cluster land uses that have complimentary heating and cooling requirements

Energy Demand Distribution

energy

INDICATOR

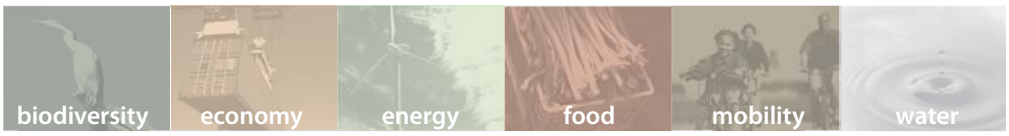
Energy Demand Distribution reveals potential energy use patterns. In addition to the other benefits of mixing uses, energy demands for a mixed use neighbourhood are more equalized throughout the day. Varying uses all have their own peak energy use periods and an appropriate mix of uses minimize overlapping demand times.

DESIGN METRICS

- Simpson's Diversity Index for all land use categories
- % of potential heat anchor land uses within 400m of mixed use areas
- % of buildings with green roofs to reduce heating/cooling loads

SUPPORTING STRATEGIES

- Monitor the difference between base energy requirements and peak demand times for a service area.
- Use smart grids and smart meters to manage energy demands and enable decentralized energy production
- Focus on energy conservation before implementing renewable sources
- Use renewable energy generation for base demand and supplement with combustion sources for peaks (with appropriate pricing scheme)
- Invest in green energy jobs
- Enable the use of micro generation technologies
- Employ low carbon landscaping
- Incorporate green infrastructure solutions
- Encourage each municipality to have an energy plan



Waste to Energy Capture Intensity

energy

INDICATOR

Waste to Energy Capture Intensity reveals the degree of energy recovery from waste sources. Recycling energy from waste sources reduces the load on conventional energy sources and landfill pressures.

DESIGN METRICS

- % of agricultural or municipal organic waste utilized for energy production
- % of municipal solid waste utilized for energy production

SUPPORTING STRATEGIES

- Employ neighbourhood biomass collection sites to encourage the reuse of yard waste

summary notes

The following summary notes were synthesized from the notes recorded during Workshop 1. The summaries identify themes that assist in describing key issues and developing design-based indicators.

energy

Energy Discussion Summary – April 16, 2009

Building Efficiency

- Pre-piping new construction for the future addition of passive solar
- Use low grade energy sources for low grade uses, such as heating
- Control high building locations to prevent shading of neighbours
- 7 – 10 story max in dense nodes for energy efficiency and to enable building turn over - to take advantage of new technologies
- 4 – 8 stories max along corridors to support transit and pedestrian neighbourhoods
- Design flexible buildings to enable reuse and minimize demolition/ construction waste
- Energy requirements for buildings of certain sizes (Merton Rule), moving to zero carbon buildings at the neighbourhood scale, LEED, LEED ND, and living buildings
- Low carbon landscaping
- less lawn and other energy intensive plantings
- Less hardscaping to encourage carbon capture, improve infiltration, lower construction and maintenance energy requirements
- Waste moved into energy system (biomass)

Resiliency

- About 80% of heat/cooling can be generated within the region through recapture and ground source sources
- For example: clustering complimentary heat exchanges/uses
- Look to biomass (using regional waste sources) and bio-gas as a renewable energy source.
- Neighbourhood waste/energy plants
- Intensified agriculture using bio-gas
- Focus on conservation first, then look to employ new renewable sources
- Meter all buildings
- Passive solar building design to minimize heating, cooling, and lighting requirements
- Integrate green infrastructure solutions to minimize energy needs for infrastructure.
- Add renewable energy generation where it make sense provincially and transmit the energy into the region
- Employ smart grids
- Decentralize and loosely couple energy sources for increased resiliency
- Meet base heat demand with renewable sources and use combustion sources for surges in demand

Mobility

- Reduce traffic speeds and promote electric vehicles (all electric within 10 years)

energy

- Annual % decrease in infrastructure and space for combustion vehicles
- Distributed mobility networks rather than high speed corridors
- Diversify modality of transportation networks by providing space and amenities (electrical outlets, pedestrian amenities)

Density

- Consider spatial needs of on-site energy generation and heat recovery
- Employ district energy system and encouraging density in the vicinity
- Each neighbourhood has an energy plant of some sort
- Mixed use distributes energy demand over a larger portion of the day
- Removing some areas from development
- To encourage densification and intensifying use of existing infrastructure
- Employ hidden and incremental density in single family neighbourhoods or ban single family home construction
- A strategic retreat from areas that are expensive (and energy intensive) to protect from flooding or the effects of climate change
- Reduce/eliminate minimum parking requirements

Implementation

- Address easy strategies and the more difficult long term strategies in parallel
- 1 hour consultation on energy efficiency as part of building permit process
- Major emission sources are buildings and mobility – initiatives should focus on these (including multi-purpose trips and carpooling)
- Utilize design considerations from QUEST
- Include actual costs of GHG emissions in oil prices and variable energy pricing based on demand.
- Refer to other cities and projects as examples of sustainable communities: Dockside Green, Okatokes, Stockholm
- Promote the beneficial aspects of sustainability, rather than inciting fear
- Use public green buildings as training grounds and educational tools
- Each municipality to have an energy plan
- Use smart growth patterns
- Create incentive to move to radiator heat / outlaw electric heat
- Subsidize green/more efficient energy and mobility options by implementing a surcharge on less beneficial options

workshop 1 notes

The following un-edited notes were recorded during the Research Roundtable Workshop 1 group discussions.

Sustainability by Design Research Roundtable
Workshop 1: Thursday, April 16, 2009 9:30am-5:00pm

ENERGY

Chair presentation
Works with Community Energy Association (CEA), which is a non-profit, collaboration of groups, to work with local govts on the how to, accelerating action, and planning for unavoidable surprises.
Not all energy is equal; we should use the right energy for what we need. Look at current energy sources (gas, diesel, natural gas, electricity, coal, propane, solar hot water, ground/air-source heat pumps, biomass, biogas, biodiesel, food). Major emission sources are buildings and mobility. Residential buildings are 46% of total building emissions mainly from heating space and water. Many buildings already built so we'll have to retrofit – 10 yr process potentially.
We have better energy sources – ground/air heat pumps, biomass, heat recovery, waste heat recovery, orientating our buildings, solar air and water heating. Utilize design considerations from QUEST. Additional considerations – design for flexibility, diversity of loosely-coupled energy sources, efficiency first then renewables, hot water radiators, design renewable heat systems for base heat requirements and combust for peaks, solar PV, building energy efficiency retrofits.

Chair:
Dale Littlejohn – Manager, Community Outreach and Strategy, Community Energy Association

Co-Chair:
Nicole Miller – Project Coordinator, DCS, UBC

Recorder:
Rachael Cabrera – Ops Manager, DCS, UBC

Participants:
Gordon Price – Director, SFU City Program, SFU
Jeff Carmichael – Senior Economist, Metro Vancouver
Kip Morison – Manager, Long Term Planning and R&D, BC Transmission Corporation
Peter Ostergaard – Sustainability Facilitator & Energy Coordinator, Smart Planning for Communities
Ray Kan – Senior Planner, Metro Vancouver
Robyn Wark – Sustainable Communities Senior Key Account Manager, BC Hydro
Ron Kellett – Professor, SALA, UBC
Ted Sheldon – Senior Climate Change Planning Analyst, Ministry of Environment
Rachel Boston – Senior Policy Advisor, Ministry of Environment
Maged Senbel – Asst Professor, SCARP, UBC
Mike Harcourt – Consultant

Bolded names were in attendance

What would a region look like operating from a sustainable energy perspective?
-crisis would tell the truth, crisis of energy would tell the truth
-GHG makes oil prices a different story

Perspective of intensity, distribution..?
-district energy use works by mixed use, sufficient space for onsite renewable resources
-pre-piping for passive solar in building code
-cheap energy has allowed space, politically hard to go against philosophy of making you poorer to do good, create a mechanism to counter this
-ALR imposed a compact form which is great. Remove things to reduce dispersion

Climate change affects dispersion..?
-cost more and more to protect risky land space (i.e. Richmond)
-need a # for a variety of things (i.e. how high are dikes, what the rise of ocean will be, how many pumps required, etc.)
-at what point does it make sense to abandon an area, cost of staying vs. cost of leaving
-where do you zone for development or not based on this, indicator of where do you stop zoning as cost of continuing dispersion is too high
-crisis leads to policy which leads to strategy (i.e. flood of 1948 led to more green space to absorb waters and compact building)

How much of energy derived locally, within the region..? (mobility, heat, electricity)…
Electricity
-use it for heat, electricity to move around
-electricity is limited, generate small %, makes more sense to generate elsewhere and pull it down
-electricity can come from sitesee, run of the river, huge wind farm potential off of the Charlottes, solar is limited unless price brought down via subsidies or improved technology
Heat
-heat more of an option
-BC is almost 40% renewable energy including the biomass
-massive wind on north coast, central coast, NE
-increase renewable energy in region by importing from these other areas
-75-80% of heat can be acquired locally, mix low-grade energy with a little electricity to meet this %, combustible for high energy use times
-metering telling ppl what they are using and what it costs
Mobility
-low hanging fruit: trips not taken, carpooling, fill empty car
-these items can affect social status, ego, etc.
-indicator: % of renewable energy coming in to the region
-electric vehicles that feed the grid, smart vehicles with plug in system
-speeds are slower
-smart grids
-hydrogen very limited use
-go electrically completely for vehicles within 10 yrs
-BC, Manitoba and Quebec can go completely electric

-Peak sharing: plan your system to meet your needs for peak requirements, incentive for ppl not to use energy during this peak time (i.e. BC Hydro paid pulp mills to shut down during peak times)
-Currently we waste huge amounts of energy. Conserve + technology can create huge conservation. Leed/green buildings/neighbourhoods, geothermal, solar panels, smart appliances, transit nodes, compact buildings/neighbourhoods are some of the things that can make a big impact in conserving energy. Big question is integrating all these initiatives. Integration is the key. 3% turnover in buildings, within 10 yrs you can change 30%

-Good indicator: how many energy related jobs created throughout the region for these initiatives.

-Create potential revenues selling renewable energy to US

-Large companies have $$ to spend on (Terasen) infrastructure. It's how they make there money, whether it's renewable or not

-Other renewable energy sources: organic waste, pine beetle trees → biomass potential is huge in BC just costly to move it

-Refer to other city examples for design of what a more sustainable community looks like: Dockside Green, Okatokes, Strathcona, Stockholm

-Each city has an energy plan, integrated energy system approaches, buildings facing south with overhangs to maximize sun, linking methane gas with more intense green house food growing, skating rink with swimming pools, clusters that work together for a heating/cooling perspective, top out at 7-10 stories as taller buildings use more energy in smaller centres, only bigger buildings in downtown Vancouver core, building resilience in the system

What about single family neighbourhoods..?
-densify without calling it that: allowed housing in downtown Vancouver, secondary suites, subdivision of single family lots when tear old one down, allow backlane cottages for rental housing or for food supply/garden, densification that doesn't overwhelm ppl

What's enough densification..?
-more along transit corridors, shopping centres, and bike paths/gardens in the rest
-get rid of single family zoning

How provocative do we want to be..?
-get going with low hanging fruit with the willing, conventional but will make an impact
-the tougher stuff is behavioral/structure changes, parallel them to come in 10-20 yr time, fear is used a lot (Bill Rees, David Suzuki) but need solution based strategies
-transition strategy
-to reduce oil/gas consumption 90% in next 10 yrs (which is reasonable) what are the first things to do? Metro Van and BC Hydro move to smart grid, smart growth patterns, partner with Washington, process to explore transition strategy (process and governance), distributed network rather than focusing on high speed corridors

-get away from towers as restrictive and highly consumptive so move towards mid-rise (public prefer low-midrise anyway), towers last longer and lock us into a system that may be green now but not in 10 yrs, ecologically less productive. Need to explore more.
-indicator: set # of proportional buildings as a target, start with public buildings first
-lots of commercial policy, want more private sector policy
-public and trades becoming more informed and receptive to green building, the processes, and requirements
-go beyond LEED to the living building and living community
-buildings to support multi-modal transportation, contribute to pedestrian/street (i.e. rain cover) realm, immediately build into building code.
-3 heat sources: burning natural gas, electric baseboards heaters, radiators. Moving to radiators seems logical choice. Outlaw electric heat as inefficient and unhealthy. Dicey moving to mandating specific heat sources, depending on where you're at in the region. Phase it out, how you set it up strategically for the change. Get some champions (i.e. dockside green) to show the benefits, not so hard, etc.
-indicator: certain buildings of certain sizes have to generate a certain % of their own energy. Zero carbon buildings and neighbourhoods. Each neighbourhood generating the vast majority of heat they require.
-neighbourhood waste plants, not just heating. Neighbourhoods that have no waste.
-city offers 1 hour training to public on how to make it more efficient, incentivize.

Other parts in urban fabric, other than buildings, do we need to consider for energy consumption..?
-landscaping, less grass, using non-treated water for non-drinking uses, pedestrian friendly streets, deploy plugs at every taxi stands, dedicated lanes that provide various benefits for various modal systems (bikes, mopeds, electric car, etc.), differential pricing or incentives for more efficient modal systems, annual % reduction for traditional combustible vehicle routes, reduce road space, living space doesn't have parking space attached to it (more affordable too), incremental shifting of reduced road/parking, more energy/waste recycling and capturing which is ecological rich environment that becomes a visual amenity part of every neighbourhood, urban agriculture-ratio of built space to cultivated space, local/organic production, traditional items become luxury items (SUV, meat), social stigmatism attached to wasteful energy uses– mcmansions, hummer, etc.

Plenary
Energy Presentation by Nicole and Dale
3 uses – mobility heat electricity – within 10 yrs
Mobility – electrify mobility
Heat – neighbourhood level, self-sufficient, short/long-term transitional stages
Electricity – provincial level and renewable side, smart-grid
Neighbourhoods-generate own heat, handle own waste, 4-10 storey buildings, living buildings, efficient and district energy, distribute to suburbs, smart grid, integrating all processes at this neighbourhood level with economic benefit back to the neighbourhood
Street systems-lane shift for other modal systems
Open spaces and how they would change over time – food growing, storm water management, geothermal energy systems
Energy pricing
Acceptability issues and phasing in, result in increase of jobs

RRT energy Notes
April 16, 2009

Price of Energy

- Building proximity to D. energy
- Space for onsite heating energy
- Pre piping for passive solar
- Effects space, take development land off the market

→Protection of valuable lands – high cost? Limits of growth?
How high will the dikes be? pumps?
→ at what point does it make sense to abandon certain parts of the lower mainland? (flooding etc)
→ What are the zoning regulations?
→ Post '48 flood regulations – compact development

- Local energy – heat, transportation, electricity
- Local = in region
- Electricity is a challenge here
- Heat – sewer, ground source approx. 80% in region?
- Low grade energy + small amount of energy
- Where is the 'wasted' energy? Carpooling, less trips
- Lots of empty space in cars and bedrooms
- % of renewable for region – monitoring
- Reducing speed, electrification of vehicles
- Energy efficient, local heat
- EVs for peak sharing
- Smart grid with mainly imported electricity
- Compact nodes
- Green infrastructure
- Integration

- Single family house is becoming "anchor"
    - Not good for district, but good for distributed energy
- Terasen Energy – use of pipe space (declining customer base)
- District energy system investments
- Pine beetle kill in biomass – costly to move - how transported?
- Each neighbourhood has an energy plant
    - Cities plus document
- South facing buildings
- Overhangs
- High building not blocking others
- Intensified agriculture using bio gas
- Proximate pairings of heat exchanges - clusters

    - 7-10 stories caps – for energy efficiency
    - Density in the centres, 4-8 stories on corridors
        - Are there elevators?
- SF – sneaky or upfront – density without calling it density
    - Secondary suites, subdivision of lots, lane housing
    - Incremental
- Density along corridors, transit right of way (ROW)
- Recycling lands
- Remove all SF zoning to allow duplexing/townhouses
- What is the transition strategy - low lying fruit first
    - Tougher stuff for the mid term
    - Big moved are parallel
- Some are really good with fear, but not solutions – people need hope
- What are the 1st things that have to happen? -
    - Infrastructure for all electric system – access to northern resources
    - Smart growth patterns
- Distributed mobility networks rather than high speed corridors

- Caution against wholesale acceptance of towers – poor energy performance; maintenance, common spaces

→ mid rise buildings types along distributed network

- What about 'green' towers?
    - Towers last longer – detriment and benefit – ecologically also productive – were not very good at "living buildings" high rise
- % of buildings larger wood frame buildings
- % LEED living buildings
    - Public versus private buildings
- How buildings support multi-modal transportation → contributions to pedestrian amenities (rain shelters)
- Space heating : Not electric baseboard, radiators
    - What is the new preference?
- Preferred – radiator heating
    - Not as transition
- Concerns over mandating certain heating technologies
- Merton rule – requirements for buildings of certain sizes
- '0' carbon buildings at <u>neighbourhood scale</u>
    - Use examples: Dockside Green, Dawson's Creek, Prince George

Neighbourhood Waste Plants

- For every SF building permit, 1 hour consulting time for information an efficiency
- Energy for landscaping –shift at the parcel level → waste being moved into energy system
- Pedestrian friendly streets

- EV infrastructure – new types of dedicated lanes – space needs, safety needs, speed needs – reduce opportunities for cars
- Charging stations available
- Reduction in total amount of space devoted to vehicles
- Parking requirements – options without parking “rights”
- Other land uses –spaces for energy and waste recapture – structured wetlands, ecological spaces, natural areas, amenities → similar to schools
- Urban agriculture: ratio of built spaces to cultivated spaces → requirement of post carbon world.