

Can we really electrify all our buildings & vehicles?

The grid impacts, GHG emissions & costs of widespread adoption of heat pumps & EVs vs. gas

Thurs July 30, 2020 | 2:00 - 3:00 PM ET Bruce (BF) Nagy & several guests



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BRUCE (BF) NAGY CLIMATE SOLUTIONS

- Columnist & features
- Consultant
- Author 200+ articles on climate solutions
- Author The Clean Energy Age, Rowman & Littlefield





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CAN WE REALLY ELECTRIFY ALL OUR BUILDINGS & VEHICLES?

WHAT WILL WIDESPREAD ADOPTION OF ELECTRIC BUILDINGS AND VEHICLES DO TO OUR POWER GRID AND BUDGETS?

- FOR MANY, ENVIRONMENTALISM SEEMED, IN THE PAST, LIKE A REMOTE, PARTISAN, COMPLEX, NON-ACTIONABLE CONVERSATION.
- FREAK OCCURRENCES LIKE INTENSE STORMS, FIRES, FLOODS AND HEAT WAVES AT THE NORTH AND SOUTH POLES HAVE INCREASED IN FREQUENCY.



• MORE PEOPLE ARE SHOWING AN INTEREST IN TECHNOLOGY THAT DOES NOT REQUIRE FOSSIL FUELS TO OPERATE.

• THE PANDEMIC HAS GIVEN US PAUSE TO RE-EVALUATE MANY OF THE ASSUMPTIONS ABOUT HOW WE DO THINGS, AND THE AGGREGATE IMPACTS OF OUR ACTIONS.

NOW THE KEY EXPERTS MIGHT BE ENGINEERS

- MORE OF US ARE LISTENING TO SCIENTISTS.
- POLICY PLANNERS ARE LISTENING TO ANOTHER GROUP OF EXPERTS – ENGINEERS.
- WHAT WORKS AND WHAT CAN BE SCALED UP?
- •.CAN WE REALLY ELECTRIFY ALL OUR BUILDINGS AND VEHICLES?
- HOW WILL IT IMPACT OUR ELECTRICITY INFRASTRUCTURE?

WILL HEAT PUMPS OVERPOWER THE GRID?

NOT SURPRISINGLY, THE GAS INDUSTRY IN CANADA HAS BEEN ADVANCING THE ARGUMENT THAT IF WE REPLACED EVERY FOSSIL FUEL HEATING APPLIANCE AND GAS POWERED CAR WITH HEAT PUMPS AND ELECTRIC VEHICLES, ALL THAT ELECTRICITY WOULD OVERWHELM THE POWER GRID.

IS THIS TRUE?



EFFICIENCY

- GRID STRESS WAS PART OF THE DEBATE IN NEW YORK STATE IN THE PAST FEW YEARS AS UTILITIES SOUGHT TO BUILD MORE PIPELINES AND COMMUNITY GAS INFRASTRUCTURE THERE.
- HEAT PUMP MANUFACTURERS AND CLEAN ENERGY ORGANIZATIONS PROVIDED CASE EXAMPLES AND STUDY DATA THAT CHALLENGED THE RUNAWAY ELECTRICITY USE ASSUMPTION.
- BOB WYMAN A GEOTHERMAL CONSULTANT SHOWED THAT BECAUSE AIR SOURCE HEAT PUMPS ARE GENERALLY TWO OR THREE TIMES



MORE EFFICIENT THAN A GAS FURNACE AND GROUND SOURCE HEAT PUMPS ARE THREE TO FIVE TIMES MORE EFFICIENT, THEY COULD PROVIDE THE NEEDED BTUS MORE EASILY THAN EXPECTED.

WEBINAR FOR CANADIAN GOVT OFFICIALS

- IN CANADA A POLICY WEBINAR WAS PRESENTED IN JUNE THIS YEAR BY THE HEATING REFRIGERATION AND AIR CONDITIONING INSTITUTE OF CANADA (HRAI).
- GOAL: HELP ABOUT 40 OFFICIALS FROM FIVE MINISTRIES LEARN MORE ABOUT AIR SOURCE AND GROUND SOURCE HEAT PUMPS.
- THREE CANADIANS MADE PRESENTATIONS AND WYMAN, WAS ALSO INVITED TO PRESENT THE NEW YORK POLICY STORY.



NEW YORK

- FIVE YEARS AGO BUILDERS, HOME OWNERS
 AND BUSINESS OWNERS WOULD BE PENALIZED
 UNDER ENERGY CONSERVATION PROGRAMS
 IF THEY WANTED TO DO FUEL SWITCHING
 AWAY FROM FOSSIL FUELS.
- NOW, MANY HEARINGS, COURT CASES AND RESEARCH STUDIES LATER, FUEL SWITCHING
 IS A KEY FOCUS FOR GOVERNMENT POLICY.
- THE STATE IS ACTING THROUGH NYSERDA -THE NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY.



• IT'S PROVIDING MULTI-PRONGED SUPPORT TO QUICKLY RAMP UP CLEANER BUILDINGS, BOTH NEW AND RETROFIT, BY PROVIDING INCENTIVE GRANTS, LOW INTEREST LOANS AND TRAINING FOR INSTALLERS, DESIGNERS AND INSPECTORS.

WEBINAR FOR CANADIAN GOVT OFFICIALS

PRESENTED BY THE HEATING, REFRIGERATION & AIR CONDITIONING INSTITUTE OF CANADA (HRAI) DURING JUNE 2020 FOR ABOUT 40 POLICY PLANNERS FROM NRCAN'S OFFICE OF ENERGY EFFICIENCY, CANMET ENERGY, ENVIRONMENT AND CLIMATE CHANGE CANADA, TREASURY BOARD SECRETARIAT, INFRASTRUCTURE CANADA AND THE PRIVY COUNCIL OFFICE.



SWEDEN: WIDESPREAD HEAT PUMP ADOPTION

- DURING THE SAME WEBINAR, MARTIN LUYMES, VICE PRESIDENT OF GOVERNMENT AND STAKEHOLDER RELATIONS FOR THE HRAI, REVIEWED A CASE STUDY ABOUT HOW SWEDEN MOVED FROM FOSSIL FUELS TO WIDESPREAD ADOPTION OF HEAT PUMP SYSTEMS.
- USER INCENTIVE PROGRAMS AND TRAINING WERE BEEFED UP
- SINCE 1994 SALES OF HEAT PUMPS HAVE BEEN BIG BUSINESS.



• MORE THAN HALF THE HOMES IN THE COUNTRY ARE HEATED AND COOLED BY HEAT PUMPS, MOSTLY GROUND SOURCE.

WEBINAR FOR CANADIAN GOVT OFFICIALS

MARTIN LUYMES, VICE PRESIDENT OF GOVERNMENT AND STAKEHOLDER RELATIONS FOR THE HRAI, JUNE 2020.



SWEDEN: KEY POINTS

- IN 1975 SWEDEN WAS USING MORE THAN 9,000,000
 CUBIC METRES OF HEATING OIL.
- BY 2014 THIS HAD DROPPED TO ABOUT 500,000
- WITH CORRESPONDING REDUCTIONS IN GREENHOUSE GAS EMISSIONS.
- ELECTRICITY USE DID NOT INCREASE.
- IT WENT DOWN NEARLY 30%, HELPED PARTLY BY IMPROVING HEAT PUMP EFFICIENCIES AND BY REPLACEMENTS OF ELECTRIC RESISTANCE SYSTEMS WITH HEAT PUMPS.



WEBINAR FOR CANADIAN GOVT OFFICIALS

JEFF HUNTER, VICE PRESIDENT OF THE ONTARIO GEOTHERMAL ASSOCIATION (OGA)

& STAN REITSMA, PRESIDENT OF THE OGA, JUNE 2020.



EFFICIENCY & TECHNOLOGY: KEY POINTS

- GROUND SOURCE HEAT PUMPS ARE 300% 500% MORE EFFICIENT THAN GAS FURNACES
- AIR SOURCE HEAT PUMPS ARE 200% 400% MORE EFFICIENT THAN GAS FURNACES
- THERE ARE MANY CONFIGURATIONS ALLOWING ALL HEATING AND COOLING NEEDS EVERYWHERE TO BE MET WITH HEAT PUMPS



- ADVANCED TECH: REAL TIME DATA MONITORING USE OF GEO IN CITIES ON BIG COMMERCIAL AND MULTI-UNIT RESIDENTIAL, INSTITUTIONAL PROJECTS, EVEN WHEN SPACE IS TIGHT.
- VERY STABLE GROUND SOURCE HEAT PUMPS CREATE LESS STRESS ON GRID PEAK USAGE THAN AIR SOURCE, WHICH IN TURN IS MORE STABLE AND MORE EFFICIENT THAN GAS.

NOT IN THE CLIP: WHEN COMBINED WITH MODERN BUILDING ENVELOPES & ERVS, AIR SOURC CAN BE AS EFFICIENT AS GROUND SOURCE, DEPENDING ON THE APPLICATION. AIR SOURCE TECHNOLOGY CONTINUES TO IMPROVE IN COLD WEATHER CONDITIONS.

ELECTRIFIED BUILDINGS, ELECTRIC VEHICLES & THE GRID

- RECENTLY A NEW REPORT WAS RELEASED CONTAINING PREDICTIONS FROM FUTURIST TONY SEBA & INVESTOR JAMES ARBIB.
- AMONG NUMEROUS PREDICTIONS: WE ARE MOVING TOWARD ENTIRELY DISTRIBUTED MODELS OF ENERGY SELF-GENERATION IN WHICH ELECTRONS ARE VIRTUALLY FREE.
- WIDESPREAD ADOPTION OF AUTONOMOUS ELECTRIC VEHICLES WILL REPLACE CAR OWNERSHIP WITH ON-DEMAND RIDE SHARING.

IT'S GRATIFYING WHEN HIGH PROFILE INDIVIDUALS PREDICT SOMETHING SIMILAR TO WHAT I WROTE IN MY BOOK, THE CLEAN ENERGY AGE (I AGREE FULLY WITH DISTRIBUTED ENERGY ABUNDANCE, AND PARTLY WITH THEIR PREDICTIONS ON CAR SHARING).



GRID CRISIS?

• ELECTRIC VEHICLES COULD USE UP TO ONE TRILLION KILOWATTS OF POWER IN NORTH AMERICA

- MORE THAN 100 MILLION BUILDINGS WILL BE ELECTRIFIED
- ON THE FACE OF IT, A MASSIVE LOAD.

BUT

- GAME-CHANGING TECHNOLOGIES & TRENDS WITH ELECTRICITY, THE GRID, BUILDINGS, TRANSPORT.
- COMPLEXITIES,
 VARIABLES AND
 INNOVATIVE
 TECHNOLOGY.





WE'RE CREATING AN ENTIRELY NEW ENERGY LANDSCAPE

WE'RE CREATING AN ENTIRELY NEW ENERGY LANDSCAPE.

FOUR KEY TRENDS IN ELECTRICITY GENERATION AND DISTRIBUTION:

- LOW COST, FAST-DEPLOYMENT RENEWABLES
- ROOFTOP & DISTRIBUTED
 GENERATION REVOLUTION



MICROGRID SOFTWARE & BATTERIES FOR MAXIMUM EFFICIENCY

VEHICLE-TO-GRID OPTIMIZATION

LOW COST FAST-DEPLOYMENT RENEWABLES

- STUNNING DROP IN COST OF UTILITY SCALE RENEWABLE POWER
- UNPRECEDENTED FLIGHT OF INVESTMENT CAPITAL FROM COAL, NUCLEAR, GAS
- WIND & SOLAR FACILITIES DEPLOYED IN A FEW MONTHS COMPARED WITH YEARS, EVEN DECADES FOR OLDER TECH
- NEW FOSSIL FUELS & NUCLEAR PROJECTS
 UNDERTAKEN ONLY BY THE UNEDUCATED
 OR COMPROMISED.



ROOFTOP & OTHER DISTRIBUTED GENERATION

- WHEN WE THINK ABOUT PEOPLE PLANNING POWER GRID CAPACITIES, WE IMAGINE PUBLIC UTILITY ANALYSTS; BUT THEY WILL BE LESS SIGNIFICANT IN THE FUTURE.
- INCENTIVES, REGULATION AND FEAR ARE DRIVING NORTH AMERICANS TO DISTRIBUTED GENERATION AND OFF-GRID SOLUTIONS.
- THE COST OF SOLAR AND BATTERIES CONTINUES TO DROP SIGNIFICANTLY.
- FEAR & INSECURITY: WORLD EVENTS LIKE THE PANDEMIC, INTENSE WEATHER, OIL PRICE VOLATILITY AND CIVIL UNREST IN THE STREETS.





DISTRIBUTED PLUS UTILITY SCALE = ABUNDANCE

- ROOFTOP, PRIVATE MICRO-GRID, UTILITY RENEWABLES ALL EXPANDING FAST WORLDWIDE.
- PRIVATE SOLAR DRIVEN BY PEAK SHAVING, RELIABILITY AND SECURITY CONCERNS.
- UTILITY PLANNERS ARE WELCOMING PRIVATE NETWORKS TO REDUCE INFRASTRUCTURE CHALLENGES.

PEAK LOAD CONTROL





- SOLAR PV IS INCREASING EFFICIENCIES AND EVOLVING INTO SMALLER, SLEEKER, INTEGRATED BUILDING PRODUCTS.
- INTEGRATED ROOFS, GENERATION WINDOWS, COATINGS THAT TRANSFORM ANY SURFACE INTO AN ENERGY CREATOR.
- 'SELF-CONTAINED, ENERGY POSITIVE' COULD BECOME A NEW NORMAL FOR BUILDINGS.

OFF-GRID DISTRIBUTED GENERATION -SECURITY CONCERNS-

- INTEREST IN OFF-GRID DISTRIBUTED GENERATION IS ALSO BEING DRIVEN BY ANYONE CONCERNED ABOUT TERRORIST ATTACKS ON PUBLIC POWER INFRASTRUCTURE.
- CYBERCRIME THREATENS MISSION CRITICAL GOVERNMENT OR CORPORATE CAMPUSES, FACILITIES, GATED RESIDENTIAL COMMUNITIES.
- OFF-GRID CAN BE EASIER TO ISOLATE, SECURE AND PROTECT.



MICRO-GRID SOFTWARE FOR EFFICIENCY

- SOFTWARE & BATTERIES WILL BE WORTH TRILLIONS
- WHISPER VALLEY, AUSTIN: THOUSANDS OF ULTRA-MODERN HIGH TECH HOMES SELLING QUICKLY, AVERAGE 1700 SQUARE FEET.



- ENERGY COMPANY CALCULATED LOADS AND CONCLUDED THAT FOR COOLING AND HEATING ROUGHLY 2.5 BOREHOLES WOULD BE NEEDED PER HOUSE.
- BUT EACH NEIGHBOURHOOD OF SEVERAL HUNDRED HOUSES COULD BE OPTIMIZED.
- MICROGRID SOFTWARE CUT THIS BY 60% TO 1.0 BOREHOLE PER YARD.

MICRO-GRID SOFTWARE & BATTERIES

- THESE CALCULATIONS DID NOT EVEN INCLUDE THE IMPACT OF HOME BATTERIES
- HOME BATTERIES ARE A HOMEOWNER
 OPTION AND WILL SOON BE A REQUIREMENT
 OF THE COMMUNITY MODEL.
- GIVEN THAT ROOFTOP SOLAR IS ALREADY A REQUIREMENT, HOME BATTERIES WILL REDUCE THE LOAD A GREAT DEAL FURTHER, BASICALLY TO ZERO OR BETTER.



• EACH GARAGE IS EQUIPPED WITH AN ELECTRIC CAR CHARGER.

VEHICLE-TO-GRID OPTIMIZATION

VEHICLE-TO-GRID OPTIMIZATION

- IN GERMANY AND AUSTRALIA VEHICLE-TO-GRID HAS MOVED BEYOND THE STAGE OF THEORETICAL OPPORTUNITY, TO ACTUAL WORKING MODELS OF SMART LOAD MANAGEMENT.
- HOMEOWNERS WITH ELECTRIC VEHICLES AGREE TO ACT
 AS PART OF AN EMERGENCY SOURCE OF BACKUP POWER
 TO THE PUBLIC GRID A FEW TIMES EACH MONTH WHEN PEAK LOAD CAN'T BE PERFECTLY SATISFIED
 OFTEN FOR SOMETHING LIKE 15 MINUTES AT A TIME.
- PAYMENTS ARE ABOUT 3X AS MUCH AS IT COSTS TO CHARGE THE SAME VEHICLE. PARTICIPANTS DRIVE FOR FREE PLUS PROFIT. NO REAL EFFECT ON LIFESTYLE.
- UNUSED POWER SHIFTED TEMPORARILY TO WHERE IT'S NEEDED BY ARTIFICIAL INTELLIGENCE.
- MORE ECONOMICAL FOR THE UTILITY TO PAY HOMEOWNERS FOR TEMPORARILY RENTING THEIR BATTERIES, THAN TO BUILD AND OPERATE A MULTI-MILLION DOLLAR GAS PEAKER PLANT.



CAN WE ELECTRIFY? WHAT ABOUT COST?

- DO WIND AND SOLAR POWER COST MORE THAN COAL,
 - NUCLEAR, AND GAS GENERATION?
- DON'T ROOFTOP SOLAR AND BATTERIES COST MORE THAN THEIR UTILITY SCALE EQUIVALENTS?
- THE COST OF HEAT PUMPS IS REPORTED AS HIGHER THAN GAS HEATING.
- ELECTRIC CARS STILL COST MORE UP FRONT AND GOVERNMENTS ARE PROVIDING CASH INCENTIVES TO DRIVE ADOPTION.



• EVEN IF OUR ELECTRICITY SYSTEM CAN EVOLVE TECHNICALLY AND ADAPT, WILL OUR GOVERNMENT BUDGETS BE ABLE TO HANDLE THE EXTRA COST?

THERE IS VERY LITTLE EXTRA COST

THE 'EXTRA COST' ALMOST ALWAYS MEANS

INVESTMENT IN SOMETHING THAT HAS A LOWER TOTAL LIFECYCLE COST:

- ALMOST ALL NEW POWER GENERATION IS RENEWABLES BECAUSE INVESTORS HAVE GIVEN UP ON COAL AND NUCLEAR, DUE TO HIGH COMPARATIVE COST.
- GAS PEAKER PLANTS WILL SOON BE TOO COSTLY COMPARED WITH INTELLIGENT UTILITY LOAD MANAGEMENT SOFTWARE/ LARGE SCALE ELECTRICITY STORAGE.
- ROOFTOP SOLAR/HOME BATTERIES ARE STILL RELATIVELY EXPENSIVE, BUT THIS IS CHANGING AT SCALE, AND OFF-GRID BENEFITS PROVIDE VALUE.
- LIFECYCLE COSTS OF AN ELECTRIC VEHICLE ARE LESS THAN A FOSSIL FUEL VEHICLE
- LIFECYCLE COSTS OF A HEAT PUMP ARE LESS THAN A FOSSIL FUEL SYSTEM. STAY TUNED.



Figure 2: 10 year savings of driving BEVs per household

DANDELION UPDATE

- DANDELION, A GOOGLE GROUND SOURCE RETROFIT COMPANY
- MASS MARKET AMBITIONS, RAISED CAPITAL A COUPLE OF YEARS AGO
- BEGAN SELLING SYSTEMS IN NEW YORK'S WESTCHESTER AND OTHER COUNTIES.

A KEY PRIVATE SECTOR PARTNER IN
 BOB WYMAN'S NEW YORK STORY. BOB
 WAS A CO-FOUNDER OF DANDELION BUT IS NOW A CONSULT



WAS A CO-FOUNDER OF DANDELION BUT IS NOW A CONSULTANT AND IS RUNNING FOR CONGRESS.

DANDELION UPDATE

- IN JANUARY 2020, BEFORE COVID-19, I VISITED SOME DANDELION PROJECTS.
- COMPANY HAS BEEN INCREDIBLY SUCCESSFUL.
- INSTALLED BETWEEN 200 AND 300 GROUND SOURCE RETROFIT SYSTEMS.HAS 300 TO 500 MORE ORDERS ALREADY ON THE BOOKS.
- PLANS ARE UNDERWAY TO EXPAND INTO OTHER STATES, WHICH ADMIRE THE NEW YORK MODEL.



• DANDELION IS SELLING SYSTEMS FOR LESS THAN USUAL. IN MANY CASES WITH A FINANCING DEAL --HOMEOWNER GETS ALL COOLING AND HEATING FOR ZERO DOLLARS DOWN AND \$135 PER MONTH.

WEBINAR FOR CANADIAN GOVT OFFICIALS

WHAT ARE THE COMPARATIVE COSTS OF GROUND SOURCE, AIR SOURCE

AND GAS-BASED HEATING & COOLING SYSTEMS?



Voice of Stan Reitsma

President & CEO Ontario Geothermal Assoc.

WEBINAR FOR CANADIAN GOVT OFFICIALS

DURING RATE CASE ARGUMENTS IN NEW YORK GAS INDUSTRY OFFICIALS ADMITTED THAT BUILDING OWNERS OFTEN ARE NOT CHARGED FOR CONNECTING TO GAS INFRASTRUCTURE, THUS CREATING A HIDDEN COST THAT IS ULTIMATELY BORNE INDIRECTLY BY RATEPAYERS

> You can't get there from here without heat pumps:

> > NY GHG Emissions: 40% Transportation, 30% Heating, 20% Electricity

Need to encourage GSHP:

Insufficient grid capacity to support ASHPonly systems. Recognized the unfair playing field:

NYSERDA study documented inequitable electric rates. - The average GSHP in New York City pays > \$800 per year in excess of cost to serve.

100 Foot Rule: "Free" hookups cost \$5,000 to \$30,000+ per hookup.

65 to 85 year cost-recovery for gas assets with 30 year life.

- Lower rates today but stranded assets tomorrow.

WHY DID NEW YORK CHANGE?

COST NOTES

- GAS HEAT COSTS THE MOST OVER ITS TOTAL LIFECYCLE, AND POLLUTES.
- AIR SOURCE COSTS LESS TO OPERATE THAN GAS, MORE THAN GROUND SOURCE DUE TO EFFICIENCY DIFFERENCES.
- THE THREE ARE IN THE SAME UP-FRONT COST
 CATEGORY FOR THE APPLIANCE, BUT FOR
 GROUND SOURCE THE GROUND LOOP MAKES
 THE DIFFERENCE IN COST.



HIDDEN COST: GAS VS. GEOTHERMAL

- DURING A HEARING A FEW YEARS AGO A LAWYER PRESSED AN EXPERT FROM ENBRIDGE ENERGY WHO ESTIMATED THE ONTARIO HIDDEN COST TO HOOK UP TO GAS AT C\$ 26,500 ON AVERAGE.
- IN THE US THIS HIDDEN COST RANGES FROM US\$5000 TO \$30,000.
- THESE HIDDEN COSTS FOR GAS ARE EVENTUALLY BORNE BY THE RATEPAYER, FOR GEO BY THE USER ALONE.
- THERE IS OFTEN NO RATE ADJUSTMENT FOR
 PEOPLE USING HIGHER EFFICIENCY HEAT PUMPS,
 EXCEPT WHERE AGGRESSIVE CONSUMER ADVOCACY CAMPAIGNS HAVE BEEN UNDERTAKEN.



ECONOMIC IMPACT ON UTILITIES

- GAS UTILITIES IN NEW YORK AND CANADA DON'T MAKE MUCH MARGIN ON THE GAS ITSELF. MOST OF THE ROI COMES FROM THE PIPES-IN-THE-GROUND ASSETS, WHICH THEY ARE CONTINUOUSLY GROWING AND MAINTAINING FOR THEIR GOVERNMENT CLIENTS.
- GEOTHERMAL IS ALSO A PIPES-IN-THE-GROUND BUSINESS, SO THE SHIFT TO GROUND SOURCE HEATING SHOULDN'T THREATEN THESE UTILITIES.
- GAS COMPANIES IN NEW YORK STATE ARE NOW WORKING
 WITH THE GOVERNMENT ON COMMUNITY GEOTHERMAL
 LOOP PILOTS.





CASE EXAMPLE, RICHMOND, BC

- A DISTRICT GEO-EXCHANGE / GSHP DISTRICT ENERGY SYSTEM HAS BEEN OPERATING FOR YEARS IN RICHMOND, BC NEAR VANCOUVER.
- THE RESULTS HAVE BEEN VERY POSITIVE. THEY STARTED WITH ONE COMMUNITY, AND ARE NOW BUILDING PHASE 5.
- IN 2019 THE CITY EXPANDED CONNECTIONS TO MORE THAN
 4.7 MILLION SQUARE METRES OF BUILDING SPACE, UP FROM
 THE PREVIOUS 330,000 SQUARE METRES. IT SERVICES WELL
 OVER 10,000 HOMES PLUS OFFICES, RETAILING AND OTHER
 KINDS OF BUILDINGS.





PASSIVE HOUSE

- GROUND SOURCE EXPERTS IMPLY THAT AIR SOURCE HEAT PUMPS COULD CAUSE A GRID PEAK CHALLENGE WITH ALL ELSE BEING EQUAL.
- HOWEVER IN REALITY ALL ELSE IS NOT EQUAL. MOST
 OF THE AIR SOURCE PROJECTS I'VE SEEN IN THE PAST
 FIVE YEARS HAVE BEEN COMBINED WITH ENERGY
 RECOVERY VENTILATORS AND BETTER
 BUILDING ENVELOPES.





CASE EXAMPLE KANSAS CITY

SECOND & DELAWARE IN KANSAS.

- A 278-UNIT, 321,000 SQUARE FOOT 7-STOREY APARTMENT BUILDING IN KANSAS.
- A PASSIVE HOUSE ENVELOPE.
- A DAIKIN VRF HEAT PUMP SYSTEM FOR HEATING AND COOLING, TWO SYSTEMAIRE
 ENERGY RECOVERY VENTILATORS ON EACH
 TOWER FLOOR, A C65 CAPSTONE MICRO-TURBINE COMBINED HEAT AND POWER UNIT FOR DOMESTIC HOT WATER, WHICH USES ITS WASTE HEAT TO GENERATE POWER.

• A 92 KW SOLAR PHOTOVOLTAIC SYSTEM TO PROVIDE SOME RENEWABLE ELECTRICITY.



CASE EXAMPLE KANSAS CITY

PRUDENCE FERREIRA, A HYGROTHERMAL SPECIALIST AND PASSIVE HOUSE PRACTICE LEAD AT MORRISON HERSHFIELD ENGINEERING, VANCOUVER:

"OUR COMPANY CRUNCHED THE NUMBERS FOR AIR-COOLED VRF, GEOTHERMAL VRF, COMBINED HEAT & POWER WITH 4-PIPE FAN COIL UNITS, AND HYDRONIC DISTRICT HEATING. WE HAVE DONE THE SAME FOR TIGHT ENVELOPE LOW CARBON BUILDINGS ALL OVER NORTH AMERICA. LATELY THE PATTERN HAS BEEN THAT VRF HEAT PUMPS HAVE THE BEST COP, AND THAT'S WHAT WAS USED IN KANSAS."



variable retrigerant how systems can deriver cooling to some zones and neating to others, with no reheat needed (an air-source system is shown here).

PASSIVE HOUSE IS A QUICKLY-GROWING ARCHITECTURAL TREND

- I MET PRUDENCE ONE WEDNESDAY AT HAPPY HOUR, A WEEKLY ONLINE MEETING OF BETWEEN 200 AND 300 TOP PASSIVE HOUSE SPECIALISTS FROM ALL OVER THE US, CANADA, EUROPE AND BEYOND, USING ZOOM SOFTWARE.
- THEY HAVE TO MEET WEEKLY BECAUSE THEY ALL WANT TO SHARE POWERPOINT SCREENS ABOUT THEIR LATEST PASSIVE HOUSE PROJECT, AND LESS OFTEN THAN WEEKLY SIMPLY WOULDN'T BE ENOUGH.
- RECENTLY TWO FAVOURITE PROJECTS OF MINE WERE
 FEATURED ON THE PASSIVE HOUSE HAPPY HOUR:
 THE 709 UNIT SENDERO VERDE PASSIVE HOUSE
 AFFORDABLE HOUSING PROJECT IN HARLEM
 AND KEN SOBLE, A SENIORS TOWER PASSIVE HOUSE RETROFIT IN HAMILTON.





PASSIVE HOUSE & HEAT PUMPS ARE POPULAR WITH ARCHITECTS, ENGINEERS & GOVERNMENTS

- PASSIVE HOUSE AND THEREFORE AIR SOURCE HEAT PUMP DEPLOYMENT JUST KEEP GROWING IN NORTH AMERICA.
- THEY ARE ALSO MOVING INTO CITY, PROVINCE AND STATE STANDARDS ALL OVER THE CONTINENT (EG. BC STEP CODE, TGS, PENNSYLVANIA, ETC.)



POPULARITY OF GEOTHERMAL IS ALSO EXPANDING QUICKLY

GROUND SOURCE:

- CONDOS & RENTALS IN TORONTO LIKE LILIAN PARK AND THE PLANT.
- UNIVERSITY BUILDINGS ALL OVER THE CONTINENT LIKE DURHAM COLLEGE, BOSTON UNIVERSITY, MICHIGAN UNIVERSITY AND UNIVERSITY OF NOTRE DAME.
- NEW SINGLE FAMILY HOMES & MICROGRID IN AUSTIN.
- DISTRICT GEO IN RICHMOND BC AND BLATCHFORD UNDER CONSTRUCTION IN EDMONTON.

• RETROFIT SINGLE FAMILY HOMES IN WESTCHESTER COUNTY



• ALL OF THESE PROJECTS ARE WORKING TECHNICALLY, ECONOMICALLY AND IN HARMONY WITH THE GRID.

CLEAN ENERGY IN THE PANDEMIC

VEHICLES:

- GLOBAL ELECTRIC VEHICLE SALES ARE DOWN MUCH LESS THAN GAS AND PETROL CARS.
- THEY HAVE BEEN GROWING QUICKLY FOR 10 QUARTERS AND SOME FORECASTERS SEE THEM DOMINATING ALL NEW CAR SALES BY 2025 AND HITTING 100% OF NEW CAR PURCHASES BY 2030.
- IN EUROPE DURING THE PANDEMIC ELECTRIC VEHICLE SALES WERE UP 56% WHILE PETROL CARS WERE DOWN 46%. LESS POSITIVE ELSEWHERE.



CLEAN ENERGY IN THE PANDEMIC

GREEN BUILDINGS: THERE SEEMS TO BE A FEELING THAT THIS TIME WE'RE GOING TO BUILD BACK BETTER, INVEST WITH A LONGER TERM VIEW, CREATE SOME JOBS AND ECONOMIC STIMULUS.



CLEAN ENERGY IN THE PANDEMIC

RENEWABLES TOO: IN GENERAL WHEREAS IN OTHER ECONOMIC DOWNTURNS CLEAN ENERGY HAS BEEN DROPPED LIKE A COLD POTATO, EVS, GREEN BUILDINGS AND CLEAN RENEWABLE POWER ARE ALL HOLDING STRONG (BUT SLOWER THAN PRE-PANDEMIC), RELATIVE TO FOSSIL FUELS, WHICH HAVE COMPLETELY CRASHED IN MANY SECTORS.



CAN WE REALLY ELECTRIFY?

ARE WE MAKING THE CLEAN ENERGY SHIFT EVEN IN THE MIDDLE OF A PANDEMIC AND RECESSION? CAN WE REALLY ELECTRIFY OUR BUILDINGS AND VEHICLES?



THE ANSWER IS A RESOUNDING "YES."



QUESTIONS?

Can we really electrify all our buildings & vehicles?

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- Affordable passive house retrofits (Hamilton & Boston)



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