Solar Panels and Battery Storage for Home Resiliency

Energy Save New West – July 30, 2026

Ben Giudici, P. Eng

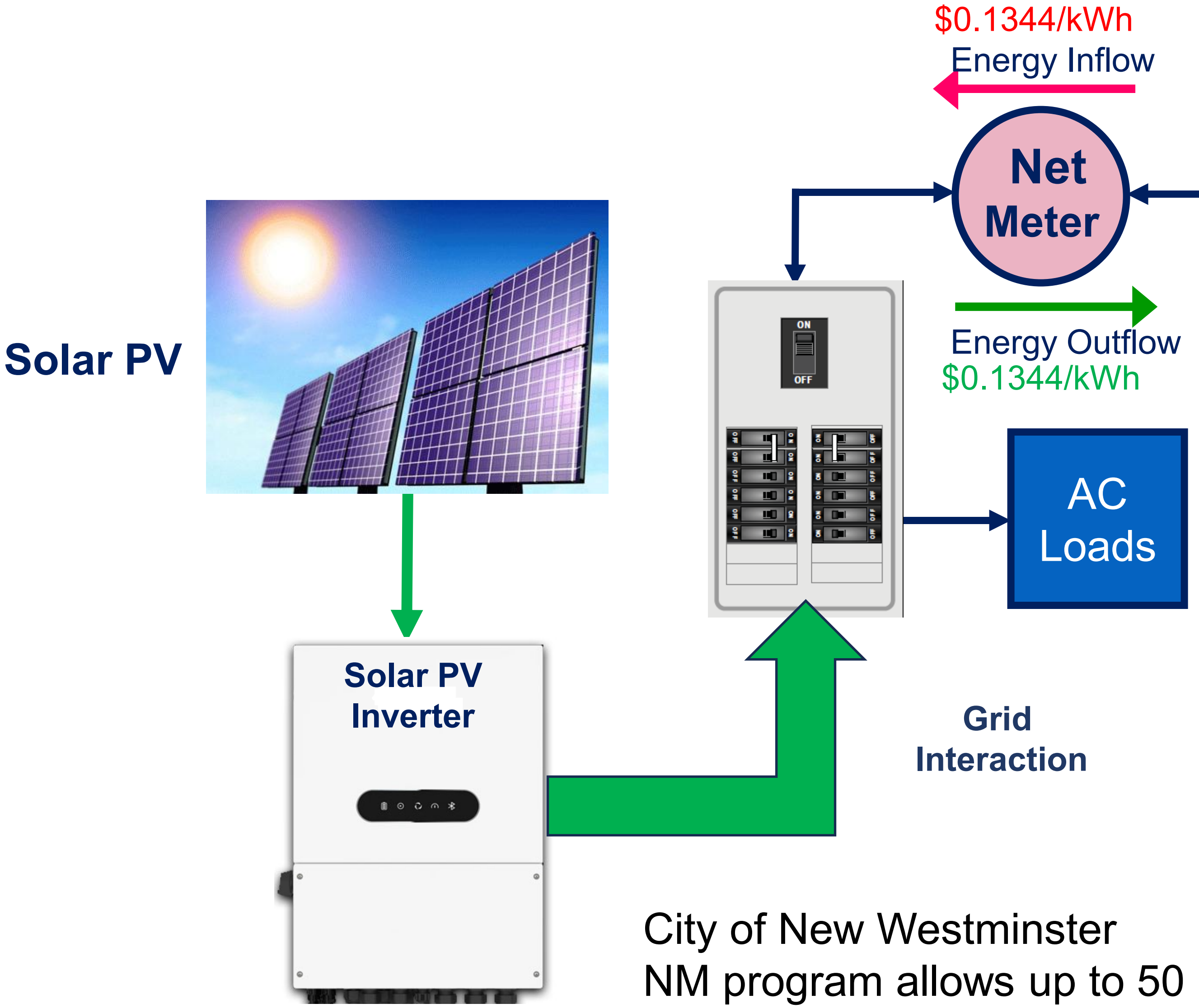
Overview

1. Solar PV and Storage Operating Principles and Resilience Motives
2. Trends and Emerging Technologies
3. Solar PV Effectiveness in BC's Lower Mainland
4. Key Considerations for Solar PV and Storage Projects
5. Approvals, Permitting, and Rebates
6. Case Studies – Motives, Project Economics
7. Overcoming Common Challenges for Best Outcomes

Solar PV and Storage - Home Resilience Motives

a) Lowering grid consumption for existing homes
b) Lowering grid consumption costs for homes undergoing electrical energy retrofits
c) Achieving performance certifications eg. Net-Zero, Living Building Challenge
   - Annual solar PV energy production ≥ Annual energy consumption of the home
d) Reducing vulnerability to grid events and evolving utility policy
   - Grid outage backup for essential loads
   - Leveraging changing rate structures

Solar PV Operation under New Westminster Net-Metering Rate 500



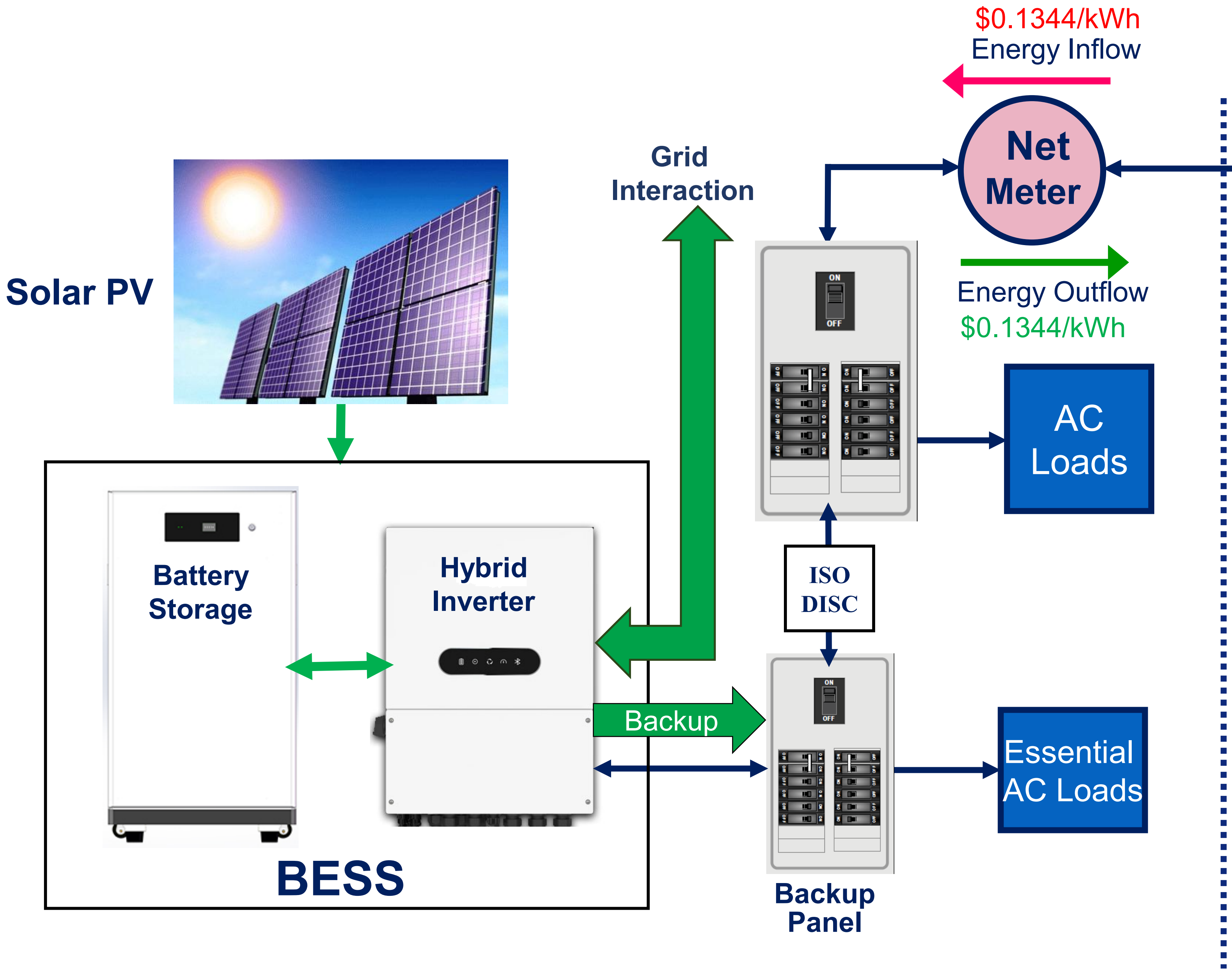
City of New Westminster NM program allows up to 50 kWac inverter capacity

Solar PV system interacts with the grid:

- Loads use PV system power as available, reducing inflow from the grid.
- PV system power output in excess of AC Load outflows to the grid, and is stored for later use.
- If billing cycle outflow > inflow, net energy credit in kWh is assigned to next billing cycle.
- Energy credits are retained and carried forward until account holder requests a refund.
- Inflow and outflow energy have equal value.

During grid outages, the solar PV system shuts down.

Solar PV with Battery Energy Storage – Adds Grid Synergies (Resilience)

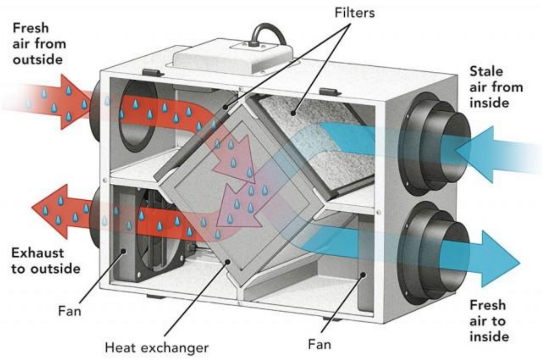


1. **Solar PV and BESS** interact with the grid to reduce grid energy purchase

2. **Essential Circuits Backup** in dedicated sub-panel during grid outages.

3. **Leveraging Utility Rates and Policy**

Reduced Grid Consumption for Existing Homes and Electrification Retrofits



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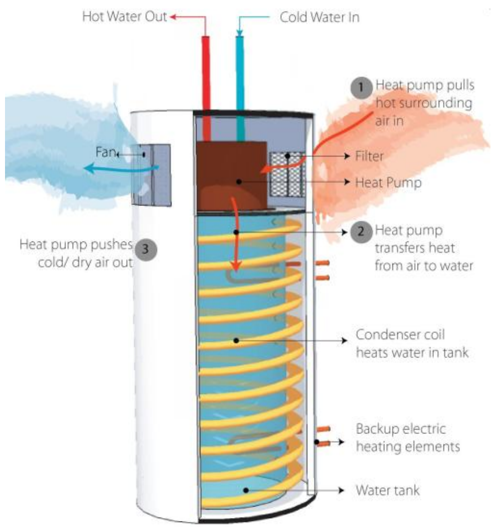

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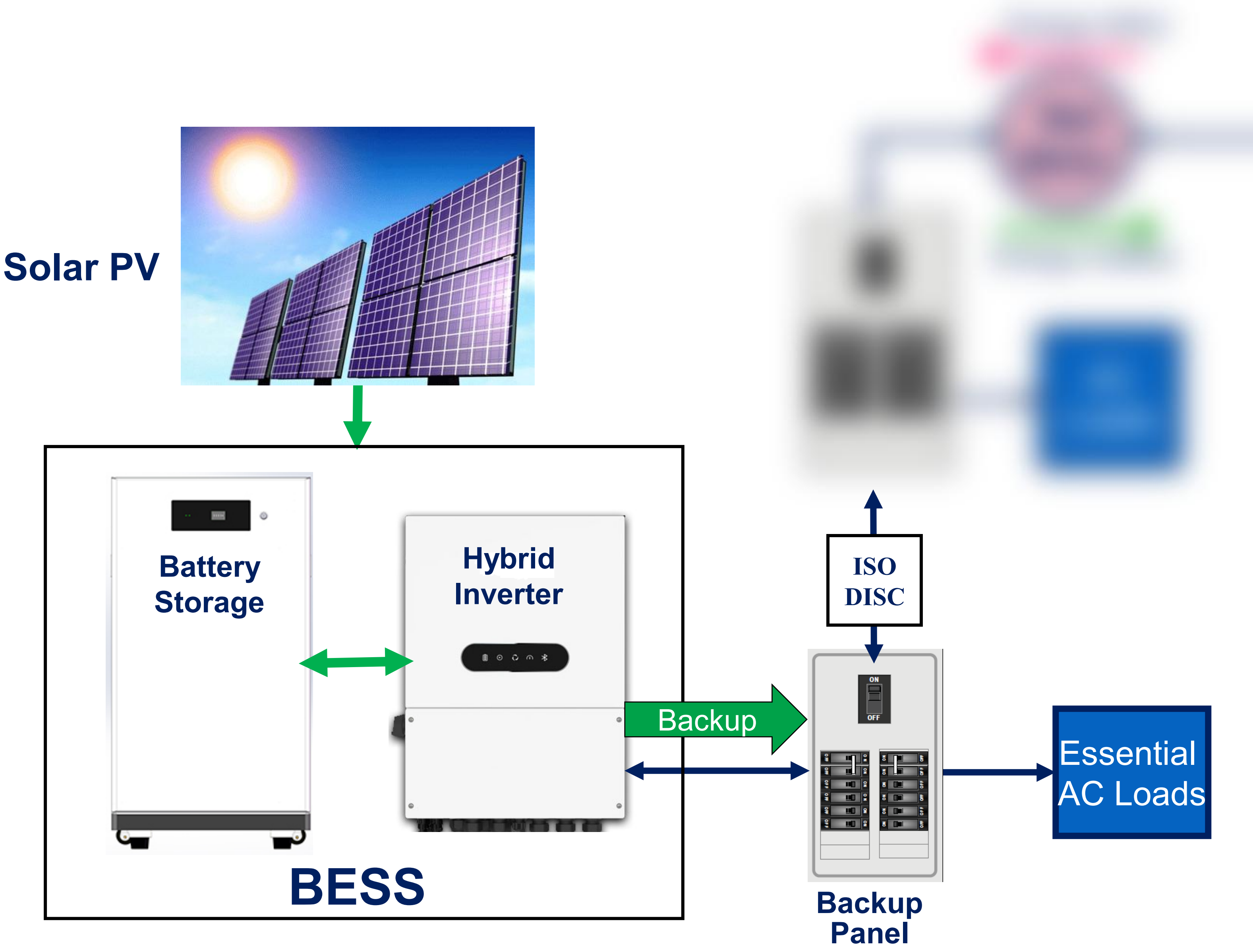
Solar PV mitigates operating costs by reducing dependence on grid energy.

Grid Resilience – Essential Loads Backup During Utility Outages

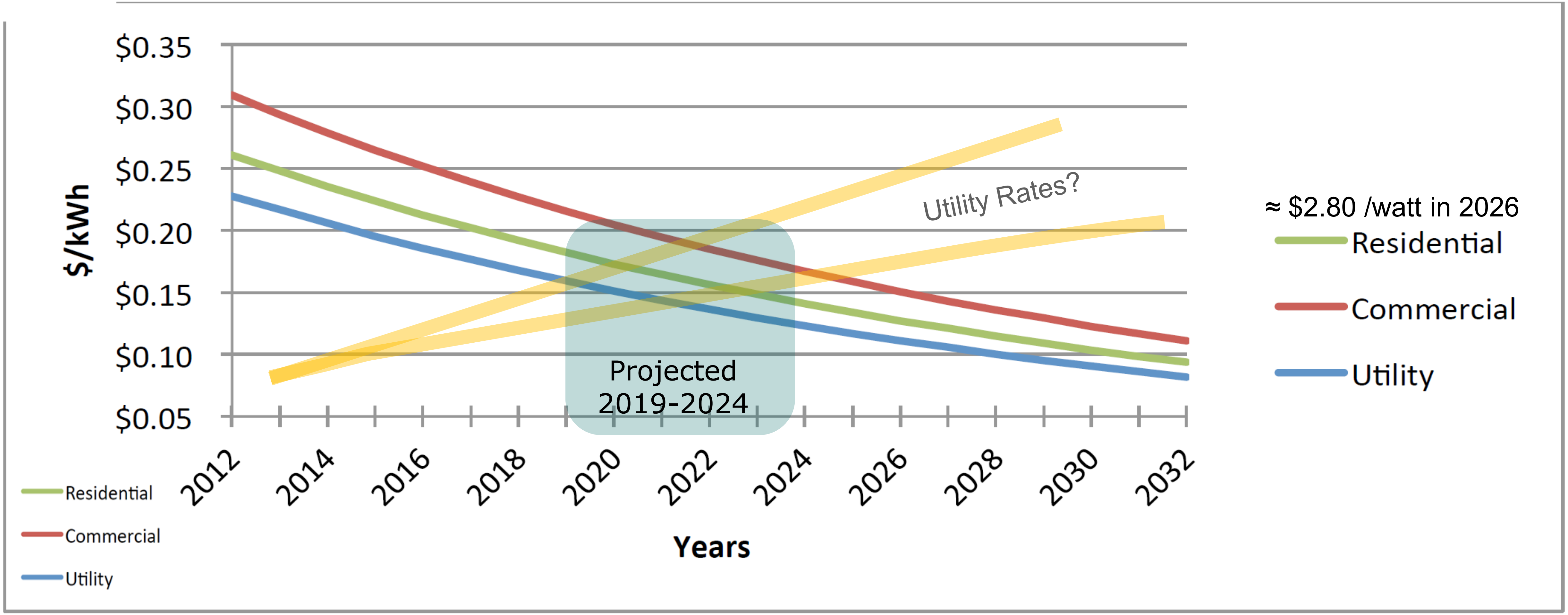


During grid outages Essential Circuits in dedicated sub-panel are backed up by solar PV and battery storage.

Solar PV Trends

1. Cost of solar PV has fallen more quickly than anticipated
   - Global normalizing of solar
   - Manufacturing competition
   - Improvements in technology and manufacturing methods
2. Cost of grid electricity has risen more quickly than anticipated
   - Utility upgrades to aging infrastructure
   - Electrification related utility capital projects
   - BCUC influences
   - Two-tiered rate structures

Quest for Solar Grid Parity



BCSEA 2013

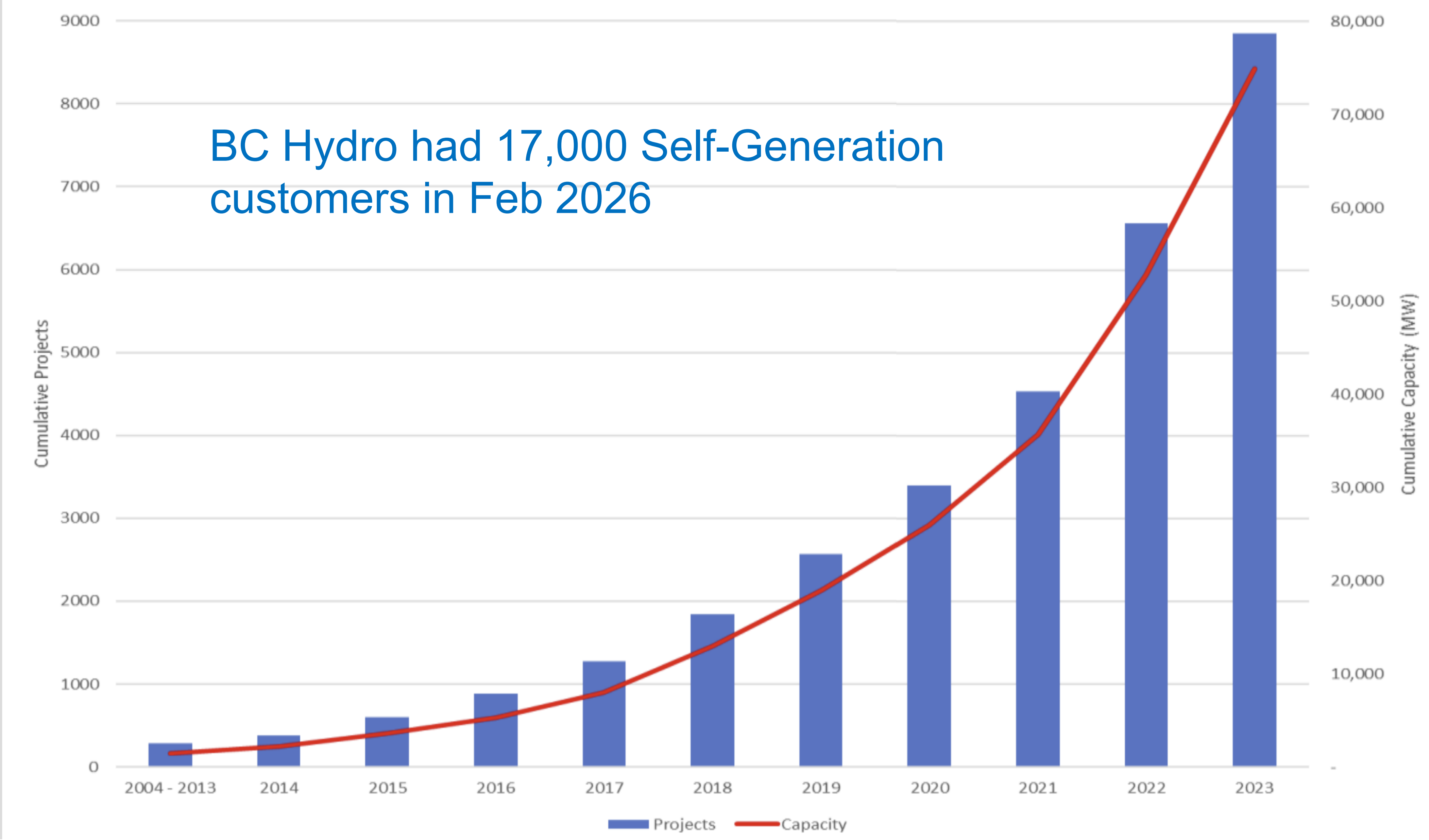
Solar grid parity for BC Hydro residential customers ≈ 2016

Residential Solar PV as an Investment

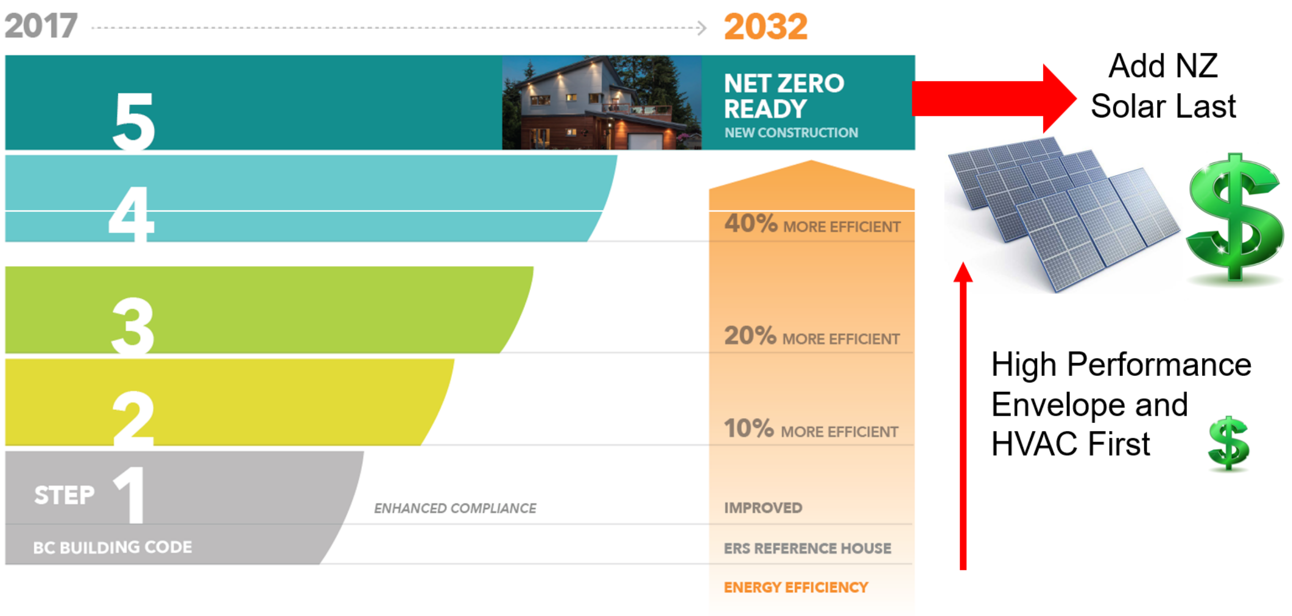
“Solar PV as an investment” is a new concept in BC ….

- Little public awareness how significantly solar costs have fallen.
- Rising energy cost concerns historically confined to industry vs households
- Aesthetics seem to trump function in residential markets.
- Solar PV incentives historically absent
- Initial capital cost has been a barrier
- PV skepticism vs trusting a globally mature and highly regulated technology
- Limited market experience with solar PV increasing property values

BC Hydro Self-Generation (Net-Metering) Adoption

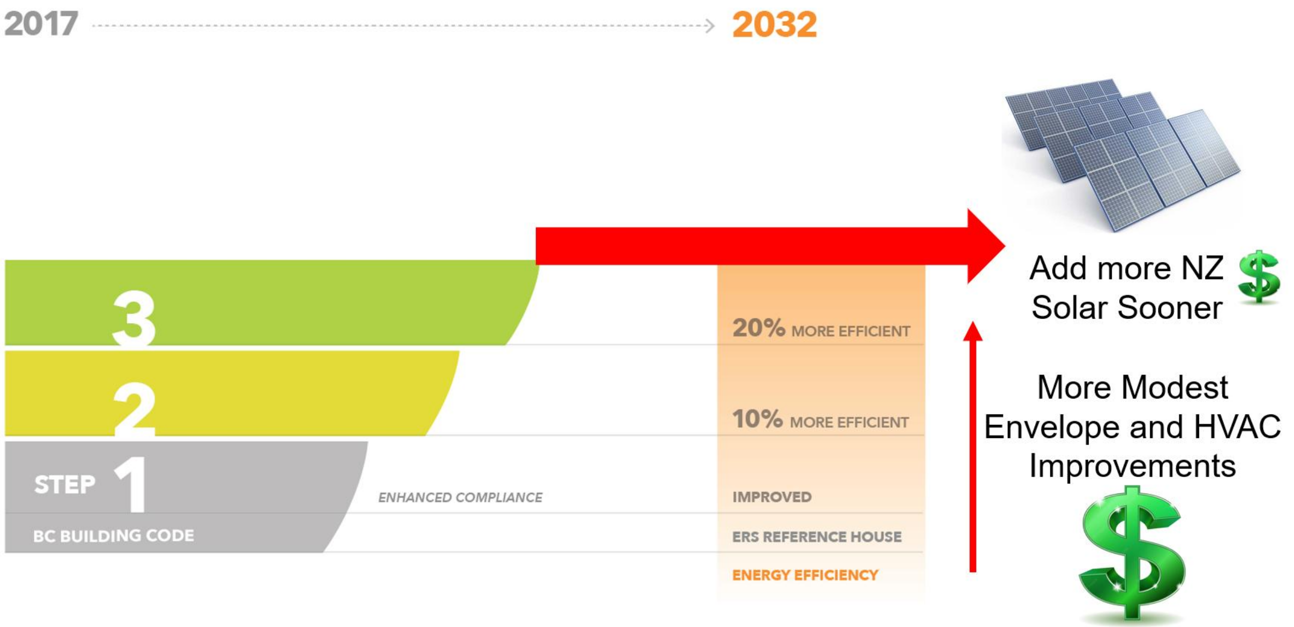


Net-Zero Thinking is Changing with Lower Solar Cost



Traditional – Solar Last

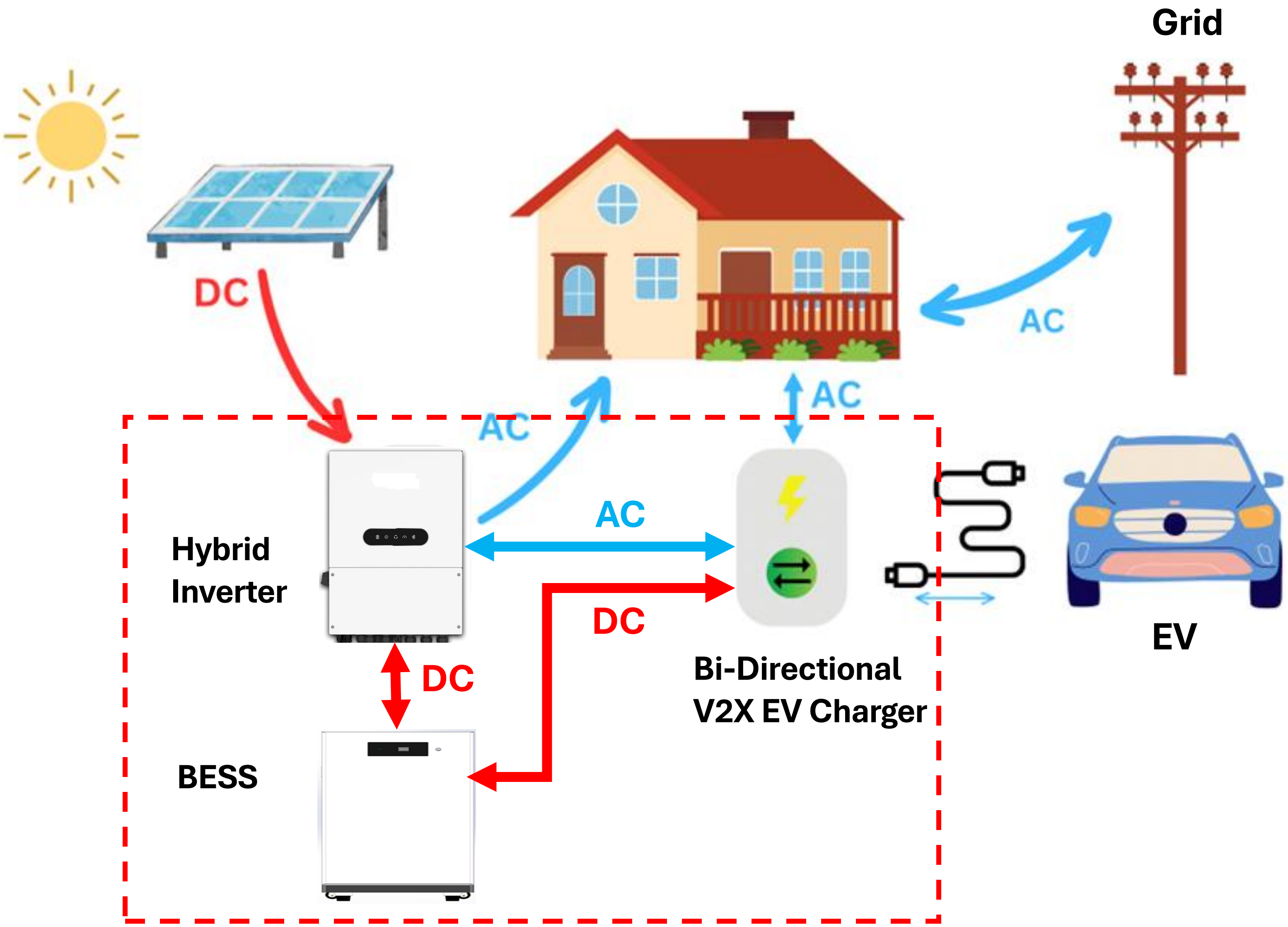
- $6+ per watt (2010)
- Solar PV only on Net-Zero homes



Recent – Solar Sooner

- $2.80 per watt (2026)
- Solar PV is not “Net-Zero or Nothing”
- Solar PV as an investment

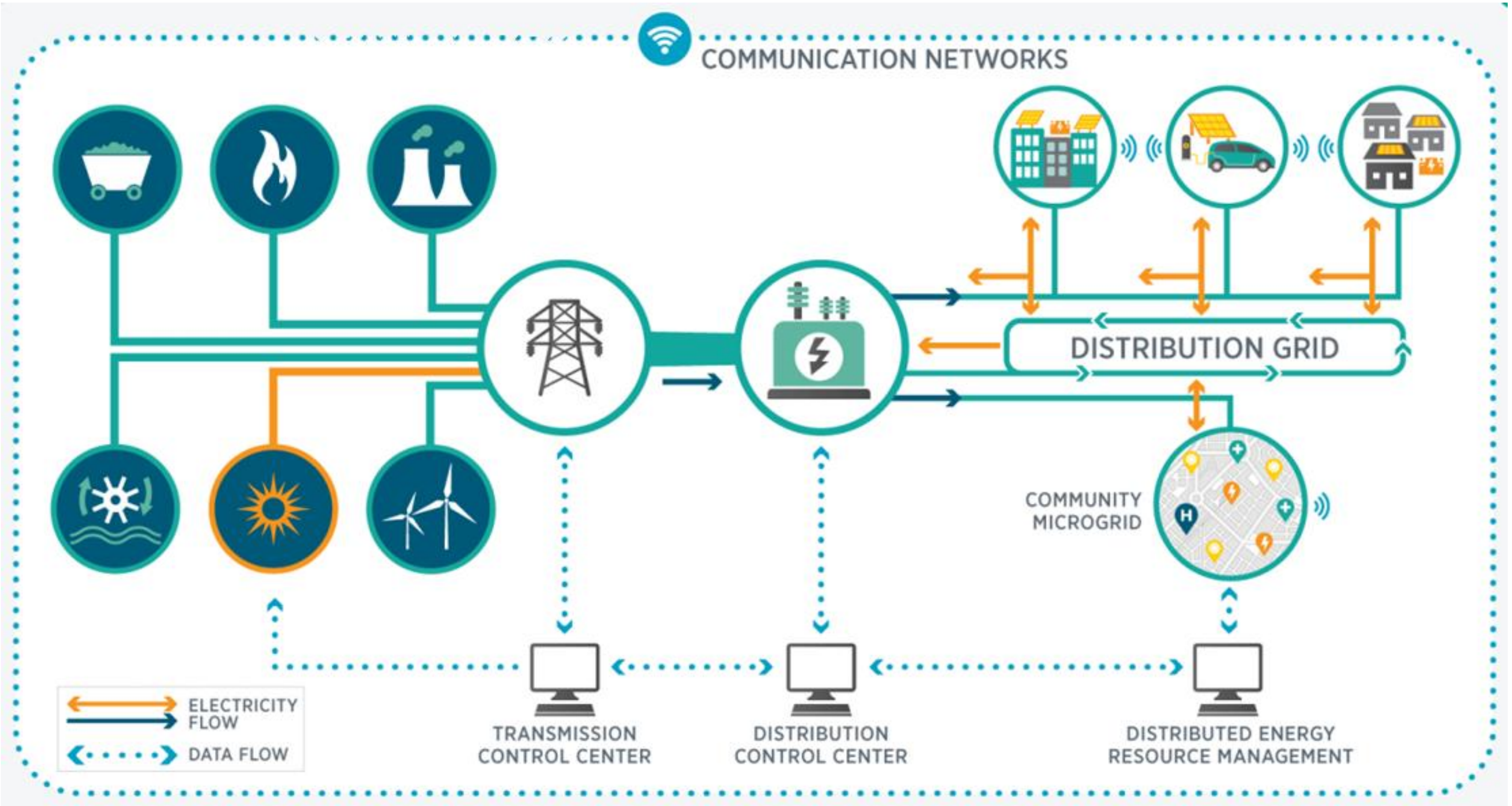
V2X - Vehicle to Grid, Home, Solar, BESS (Coming Soon)



- Enhances grid resilience
- EV charging directly via solar PV
- EV battery can interact with grid and backup AC loads with or without an existing BESS.
- Many EVs and some recent residential BESS systems are ready for this.
- Certifications, CE Code and utility policy needs to catch up to technology

Utility Distributed Energy Resource Management Systems (DERMS)

- Monitor and control customer-owned DER (solar PV, BESS, EVs) to meet peak demand, and improve grid stability.
- Aggregates multiple DERs as Virtual Power Plants (VPP) to support grid operation.
- Demand response load shedding to reduce demand during grid compromising events.



BC Hydro Peak Saver Demand Response Program and Eguana Home Batteries

BC Hydro DERMS system remotely adjusts battery discharge during periods of high grid electricity demand during peak load events.

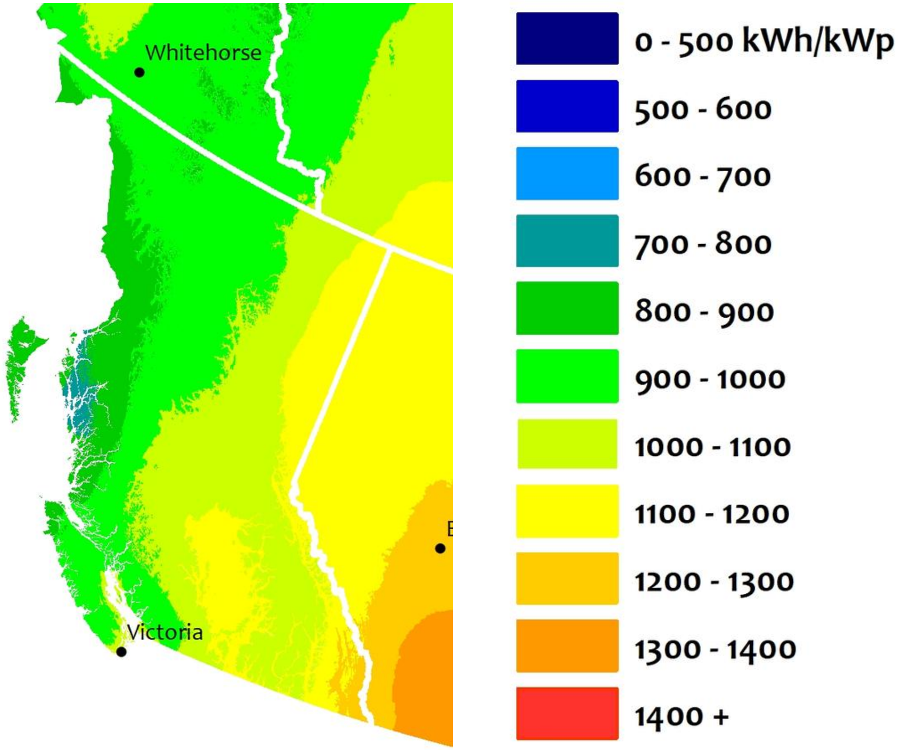
BESS discharges to help power customer home circuits during peak load events for up to 4 consecutive hours.

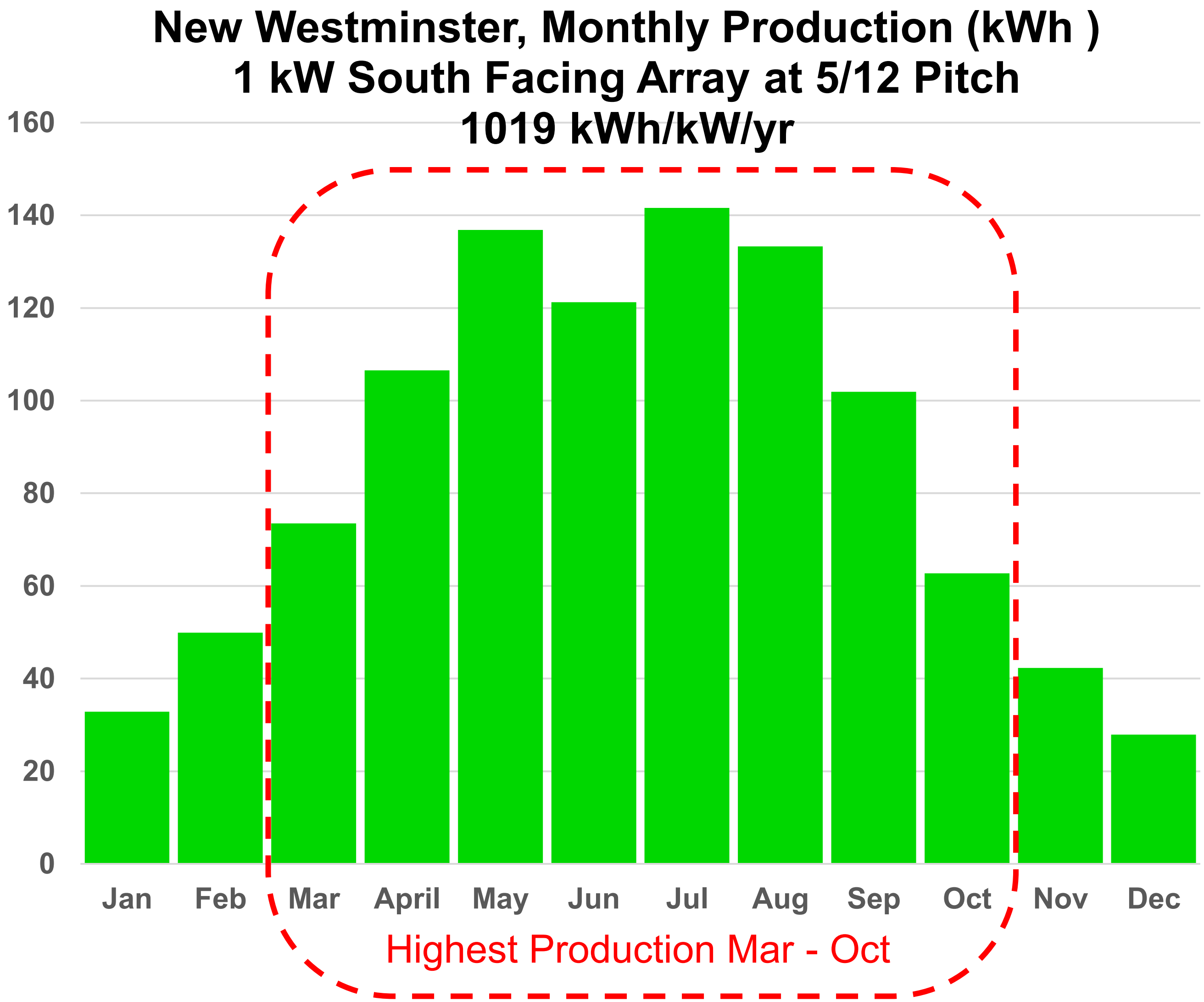
Solar PV Effectiveness – Universal Metric

AC electrical energy produced by 1 kW of solar PV at a specific orientation over 365 days at a particular location.

BC Average: 1000 kWh/kW/yr

New Westminster: 940 – 1030 kWh/kW/yr





Solar PV Effectiveness

Dependent on

- Latitude and longitude
- Historical regional climate, weather, and atmospheric conditions
- Array orientation (azimuth and pitch)
  - South orientation (180°) is best
    - Less critical for lower roof pitch
  - Reasonable results East (90°) through West (270°)
    - Improves for lower roof pitch
- Solar access and shading impacts hinders performance
  - Far shading – mountains, buildings, neighboring trees
  - Near (self) shading – chimneys, plumbing stacks, hips, electrical masts, dormers

Not all homes will be well suited for good rooftop solar PV performance

- Reputable solar PV providers assess all factors and advise responsibly
- Competent professionals establish realistic expectations for and confidence in residential solar PV investment

Estimating Annual Solar PV Harvests

A number of comprehensive modelling tools are used by solar practitioners.

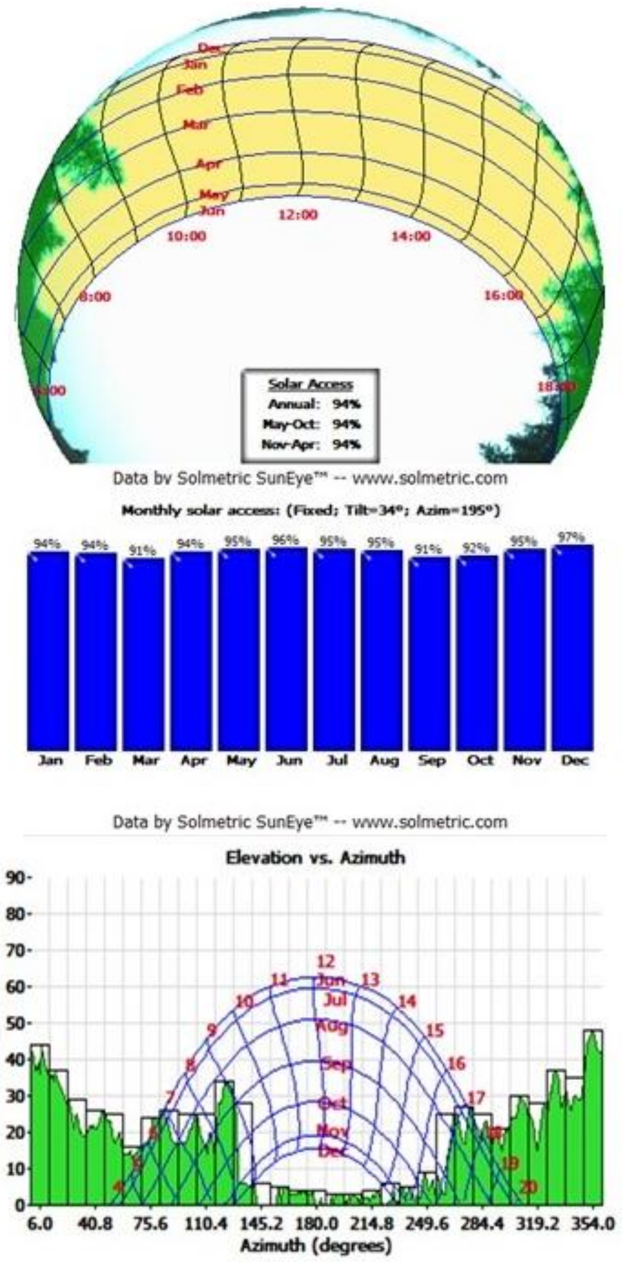
Helpful free resources include:

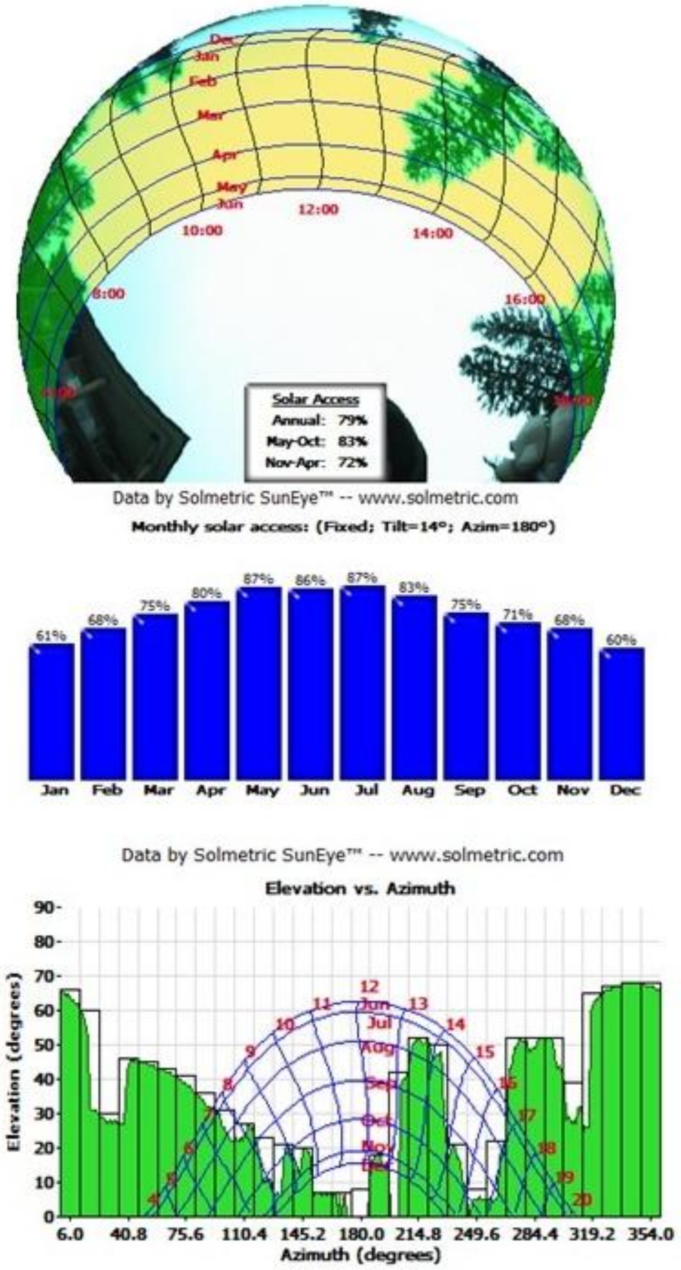
1. Insolation maps such as NRCan Photovoltaic potential and solar resource maps of Canada
2. Solar PV effectiveness databases such as NRCan Municipality database – Photovoltaic potential (kWh/kWp/yr)
3. Solar PV modelling software such as NREL PVWatts

Importance of Solar Access and Shading Analysis

- Shaded arrays produce much less annual energy because they experience reduced direct solar irradiation.
- Solar providers will assess shading before proposing system designs.

Solar Photography Measures Solar Access and Far Shading





3D Modelling Used to Assess Near/Self Shading

West Facing Array Shading by West Gable

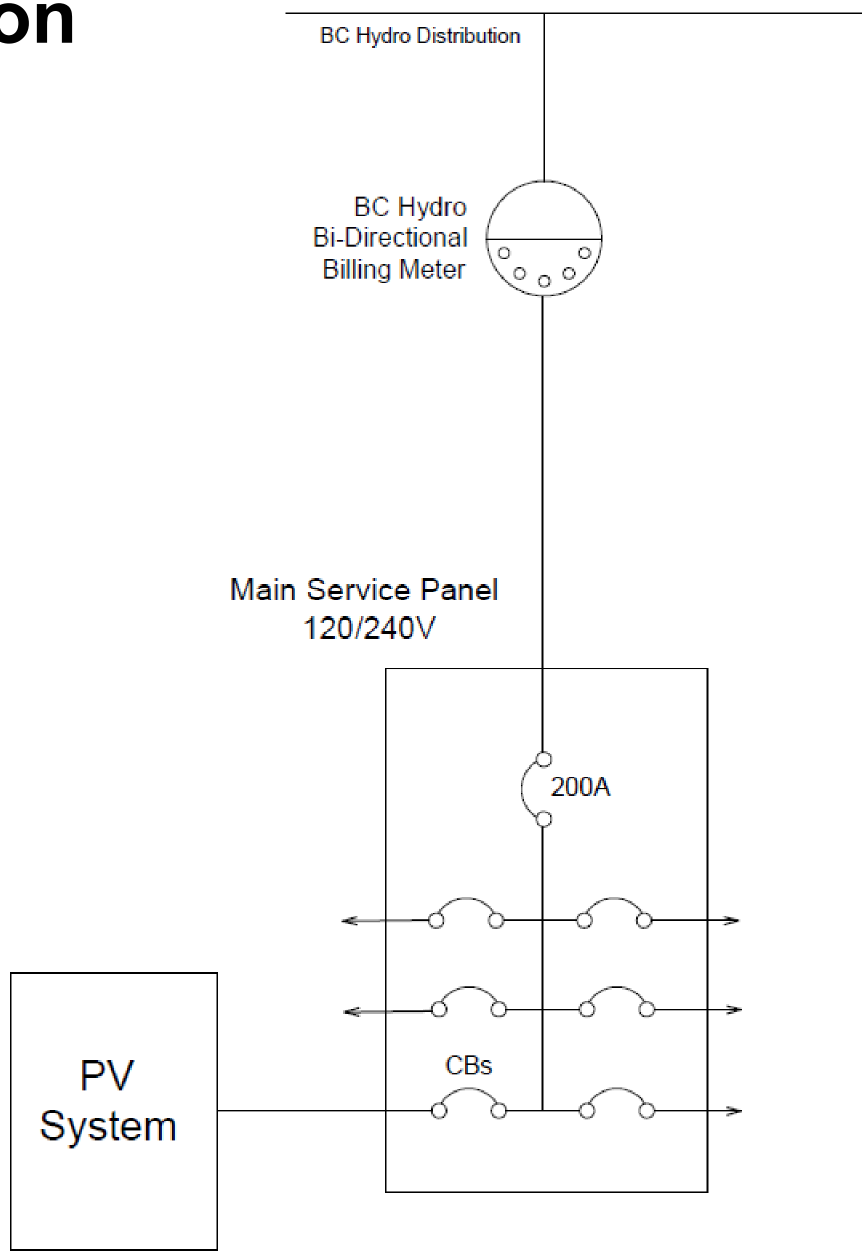
Solar PV Impacts on Building Systems

- Electrical service equipment and infrastructure
  - Service panels ratings can limit allowable solar PV system capacity
- Roof design, space, structure, and membrane
  - Which roof sections are best suited to solar? (orientation, pitch, size, shading)
  - Solar arrays add load and wind uplift
  - Anchoring strategy can affect structural and roof membrane integrity
- Equipment placement requirements
  - Inverter(s), disconnection means, rapid shutdown initiator
- Building envelope penetrations for solar-electric cable routing

Residential PV Electrical Connection

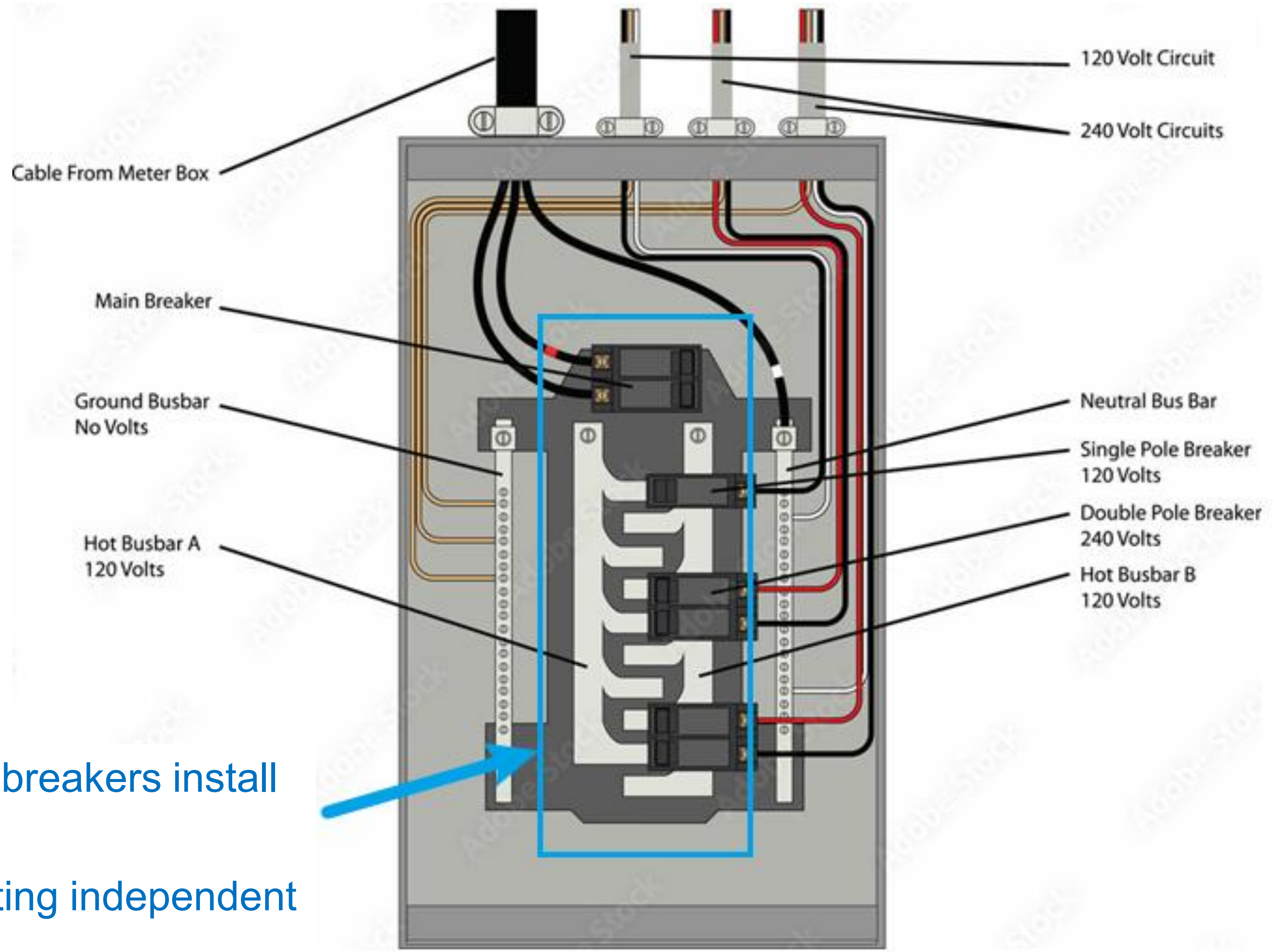
Main Service Panel Connection

- PV system generates into the main service panel via a designated solar system circuit breaker.
- Max PV system size limited by bus bar capacity of service panel.



Residential Solar PV Electrical Connection

In the presence of two energy sources (grid and solar PV), electrical panel bus bars must be protected from overload



Load and solar PV circuit breakers install onto panel bus bars.

Bus bars have specific rating independent of main breaker.

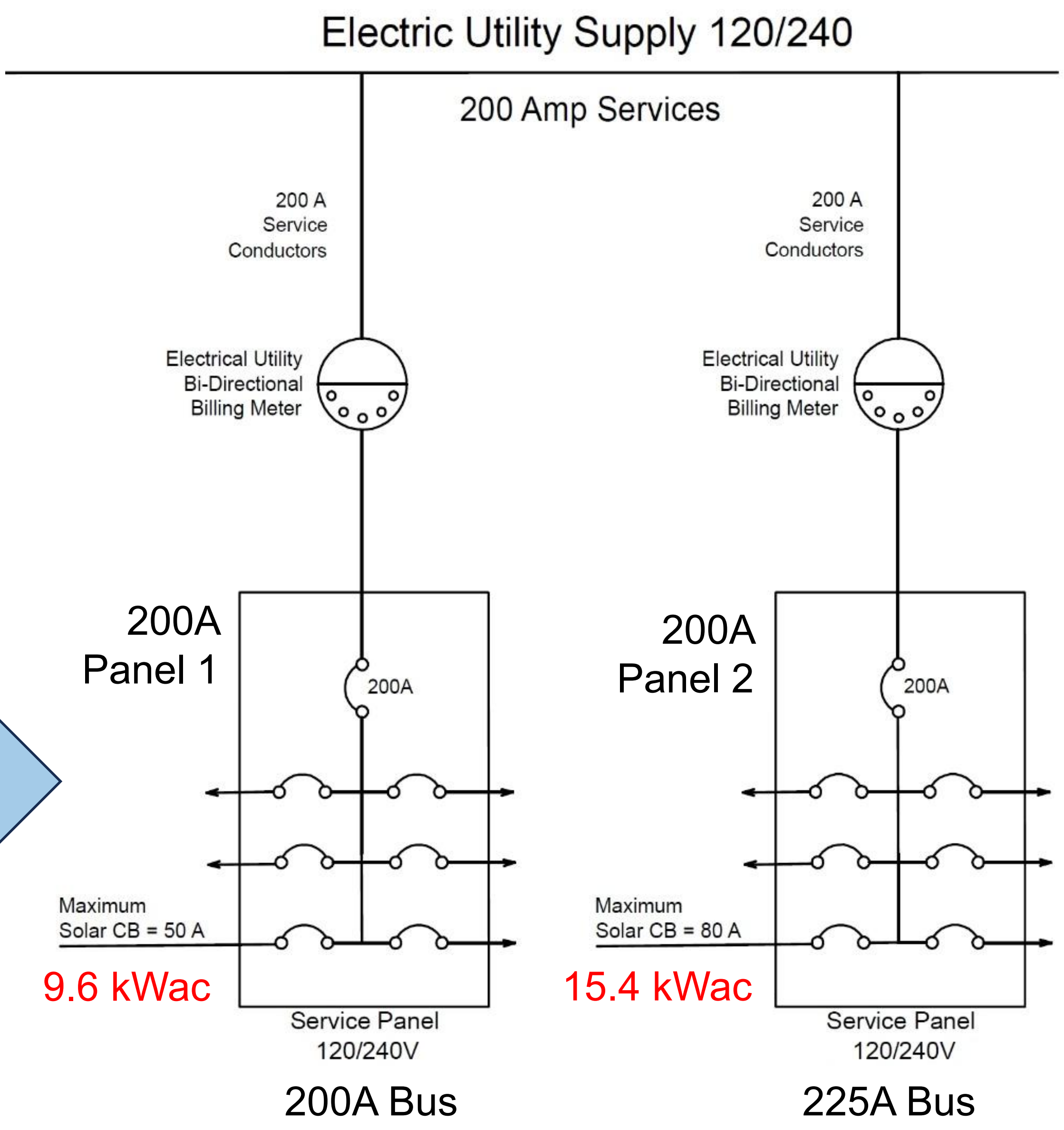
Residential Solar PV Grid Connection - A Common Snag

- Solar PV size is limited by electrical service panel bus capacity per **CEC 64-112 Point of Connection Rule** to protect bus bars

  Solar CB + Main CB ≤ 125% x Bus Bar Rating

- Existing and new service equipment must to reviewed carefully to avoid unintended solar system limitations.

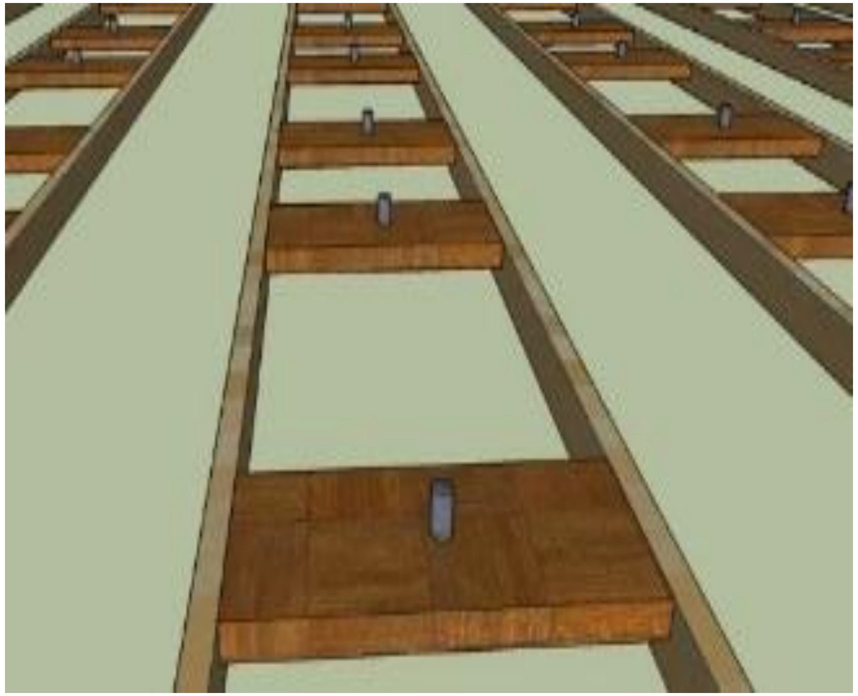
  For Solar PV installation, these 200A Service Panels are VERY DIFFERENT.
  Panel 2 accommodates 60% more solar inverter capacity than Panel 1.



Residential Solar PV Structural Impacts

- Roof attached solar arrays add 2.5 – 3.5 psf deadload and significant point loads when arrays snow covered.
- For new homes, builders can use solar PV - ready trusses manufactured to Truss Plate Institute of Canada (TPIC) standards.
- For retrofits, existing roof structure sufficiency must be confirmed.
- Solar PV arrays can be anchored to rooftops using:
  - Flashed racking anchors secured into roof decking and trusses
  - Flashed racking anchors secured into roof sub-structure.
  - Standing seam metal clamps.
  - Ballasted racking systems in the case of flat roofs.
- Anchoring methods finalized between PV installer, builder, truss designer, structural professional, and roofing contractor to minimize risk and maintain roofing warranties.

Flashed Roof Anchor Types



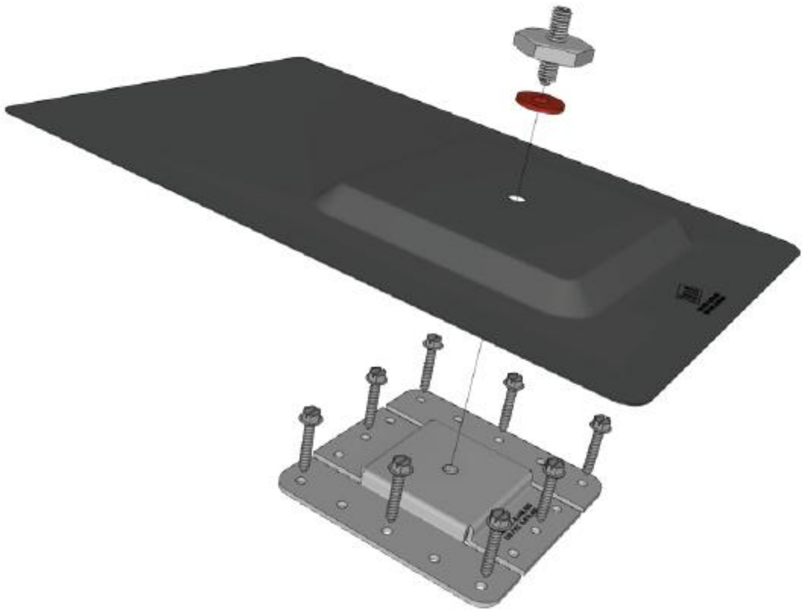
Deck Attached

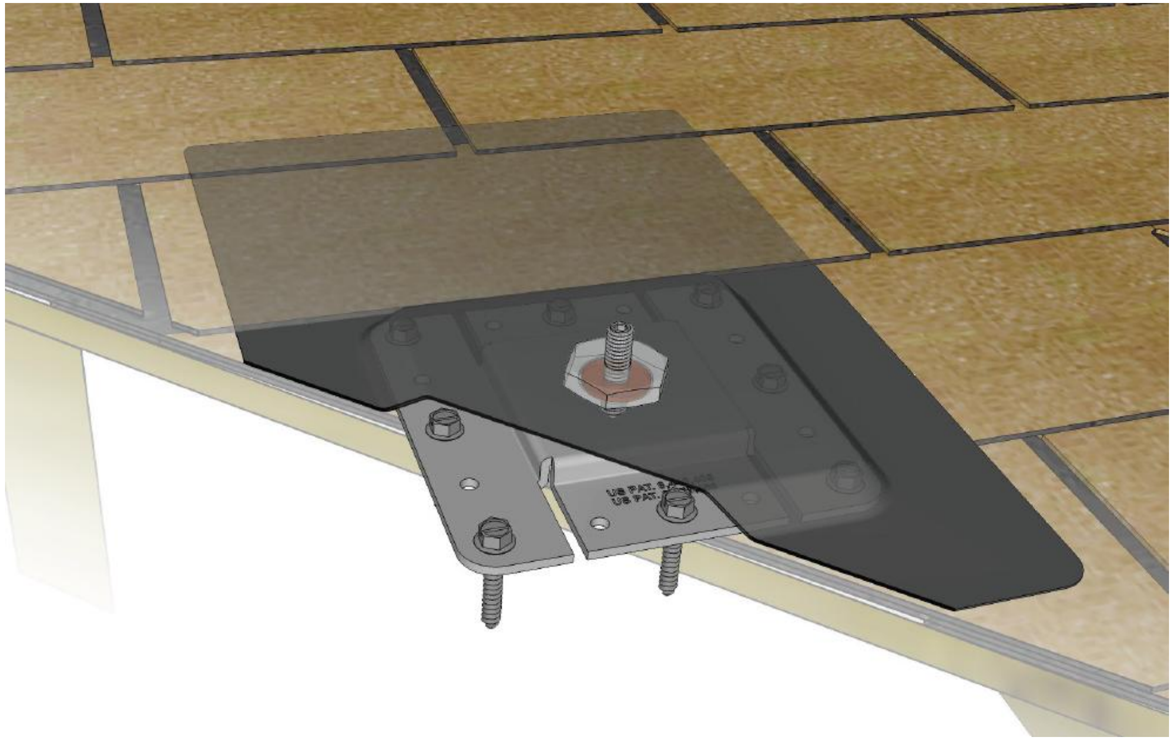
- Fastens to sheathing and/or trusses with multiple small screws.
- Installs after roofing.

Sub-Structure Attached

- Fastens to “sisters” or blocking with GRKs or lags.
- Installs before or after roofing.

Deck Attached Flash Roof Anchors





Reduced Risk of Truss Top-Chord Damage

- Fastens to trusses and sheathing with multiple small screws.
- Installs after roofing so works well for retrofits.

Deck Attached Flashed Anchors – Asphalt Shingle Retrofit

- **Flashed anchors:** 48” spacing or less
- **L-Feet:** bolted to anchors
- **Extruded Al Solar Rails:** bolted to L-Feet
- **Mid and End Clamps:** secure modules to solar rails

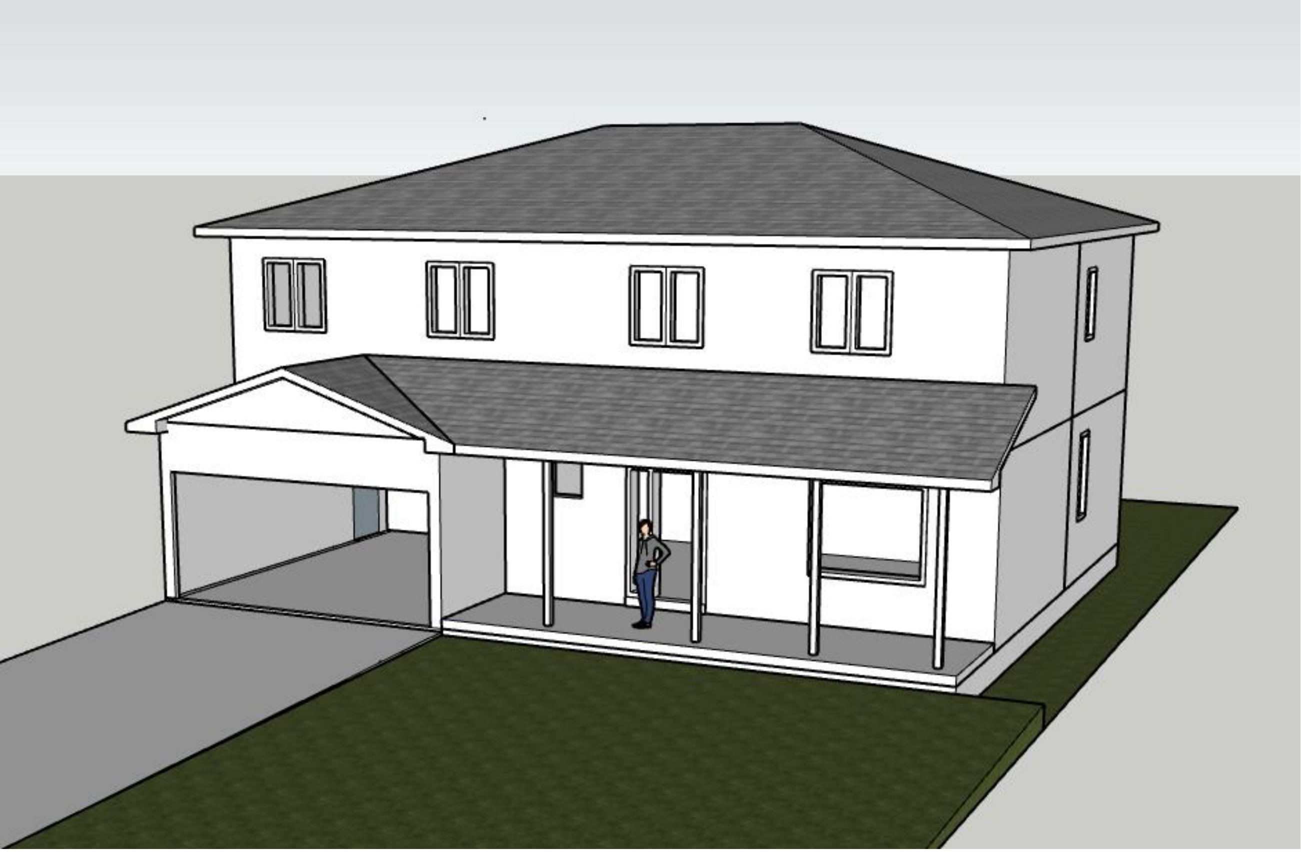
Standing Seam Metal Clamp Attachment

- Avoids roof membrane penetrations.
- Minimum 24-gauge roofing material required.
- Clamp styles available for various roofing profiles.
- 16” seam spacing or less preferred.

Flat Roof Ballasted Racking

- Ballast patterns engineered to local wind loads
- Avoids roof penetrations by eliminating mechanical attachments.
- Additional deadload requires structural review.

Hypothetical - Single Family Energy Retrofit – New Westminster



Energy Consumption Before Retrofit

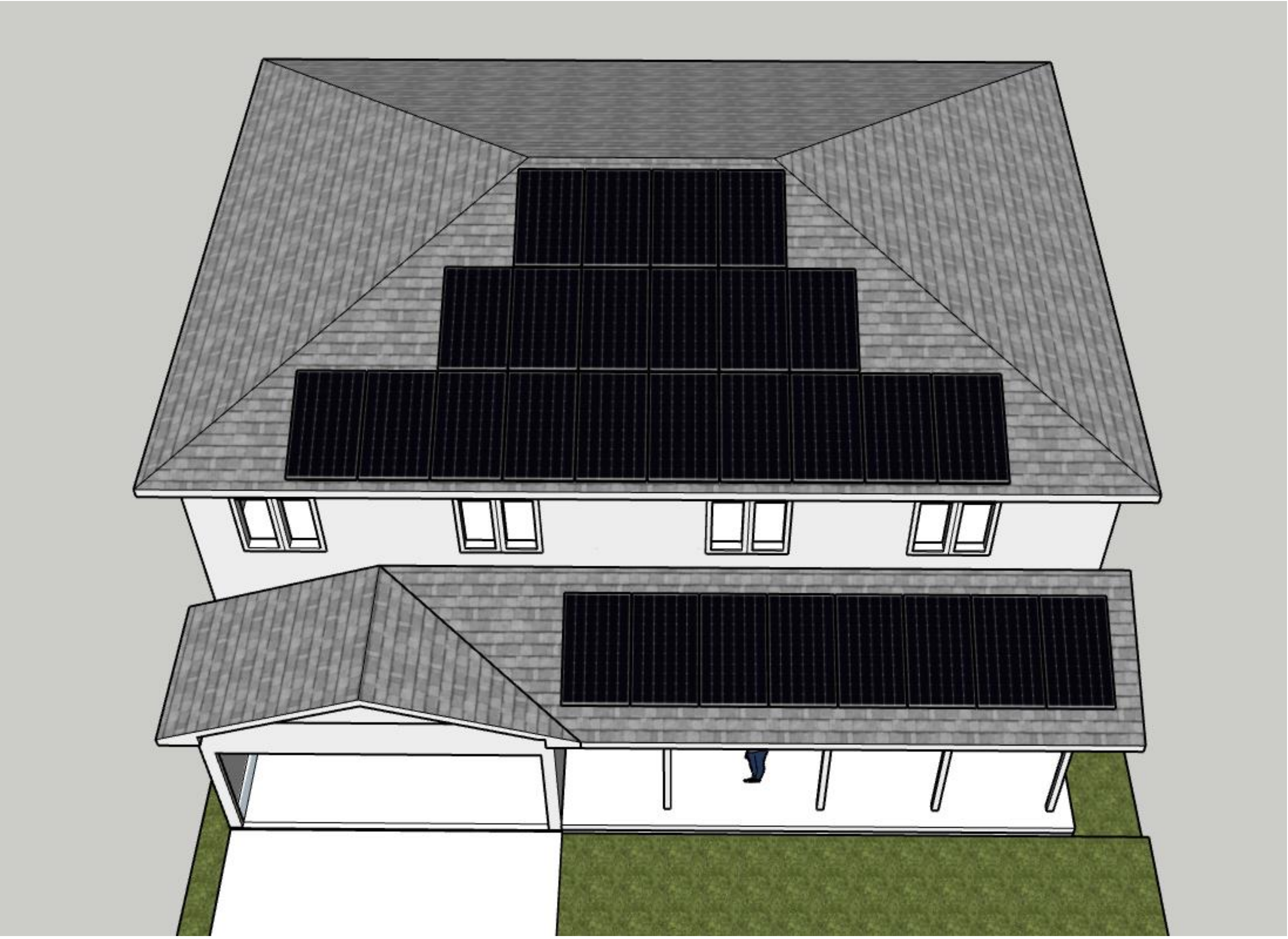
- 35,967 kWh/yr Electricity

Energy Consumption After Retrofit

- 14,225 kWh/yr Electricity

Solar PV Options to Reduce ongoing Operating Costs?

Hypothetical - Single Family Energy Retrofit – New Westminster



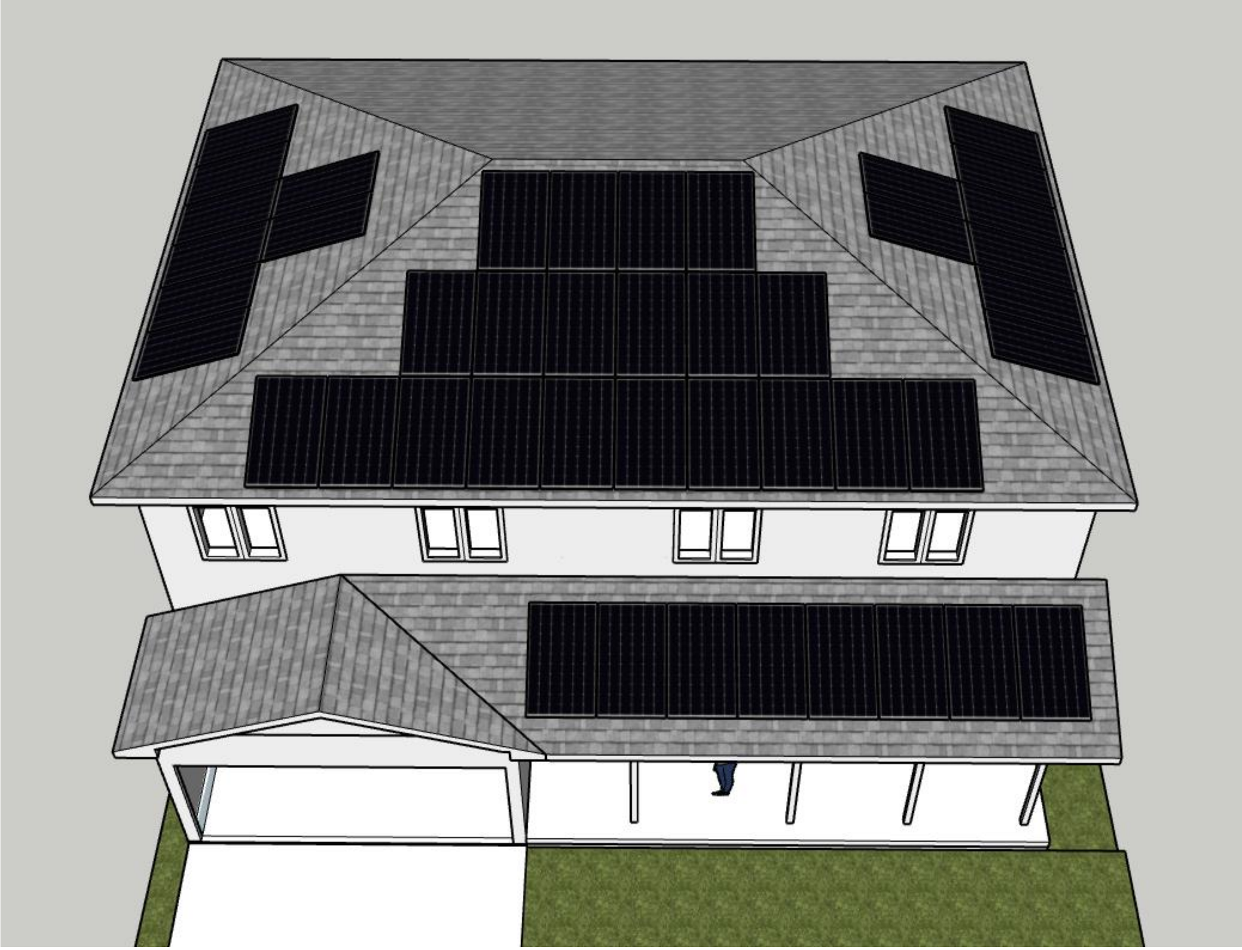
Option 1: South Roof Sections - 4:12 Pitch

- Space for 10.1 kW using 28 x 360W modules

- **Estimated production** = 10,124 kWh/yr
- Offsets **71.2%** of annual projected consumption post renovation.

- **Estimated Cost:** $28,280
- **Less Rebate:** $5000
- **Net Cost:** $23,280
- **Simple Pay Back:** 14 years
- **CAGR:** 5.08%
- **Year 1 Electricity Savings:** $1468

Hypothetical - Single Family Energy Retrofit – New Westminster



Option 2 - South, East, West Roofs Capacity

- **South:** 10.1 kW - 28 x 360W modules
- **East/West:** 5.8 kW - 16 x 360W
- **Total Capacity:** 15.9 kW

- **Estimated production:** 15113 kWh/yr
- Solar PV offsets **106%** annual consumption after renovation, for **Net-Zero** result

- **Estimated Cost:** $44,520
- **Less Rebate:** $5000
- **Net Cost:** $39,520
- **Simple Pay Back:** 15.8 years
- **CAGR:** 4.48%
- **Year 1 Electricity Savings:** $2133

Approvals and Permitting

Technical Safety BC (TSBC)

- Electrical permit for solar PV installation by electrical contractor
- Electrical inspection and final approval

3

New West - Electrical Utility

- Net-metering application review
- Interconnection requirements
- Final operating approval

1

Solar PV/Storage Installation Project

2

New West – Planning and Development

- Building permit for solar PV installation
- Inspection and final approval

Approvals and Permitting

New Westminster - Electrical Utility (per Bylaw No. 6502)

1. Application for Rate 500 Net-Metering Service
   - 50 kWac PV system size limit with simplifications for systems ≤ 27 kWac
   - Applies to single family residential customers under rates 101,102, and 103, with energy charge $0.1344/kWh
   - Also, to MUR customers on rates 131, 133, and General Service customers on rates 201, 202, 203, 210, 211, 212, 213, 220, 230 and 240, with energy outflow value = inflow purchase rate

2. Compliance with Guidelines for Operating, Metering, and Protective Relaying for Net Metered Systems up to 50 kW and Below 750 Volts.
   - Equipment certified for use in Canada
   - Installation fully compliant with CE Code
   - Lockable solar PV disconnecting means accessible to utility

3. Customer signs Net Metering Interconnection Agreement
4. Proof of Electrical permit approval provided
5. Utility issues parallel operating approval before system may be energized

Approvals and Permitting

New Westminster Planning Dept

- The City requires a building permit for residential solar PV installations.
- Please reach out to the Building department to learn more and determine next steps for your project.
- Extra costs may be incurred in meeting building permit criteria
  - ➢ Best to fully understand these before committing to a project
  - ➢ Reputable installers will understand requirements and advise appropriately

Solar PV and Storage Incentives

The City of New Westminster in collaboration with BC Hydro is offering rebates up to **$5,000 on eligible grid-connected solar panels** and up to an additional **$1,500 for battery storage systems** installed in conjunction with a solar panel system (effective April 1, 2026)

Solar Panel Rebates

Harness the power of the sun to generate your own renewable energy. Solar generation is a sustainable choice if you're looking to gain energy independence and lower your electricity bills.

PRODUCT	REBATE AVAILABLE
Solar photovoltaic (PV) panels	**Up to $5,000** • $1,000 per kilowatt (kW) of installed generator capacity • Rebate amount capped at 50% of total installed product cost (including labour and materials) • Maximum rebate $5,000

Solar PV and Storage Incentives

Battery Storage Rebates

Battery storage allows you to store your excess renewable energy to power your home on cloudy days, overnight, or in the event of a power outage. A battery can be installed with a new solar panel system, added to an existing solar panel system, or installed without any solar generation.

PRODUCT	REBATE AVAILABLE
Battery energy storage systems Minimum storage size: 5 kilowatt-hours (kWh)	**Up to $1,500 when installed with a solar PV system** • $500 per kWh of installed storage capacity • Rebate amount capped at 50% of total installed product cost (including labour and materials) • Maximum rebate $1,500 when installed with a solar PV system

Energy Save New West info

Solar PV and Storage Incentives

Eligibility Criteria

To be eligible for rebates, your system needs to be reviewed and approved to connect to our grid through our Electrical Net Metering Program.

Eligible customers and properties:

- The property must have a New West Electrical Utility residential account.
- You must own the home.
- The property must be a grid-connected residential home.
- The property must be located in New West Electrical Utility service territory.
- Eligible property types include:
    - Single-family detached dwellings
    - Duplex, triplex, row home or townhomes
    - Mobile homes that are fixed to a permanent foundation that are structurally complete with installed and connected plumbing, heating, electrical, water and sewer services, and with towing apparatus and axle removed.

Case Study 1 – 6 kW PV Retrofit for Electricity Net-Zero – Thompson Okanagan

- Annual consumption 7000 kWh, to be totally offset.
- **Installed cost** = $11,800 after $5k Greener Homes grant.
- Simple payback in 12 years.
- **CAGR** = 5.95%

New Westminster Rate 500

- **Installed cost** = $11,800 after $5k BC Hydro rebate.
- **Production** = 6110 kWh/yr
- Simple payback in 12.6 years.
- **CAGR** = 5.66%
- **Year 1 Electricity Savings:** $872

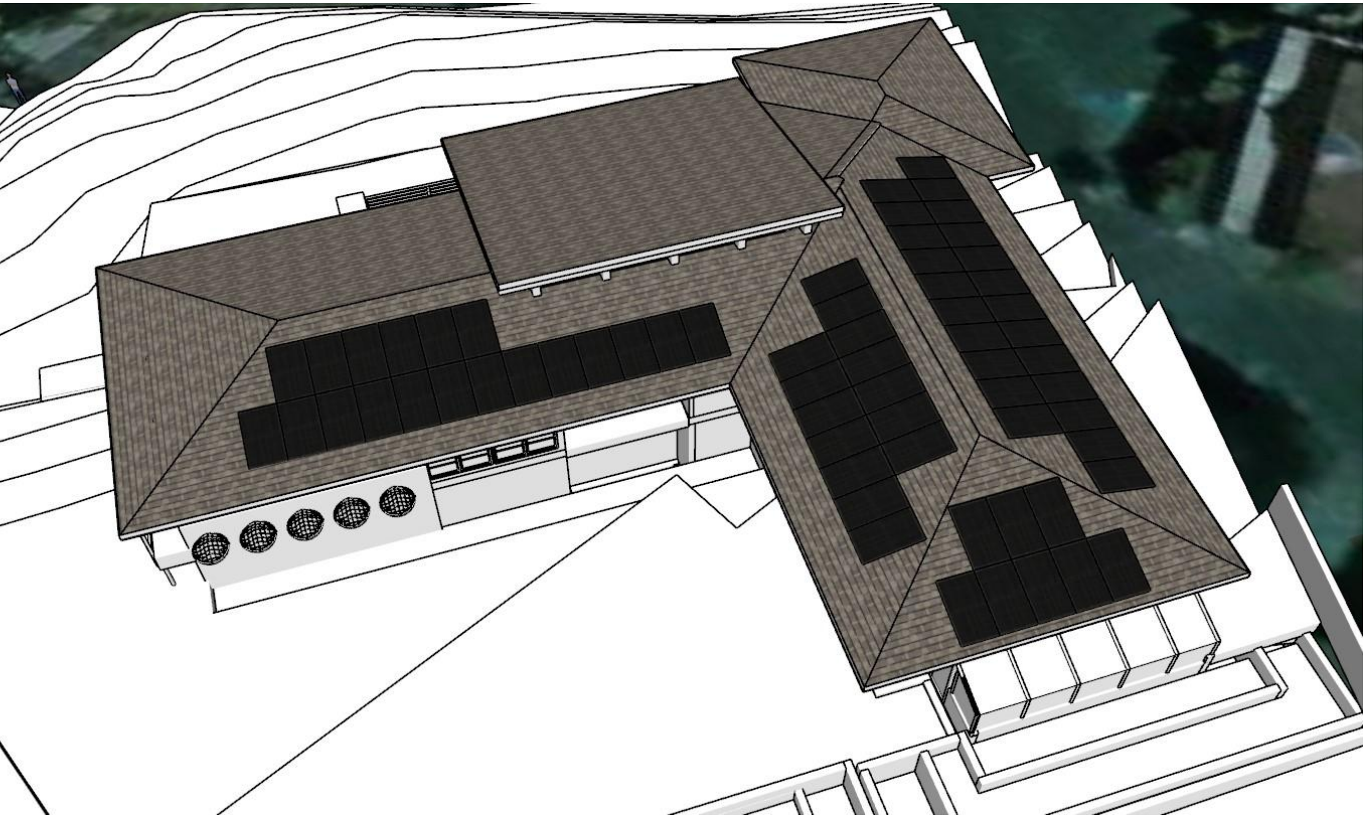
Case Study 2 – 9.5 kW PV Retrofit for Tier 2 Reduction – Thompson Okanagan

- **Annual** = 28,800 kWh,
- **Step 2** = 20,700 kWh
- **Step 2 reduced 33%,** 32% overall.
- **Installed cost** = $22,930 after BC Hydro $5000 rebate.
- **Simple payback** in 12.6 years.
- **CAGR** = 5.65%

New Westminster Rate 500

- **Installed cost** = $22,930 after BC Hydro $5000 rebate.
- **Simple payback** in 13.6 years.
- **Production** = 9300 kWh/yr
- **CAGR** = 5.23%
- **Year 1 Electricity Savings:** $872

Case Study 3 - Net-Zero Certified New Build – Thompson Okanagan



- **Motive:** Offset full 24,000 kWh/yr projected by Hot2000
- **Size:** 23.0 kW; using S, E, and W Roofs
- **Annual production:** 25,300 kWh;
- Solar ready trusses, and flashed anchors
- **Installed Cost:** $59,400 After GH Grant
- **Simple Payback:** 13.3 years
- **CAGR:** 5.35%
- **Year 1 Electricity Savings:** $3682

New Westminster Rate 500

- **Installed Cost:** $59,400 after BC Hydro $5000 rebate.
- **Simple Payback:** in 14.3 years.
- **Production** = 21,800 kWh/yr
- **CAGR:** 4.97%
- **Year 1 Electricity Savings:** $3343

Case Study 3 - Net-Zero Certified New Build – Thompson Okanagan

Case Study 3 - Net-Zero Certified New Build – Thompson Okanagan

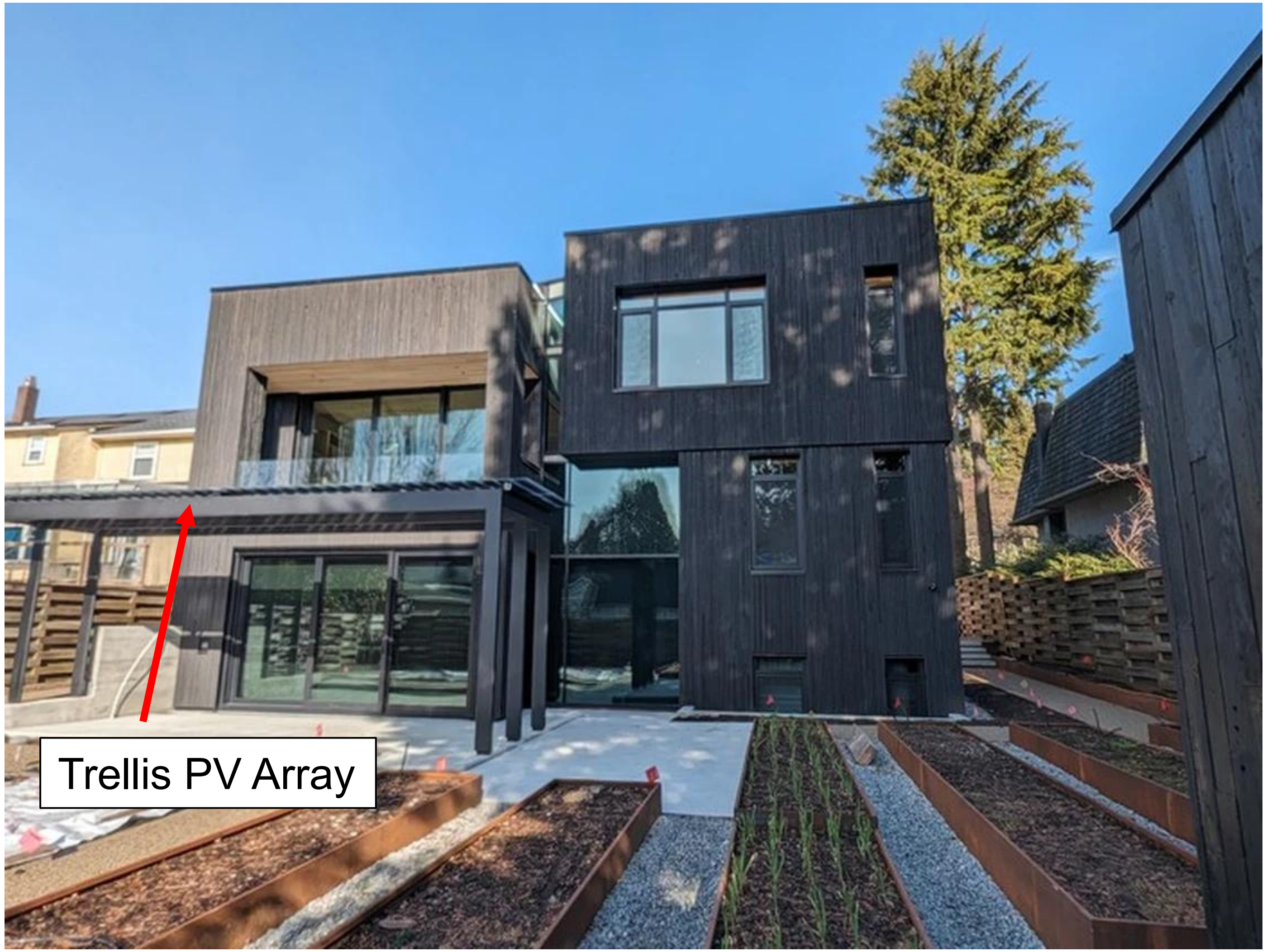
Case Study 4 - Living Building Challenge Home - Vancouver BC

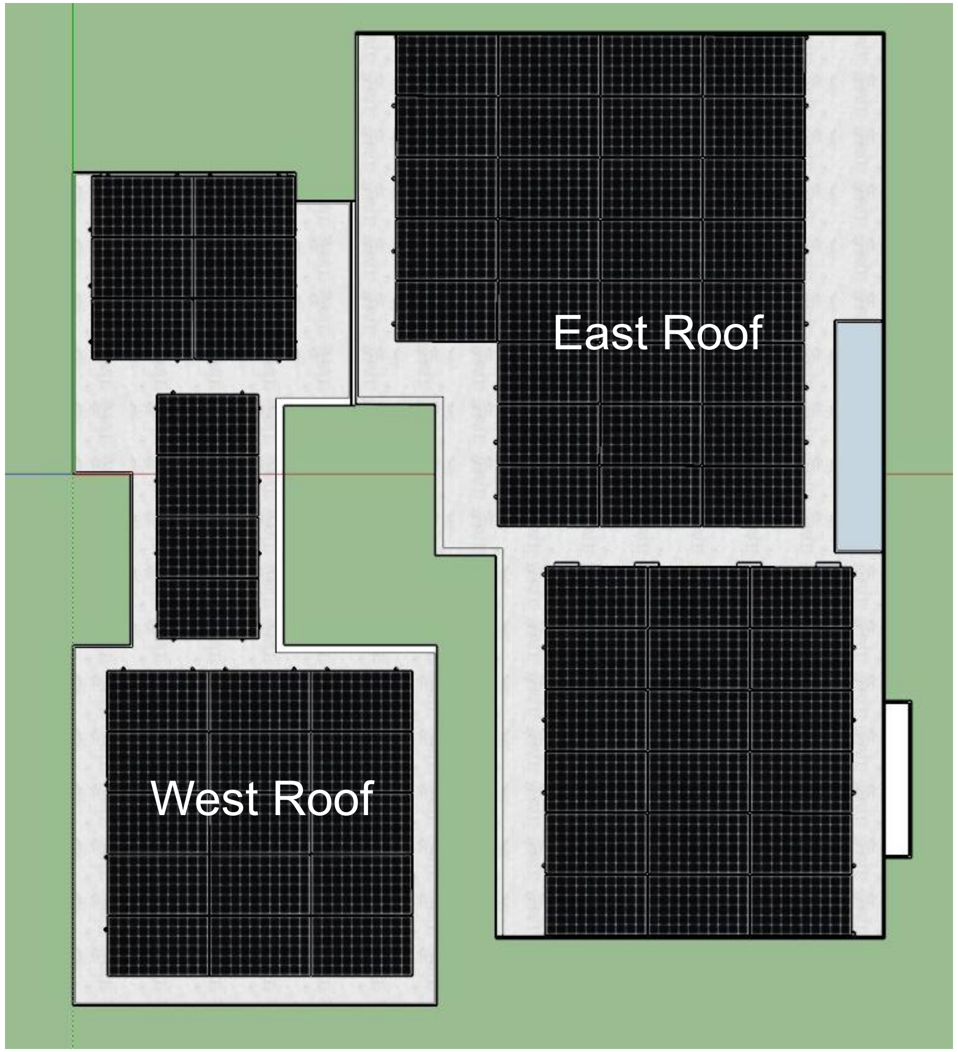
LBC goes well beyond Net-Zero energy targets to include grid-resilience and sustainability measures

- Fully electrified.
- Grid connected solar PV production ≥105% of annual electrical consumption
- Energy storage sustains essential loads backup for 7- day grid outage
- Rain water collection reduces reliance on domestic water supply
- Restrictions on allowable construction materials

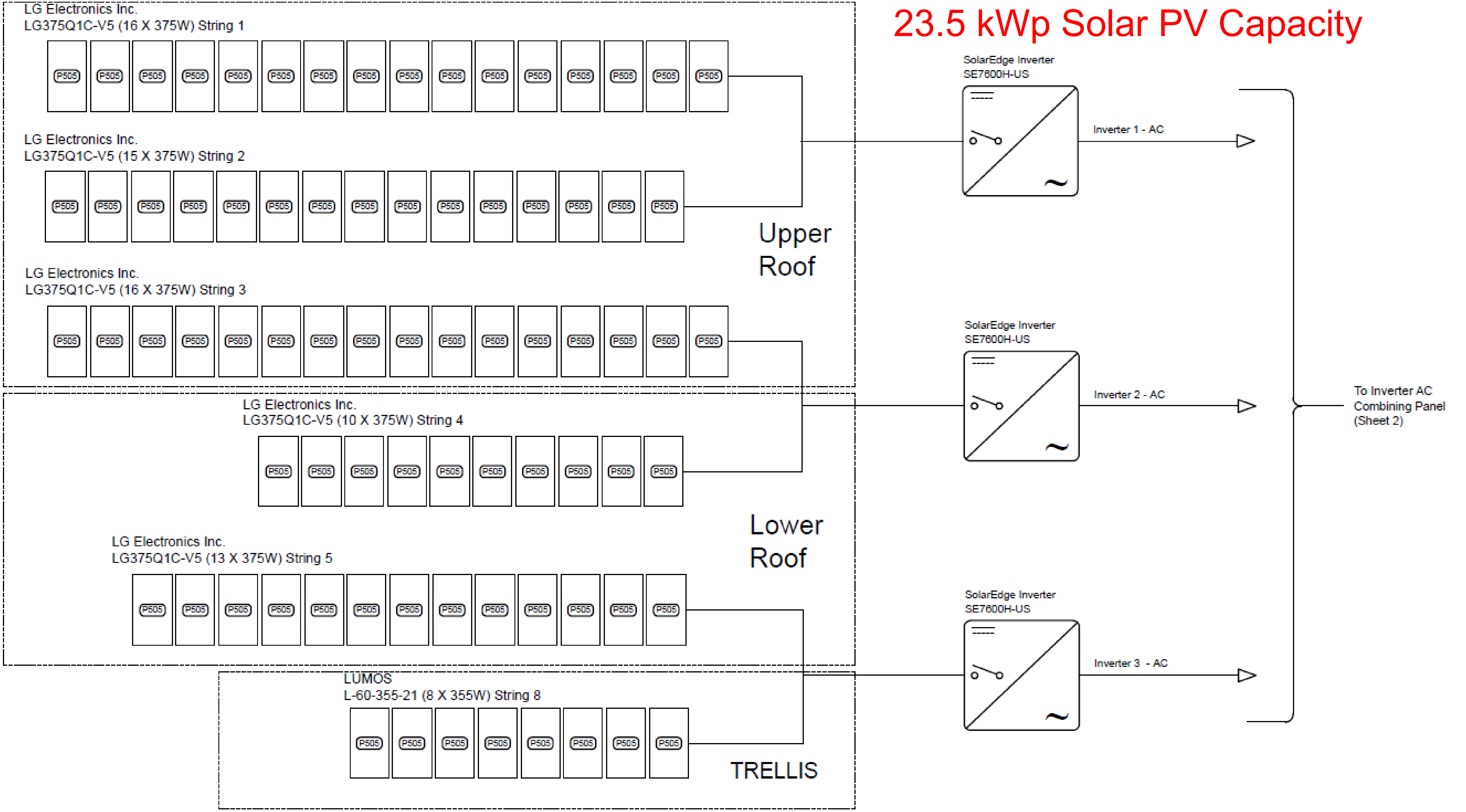
- Read about it here

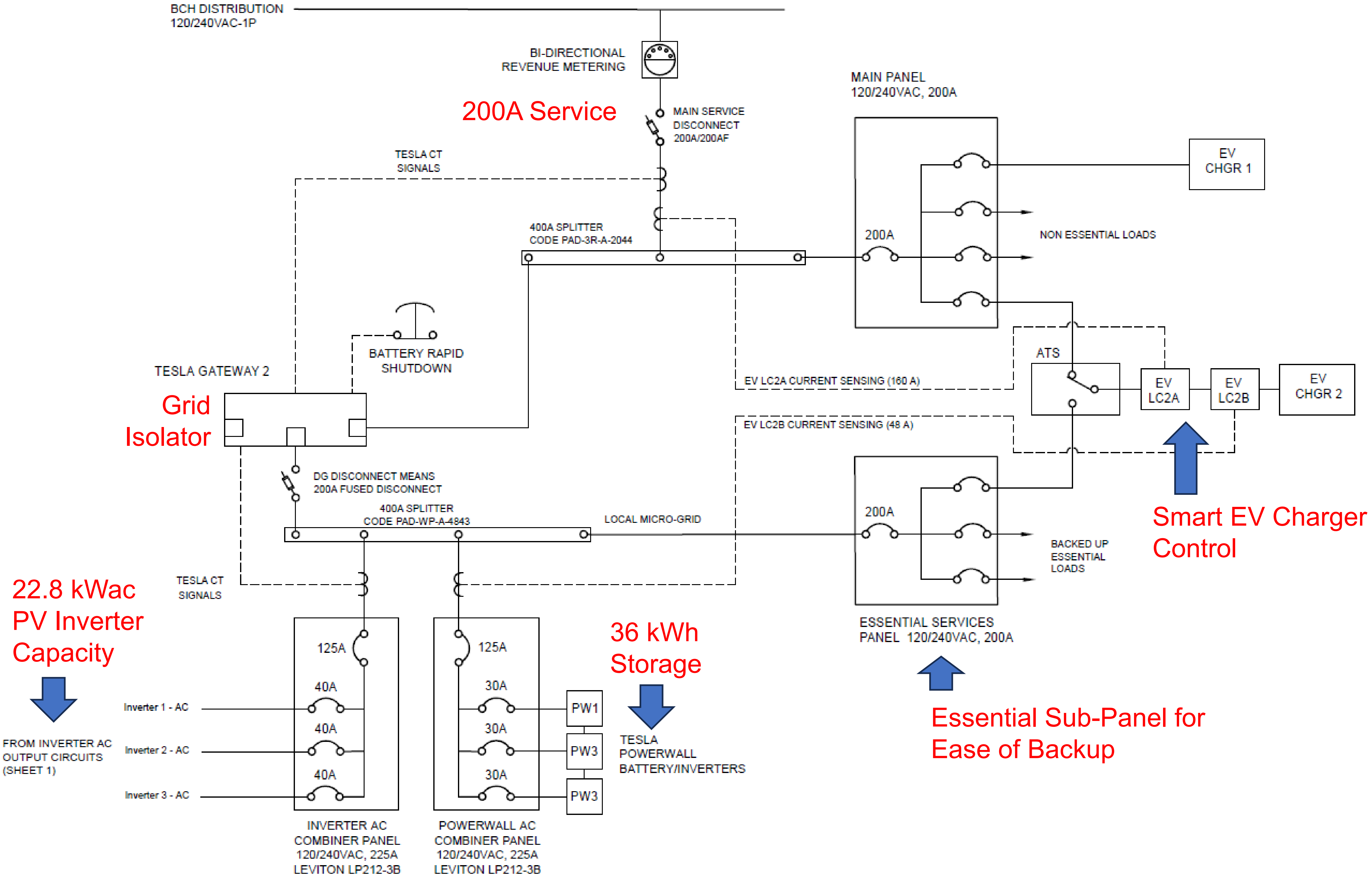
Case Study 4 - Living Building Challenge Home - Vancouver BC





23.5 kWp Solar PV Capacity




BCH DISTRIBUTION
120/240VAC-1P
BI-DIRECTIONAL
REVENUE METERING
200A Service
MAIN SERVICE
DISCONNECT
200A/200AF
MAIN PANEL
120/240VAC, 200A
EV
CHGR 1
TESLA CT
SIGNALS
400A SPLITTER
CODE PAD-3R-A-2044
200A
NON ESSENTIAL LOADS
BATTERY RAPID
SHUTDOWN
TESLA GATEWAY 2
Grid
Isolator
ATS
EV LC2A CURRENT SENSING (160 A)
EV
LC2A
EV
LC2B
EV
CHGR 2
EV LC2B CURRENT SENSING (48 A)
DG DISCONNECT MEANS
200A FUSED DISCONNECT
400A SPLITTER
CODE PAD-WP-A-4843
LOCAL MICRO-GRID
200A
BACKED UP
ESSENTIAL
LOADS
Smart EV Charger
Control
22.8 kWac
PV Inverter
Capacity
TESLA CT
SIGNALS
125A
125A
36 kWh
Storage
ESSENTIAL SERVICES
PANEL 120/240VAC, 200A
40A
30A
PW1
Inverter 1 - AC
40A
30A
FROM INVERTER AC
OUTPUT CIRCUITS
(SHEET 1)
Inverter 2 - AC
PW3
TESLA
POWERWALL
BATTERY/INVERTERS
Essential Sub-Panel for
Ease of Backup
40A
30A
Inverter 3 - AC
PW3
INVERTER AC
COMBINER PANEL
120/240VAC, 225A
LEVITON LP212-3B
POWERWALL AC
COMBINER PANEL
120/240VAC, 225A
LEVITON LP212-3B

Case Study 4 - Living Building Challenge Home - Vancouver BC

West Roof

East Roof


Service
Entrance
Grid
Isolator
Solar Inverters
BESS
TESLA
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Achieving Best Solar PV Results – Avoid Common Snags

1. **Don’t leave solar PV and storage as an afterthought**
   - Careful design stage consideration is required for best outcomes.
   - Issues become more costly to mitigate as construction progresses
2. **Establish clear motives, performance goals, and energy production targets**
   - Essential to ensuring viability and meeting expectations
3. **Choose solar providers carefully**
   - Lowest Price ≠ Best Results
   - Experience and proven track record reduce risk and improve outcomes
     - ✓ Thorough site evaluations addressing electrical, structural, and other concerns up front
     - ✓ Workable proposed designs with responsible energy production projections
     - ✓ Well versed in electrical AHJ, utility, and municipal approval and permitting requirements
4. **Become familiar with operation, terminology, and authority requirements**
   - Available technologies and certifications
   - CE Code compliance requirements
   - Utility approval and Building Development applications and permitting.
   - Use helpful resources
5. **Discourage service providers working in silos**
   - Solar providers, electricians, roofers, mechanical providers, must coordinate and collaborate throughout
   - Designate rooftop array locations BEFORE construction to avoid mechanical conflicts
   - Avoid plumbing stacks, roof vents, skylights, etc; in designated array locations

Choosing an Installer

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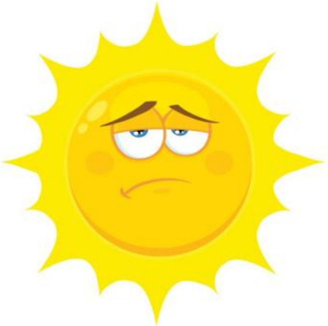
1. **Refer to CanREA** Member Directory and Code of Conduct

2. **Obtain multiple proposals to meet stated motives and goals**
   - Thorough site assessment
   - System sized and designed appropriately to motives and goals
   - Reliable (unexaggerated) energy production, performance, and cost saving projections
   - Structural, electrical, roof condition, and other impacts thoughtfully considered
   - Shading impacts assessed and accounted for
   - Engineering assurances, permitting, and incentives included in costing

3. **Check references, experience, and qualifications**
   - Providing design and installation skills, experience, and integrity - not just equipment
   - Licensed electrical contractors
   - Local in-house engineering and design team
   - Well versed in CE Code utility, TSBC, and local government approvals/requirements
   - Project portfolio, years in business, # of installations completed, which utility jurisdictions?
   - Appropriate insurance coverage
   - Warranty and after-market service

Don’t Leave Solar PV as an Afterthought (Net Zero Home)

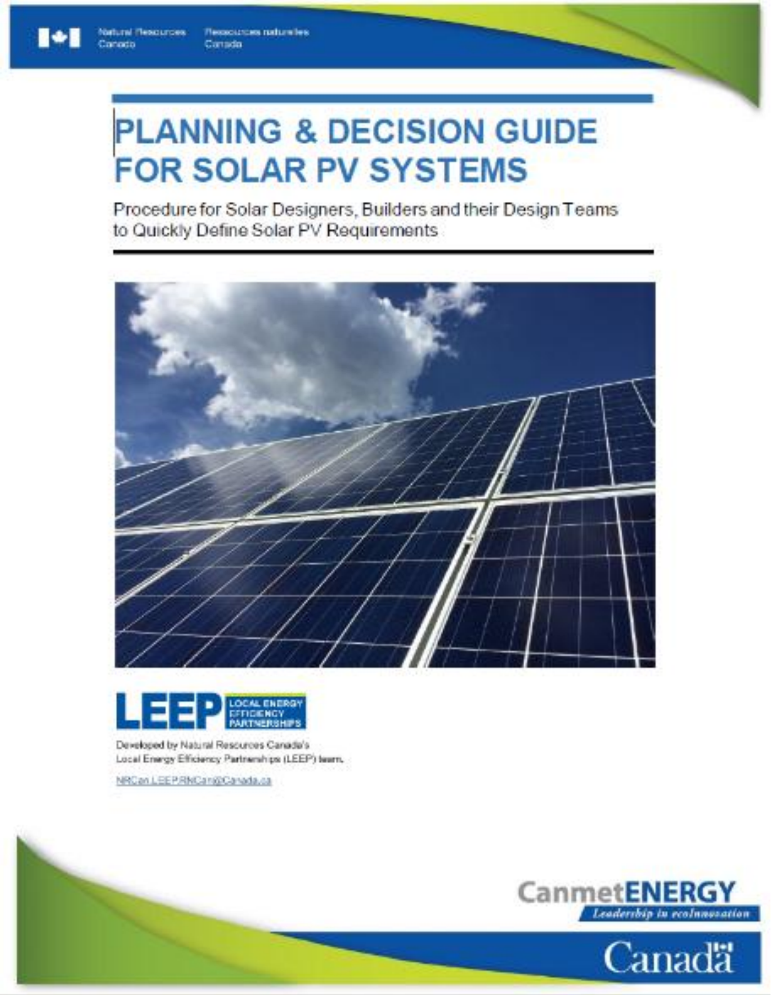
PV Consult in Design Stage vs PV Consult After Lockup



“Solar Ready” Mechanicals Placement without PV Consultation

Achieving Best Solar PV Results - Resources

NRCan Planning and Decision Guide for Solar PV Systems



Key design stage decision steps with PV provider, and other stakeholders to improve outcomes, lessen confusion, and reduce risk.

STEP 1: Builder’s Preferred Goal for Solar PV
STEP 2: Utility Connection Options and Site Constraints
STEP 3: Confirm PV Integration Design Requirements
STEP 4: Define Annual PV Energy Production Target
STEP 5: Define PV Location and Array Sizing
STEP 6: Define Electrical Requirements for Solar
STEP 7: Structural Impacts and Preferred PV Attachment Method
STEP 8: Preferred Solar Module Technology
STEP 9: Preferred Inverter Technology
STEP 10: Preferred Energy Monitoring Approach

Achieving Best Solar PV Results - Resources

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[CanREA Go Solar Guide 2024]

- How solar works
- Solar plus storage
- Net-Metering
- Choosing an installer
- Checklists for best outcomes

Achieving Best Solar PV Results - Resources

BCIT – Zero Energy & Emissions Buildings Learning Centre

XZEB 1150 - Introduction to Integrated Solar Photovoltaic and Electrical Systems for Zero Energy and Passive House Homes

The course will outline the decision-making for planning, designing, and constructing/renovating a Zero Energy home with integrated solar PV and electrical systems. It applies “lessons learned” from case studies of Zero Energy homes equipped with solar PV technology.

Key topics include critical elements of a design-build process, pre-design considerations and requirements, future-proofing for new technologies and electrical circuit load capacity, equipment and monitoring options, and construction hand-off best practices.

Questions?

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