



Roadmap to Resilient, Ultra-Low Energy Buildings in the Pacific Northwest

2017 PNWER ECONOMIC LEADERSHIP FORUM
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Benefits from Addressing Energy in Buildings

- **Affordability**
 - ▣ Reduced energy costs to consumers
 - ▣ Lower carbon emissions
- **Health and Safety**
 - ▣ Improved indoor air quality
 - ▣ Resilience to extreme weather events
 - ▣ Resistance to hazards
- **Functionality**
 - ▣ Comfort
 - ▣ Durability and lower maintenance costs
 - ▣ Increased market value



PNWER Roadmap to Resilient, Ultra-Low Energy Buildings

- **A document** that will seek endorsement by legislators and private sector leaders from 10 PNWER jurisdictions
- **Goal** is to inform energy-efficiency legislation to achieve the desired benefits and specific targets for the year 2030
- **Provides:**
 - › Market data, analysis and benefits
 - › Metrics, targets, timelines
 - › Policy best practices
 - › Market-driven solutions
- **Includes case studies** of new and retrofitted buildings that demonstrate best practices throughout the PNWER

region

CONSTRUCTION
CENTER OF EXCELLENCE

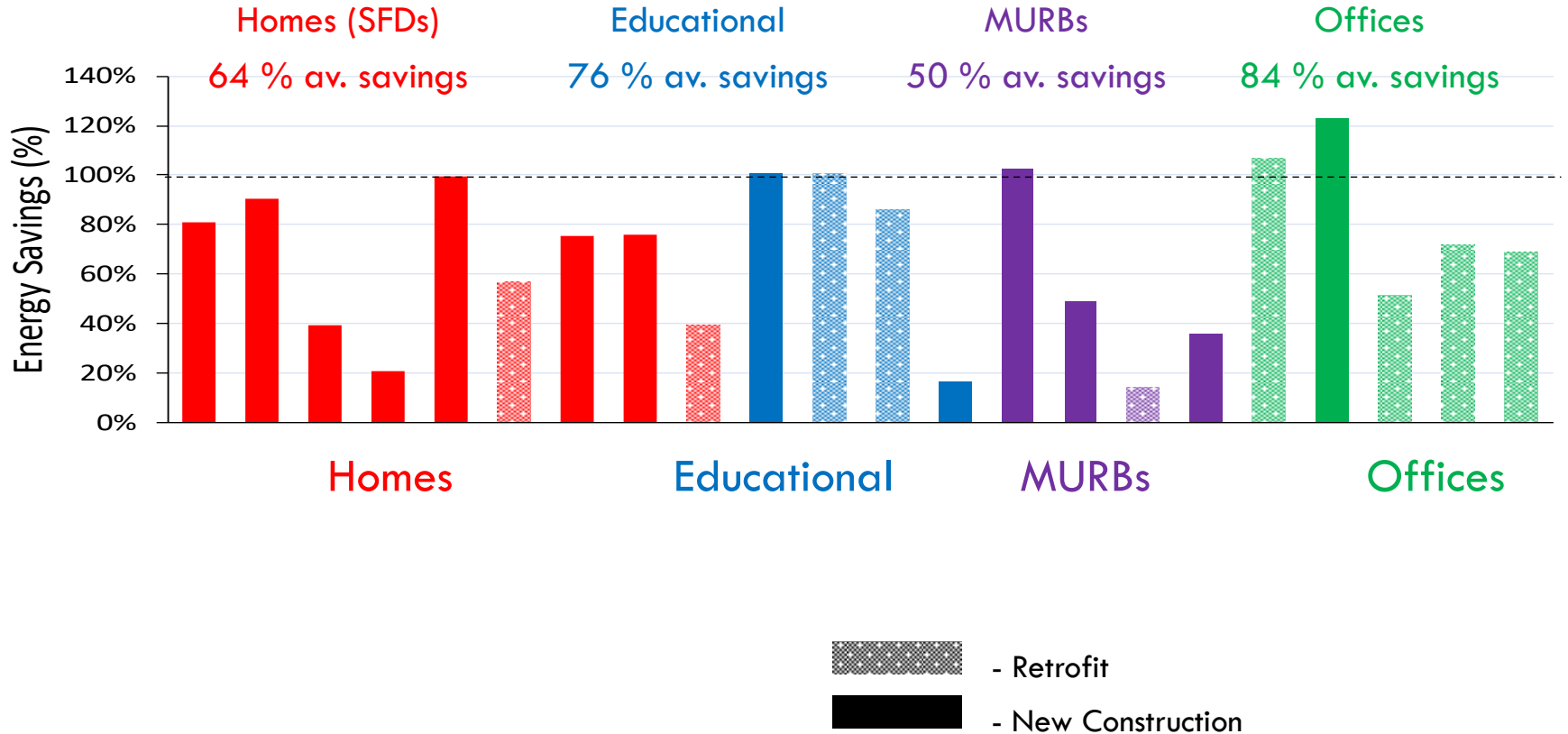


Case Studies

Energy Savings

New Case Study

Energy Savings of Case Studies



Example Buildings



Next step: Region - wide extrapolation

Method

Region-wide Impact Assessment

- Forecast benefits and costs of implementing archetypes across the entire PNWER region by 2030
- Benefits include: Energy savings, GHG emission reductions, associated cost savings, resiliency, investment and job creation.
- Extrapolation of case study impacts in line with:
 - ▣ Current and future building stock and floor space by jurisdiction (10 in total)
 - ▣ Consideration of regional climates and energy mix by jurisdiction



Extrapolation Methodology

- Estimate the annual floor area of new construction and alterations of existing buildings
- Estimate the annual energy savings for new or retrofit construction from case study averages
- Extrapolate energy savings of achieving performance levels of the PNWER case studies, rather than current practices
- Estimate associated GHG savings
- The annual savings will be extrapolated over the 30-yr time horizon with staged implementation to estimate cumulative annual savings in key years

Building Area

- Building Retrofit Area = Total Area x Retrofit Rate
- Building New Area = Total Area x New Build Rate
- Existing Building Area (millions ft²)

Jurisdiction	SFH	Low-rise	High-rise	Educational	Office	Retail
AK	348	16	37	16	37	30
ID	772	35	83	63	69	59
OR	1,875	84	201	84	201	164
MT	483	22	52	40	43	37
WA	3,334	150	357	149	358	292
BC	2,886	312	132	117	207	97
AB	2,751	218	117	104	184	86
SK	654	50	32	28	50	23
YK	25	2	0	1	2	1
NWT	29	2	0	1	2	1

Annual Energy Savings

- Savings = Baseline x % Savings from Case studies
- Estimated Savings from Case Studies

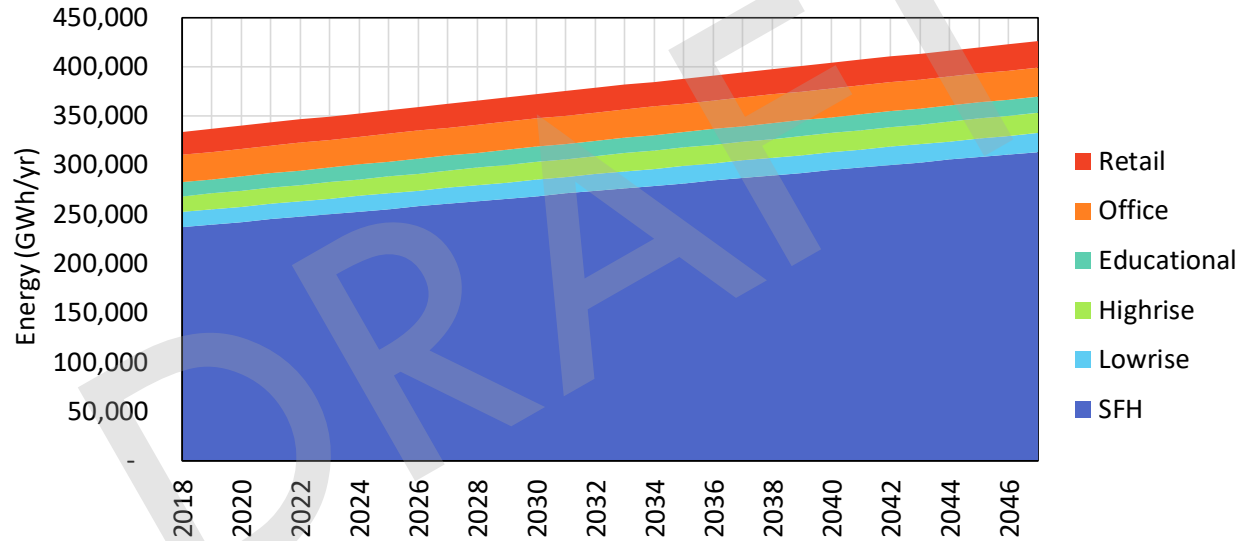
Type	Retrofit Savings	New Build Savings
SFH	50%	60%
Low-Rise	50%	35%
High-Rise	50%	35%
Educational	50%	35%
Office	50%	35%
Retail	50%	35%

Note: the retrofit and new construction are relative to different baseline energy use

Region - wide extrapolation

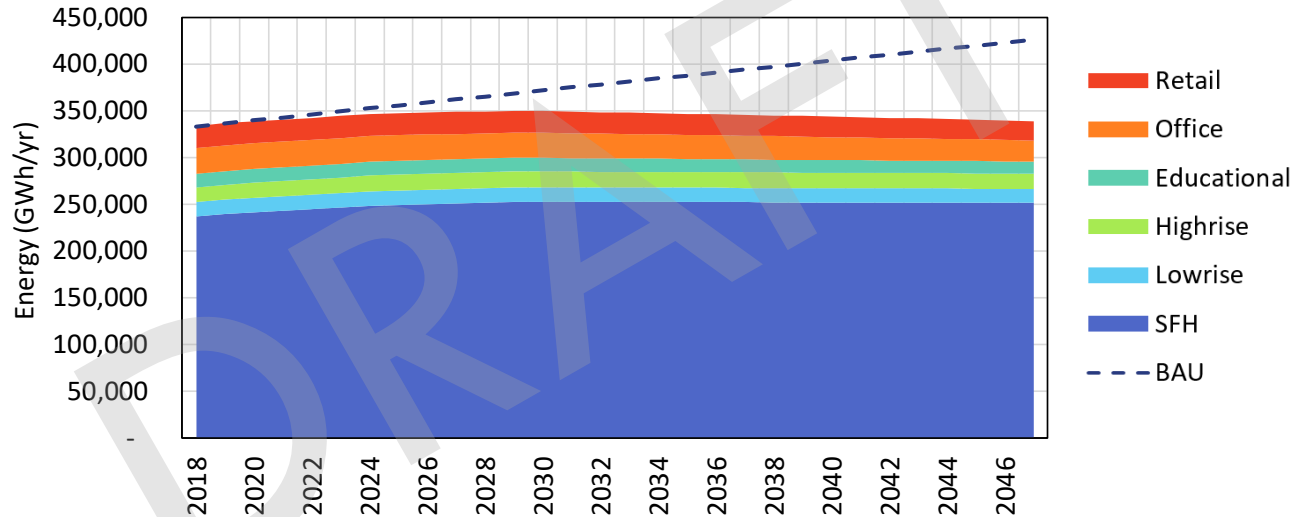
Preliminary Results

DRAFT: Total Energy Use with Business as Usual



- Significant energy increases even with anticipated efficiency gains in new construction and retrofit projects
- Single family home market is the dominant contributor

DRAFT: Total Energy Use with Roadmap Intervention



- ❑ Significant reductions in consumption with Roadmap intervention
- ❑ Prevents rise in consumption over 30-yr time horizon

Highlights from Key Intervals (all building types)

Year		<u>2025</u>	<u>2035</u>	<u>30 yrs</u>
Energy Savings	GWh/yr	8,500	41,000	87,000
	%	2%	11%	20%
Electricity Savings	GWh/yr	4,500	21,000	43,000
	%	3%	13%	23%
Natural Gas Savings	GWh/yr	4,000	20,000	44,000
	%	2%	9%	19%
GHG Savings	T/yr	1,850,000	8,850,000	18,600,000
	%	3%	11%	21%

- ❑ Substantial improvements compared to business as usual
- ❑ Approximately 20% reduction after 30-yrs
- ❑ Business as usual
 - ❑ Retrofits: 10% improvement when retrofit
 - ❑ New: ASHRAE 90.1-2013 with 1.5% annual improvement

Conclusions

- Ultra-low energy new construction and deep energy retrofits have been demonstrated with case studies in the 10 PNWER states/provinces/territories
- Energy savings can improve affordability for citizens, businesses and institutions
- Associated non-energy benefits include improved comfort and healthfulness, lower carbon emissions, increased durability and resilience to extreme events
- “Roadmap” could be used to guide PNWER jurisdictions to achieve those objectives through market-based approaches
- Partnership underway through PNWER Energy and Environment Working Group to complete research and prepare a White Paper

Future Work - Extrapolation

- Projections for:
 - ▣ Greenhouse gas emission reduction
 - ▣ Economic impacts: benefits and costs
 - ▣ Investment, jobs, economic diversification
- Detailed analysis and extrapolation for specific regions
 - ▣ Depends on funding partners, sponsorship

Discussion

- Roadmap to Resilient, Ultra-Low Energy Buildings
- Case Study Results
- Case Study Examples
- Extrapolation Methodology
- Future Work
- To become involved: contact PNWER at (206) 443-7723

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