Prism ENGINEERING

Latest Technology and Trends in Energy Management

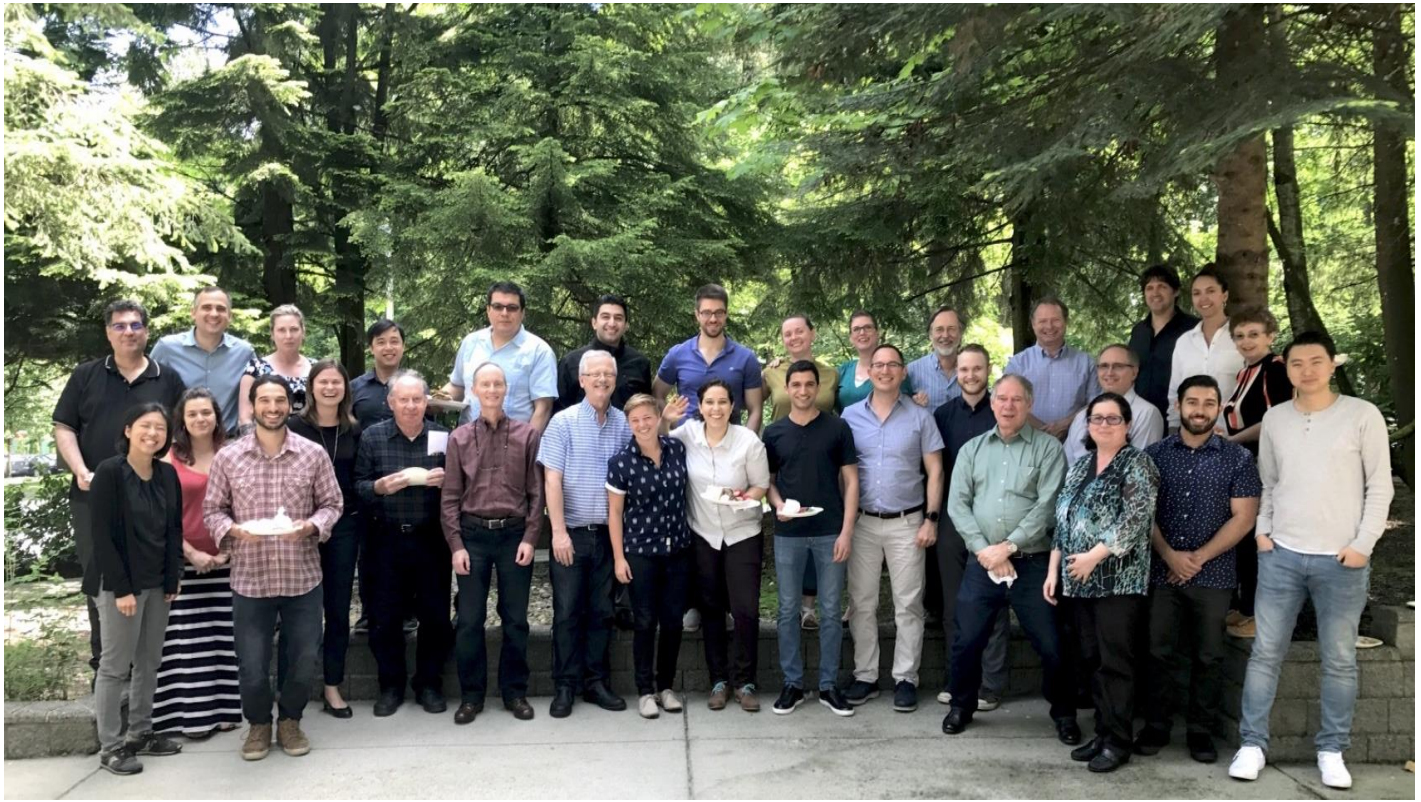
for Commercial Buildings in Canada

BOMA China 2018 Conference

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA | OQM CERTIFIED

Vancouver, British Columbia

Our Prism Team



BC's leader in helping organizations save energy.

帮助企业节能的BC省领先者

Our Mission

Our team of specialists achieves our vision by working collaboratively with our clients to improve facility performance through:

1. technical innovation and building system upgrades,
2. effecting operational and cultural change, and
3. monitoring results for continuous improvement.

The result is energy efficient and modernized facilities, reduced environmental impact, and lower costs.

我们的使命

我们的专业节能团队与客户密切合作，通过以下措施提高设施的能源使用效率，进而实现我们的愿景：

1. 技术创新与建筑系统升级；
2. 实施运营与企业文化变革，以及
3. 监测结果以持续改进。

最终获得了高能效的现代化设施，减少对环境的影响并且降低成本。

Our Core Values
我们的核心价值理念

Impact
影响

We have a part to play in creating a more energy efficient and sustainable world.

我们在创造高效能源和持续发展方面发挥一己之力。

People
人员

Our people are our most important asset. We foster an engaging, collaborative and supportive workplace.

我们的员工是我们最宝贵的财富。**我**们致力于创造积极活泼、**合作有爱**、**互帮互助的工作**环境。

Relationships
关系

We build trust by understanding our clients' needs, communicating with them effectively and building strong relationships.

我们准确把握客户的需求，实现高**效沟通**，稳固合作，**互信互助**。

Quality
质量

We deliver effective solutions that provide value for our clients.

我们提供高效的解决方案，为客户带来效益。

Improvement
提升

We are committed to continuous improvement. We invest in our people, systems and tools to become better at everything we do.

我们承诺持续改进。**我**们积极投资员工、**系**统和工具，**提升**专业水准。

Integrity
诚实守信

We run our business with integrity. We act honestly and ethically.

我们倡导诚信经营。诚实守信，**遵守企**业职业道德。

Holistic Energy Management
着眼于整体的能源管理

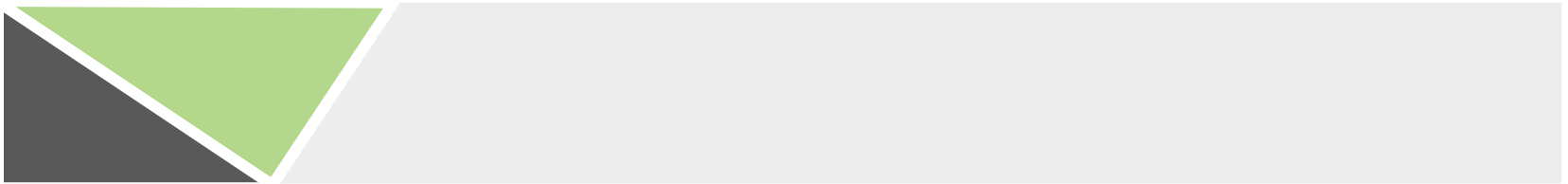
Projects
项目

Technical solutions
and innovation
技术解决方案和创新

Programs
计划

People
人员

PROJECTS:
IMPROVING BUILDING ENERGY PERFORMANCE
项目——改善楼宇能源表现



1

Building HVAC Controls Upgrades

Match the Need with DDC (Direct Digital Controls)
利用DDC（直接数字控制）满足用户需求

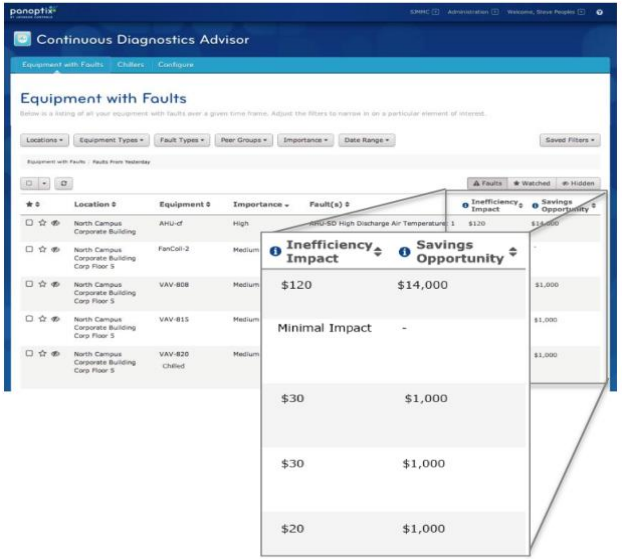
- Schedules
  日程表
- Setpoints
  期望值
- Sequences
  次序
- Operations and Maintenance Practices
  运营与维护实践

Island Savings Centre (CVRD)
Island 储蓄中心

- Electrical savings of over 500,000 kWh or ~20%
  节省电量500,000 kWh，即大约节省20%
- Fuel savings of 4,000 GJ or ~ 50%
  节省能源4,000 GJ，即大约节省50%
- Cost avoidance $120,000 or 40%
  成本降低 120000美元，即降低40%
- Retrofit budget cost: $370,000 3 year simple payback

What's New: Automated Fault Reporting (FDD)
后续举措：自动故障报警

- Automated Reports
  自动化报告
  - Filtered / prioritized by equipment type, savings opportunity in $ or energy
    根据设备类型、能源节省金额或节省能源进行过滤/优化
- Scalable to different users
  可扩展至不同用户
  - Headlines only (portfolio director)
    仅限标题（资产组合总监）
  - Detailed output (building operator)
    详尽的输出（楼宇运营方）



2

Chilled Water Plant Upgrades
冷冻水设备升级

Kootenay Boundary Regional Hospital
库特内边界地区医院

Kootenay Boundary Regional Hospital
库特内边界地区医院

Upgrade Cost: $840,000

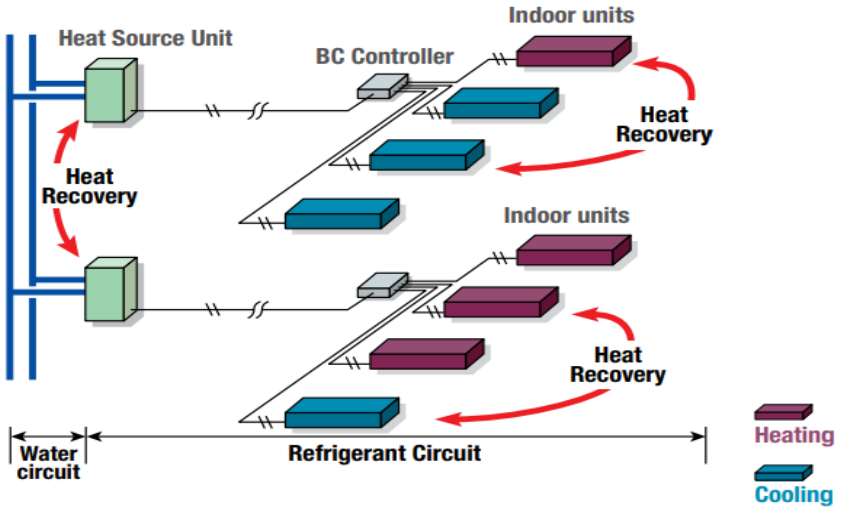
Energy Savings: $50,000 per year

Old
改进前

New
改进后

Variable Refrigerant Flow (VRF) Upgrade

- Retrofit existing HVAC system with **air or water source VRF** fan coil system
- Use **boiler** and **chiller** for peak heating and cooling loads
- Energy Recovery Ventilation



3

Heating Plant Upgrades
供暖设备升级

City of Trail – Memorial Centre (Community Centre)
城市象征—纪念中心（社区中心）

City of Trail – Memorial Centre 城市象征—纪念中心

- Before:
  - 2 x 1670 MBH atmospheric boilers for heating and Domestic Hot Water (DHW)
- After:
  - Replaced 1 boiler with 1800 MBH dual return port condensing boiler
  - Offset boiler load by heat recovery from ammonia ice plant for DHW pre-heat
  - Re-configured heating plant piping and controls

- 升级前：
  - 2 x 1670 MBH 大气锅炉（供暖+DHW）
- 升级后：
  - 用 1800 MBH 双回流口冷凝式锅炉替换，
  - 包括重铺管道和控制系统同时启动一个DHW罐，
  - 用于氨（制冰厂）热回收预热罐，抵消锅炉荷载。

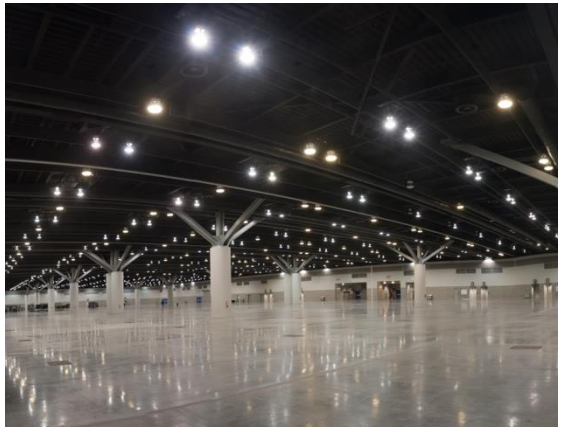
Savings: 1,980 GJ/year **(31%)** or $19,500/year
Rebate: $68,600
Cost before rebate, including engineering: $300,000
节省：1,980 GJ/year (31%)，即19,500美元/年
折扣：68,600美元
折扣前成本，包括建造: 300,000美元

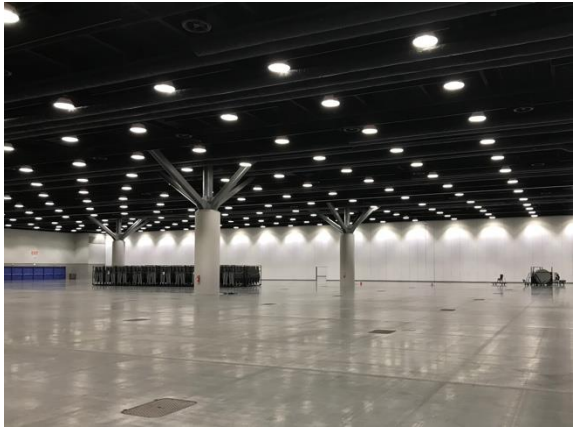
4

LED Lighting Upgrades
LED 照明设备升级

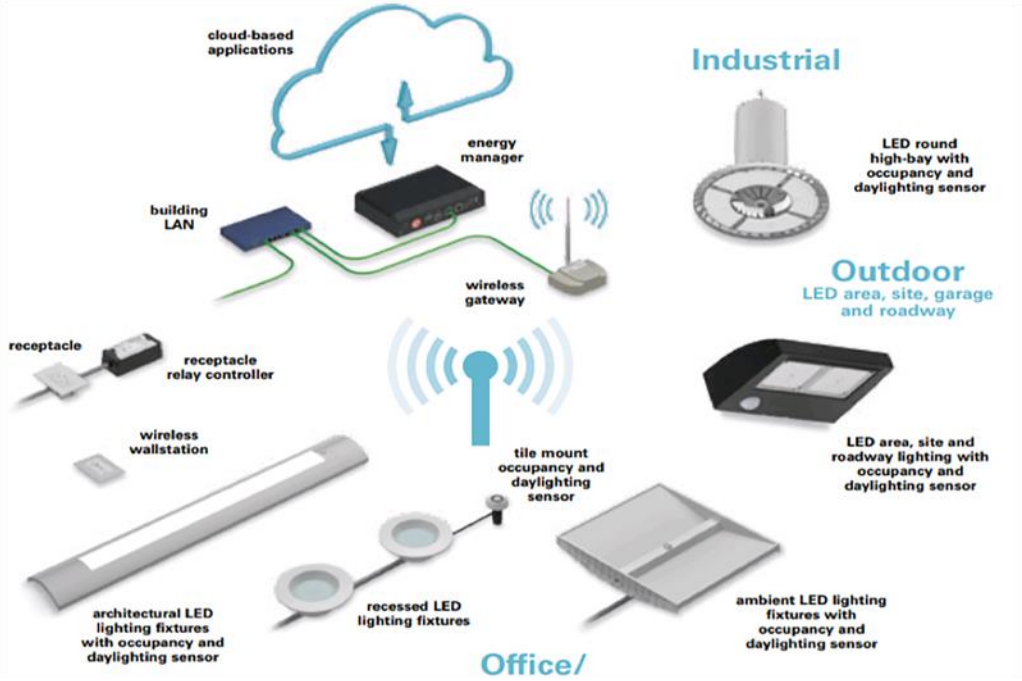
Vancouver Convention Centre

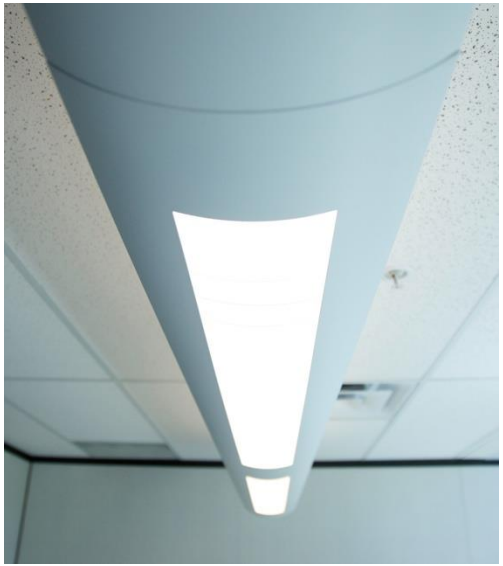
Old 改进前	New 改进后		
335 kW	193 kW	Power	42% Reduction
1,100,000 kWh	500,000 kWh	Energy	51% Reduction
Upgrade Cost: $900,000	Energy Savings: $100,000/year		9 year payback





Lighting Control Systems





Prism Office Expansion

- Reduced to 0.2 W/ft^2 or 2.1 W/m^2

Year	2012	2013	2014	2015	2016	2017	Total
Savings kWh	5,685	4,972	5,925	6,026	6,329	6,444	35,000
%	54.6	52.2	53.7	55.7	50.0	48.3	52%

5

Building Envelope Upgrades

Government of Canada

Deep Energy Retrofits

- Low Carbon Studies
- Challenge the status quo in existing buildings
- Federal government leading the way

→ Constructed in 1961
→ 3 stories; 6,100 m2

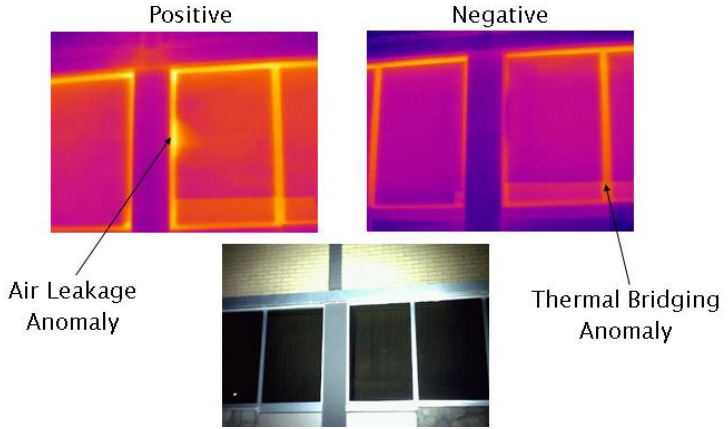
South & West Elevation

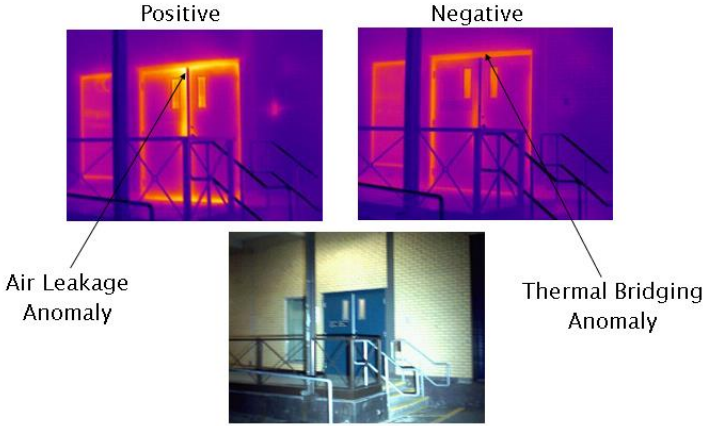
North Elevation

South & East Elevation

Air Tightness Thermography

Windows & Doors





Retrofit Opportunities

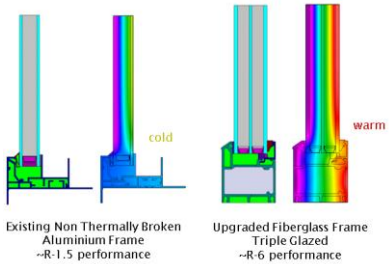
External Insulation

< Walls

< Roof

Air Tightness

Windows >



Existing Non Thermally Broken Aluminium Frame
~R-1.5 performance

Upgraded Fiberglass Frame Triple Glazed
~R-6 performance

6

Fuel Switching and Energy Supply

CO_2 Heat Pump

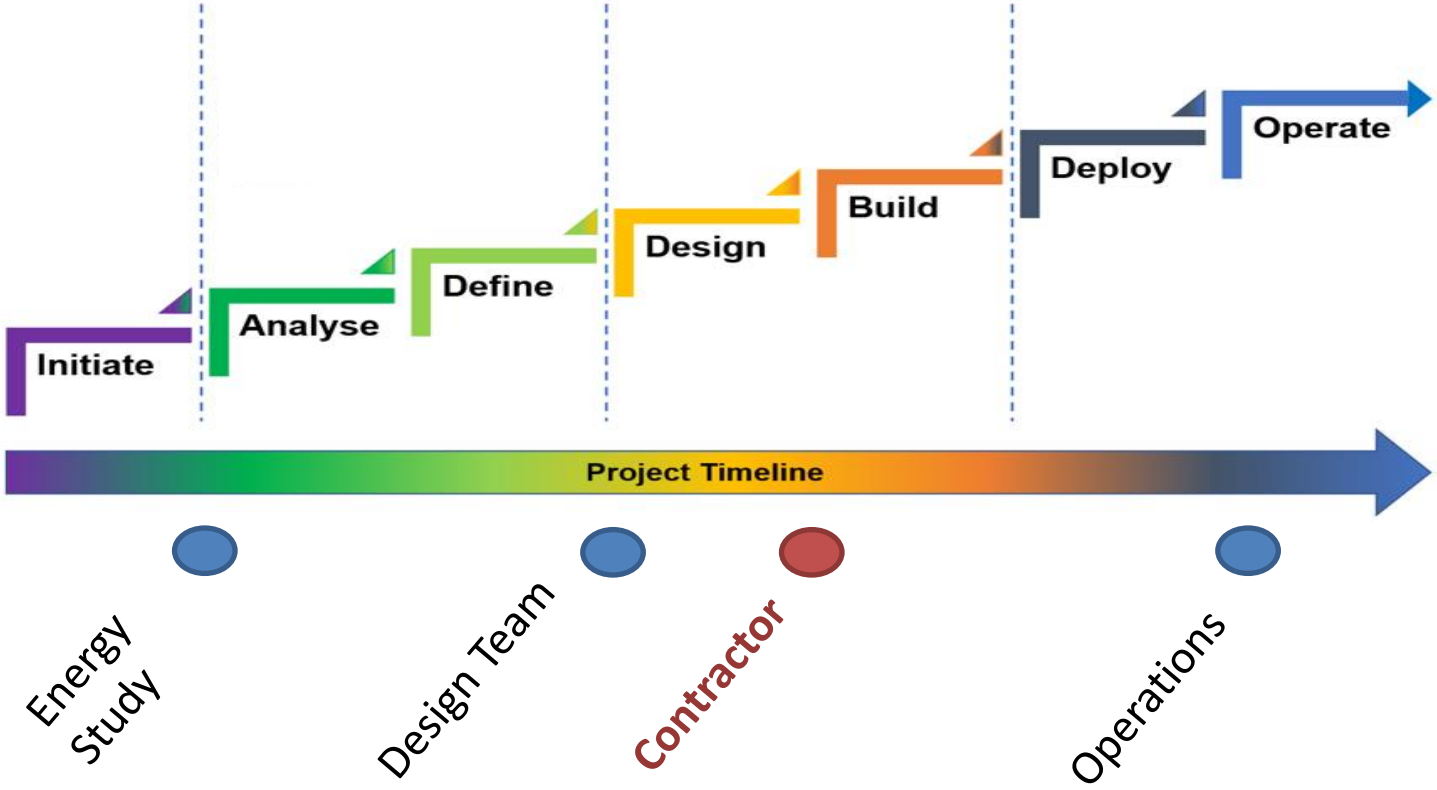
- Heat from outdoor air
- Environmentally friendly refrigerant
- Split system (air to water)
- Direct exchange (refrigerant line runs from tank to outdoors)

Photovoltaic

- 35% of annual electrical consumption displaced

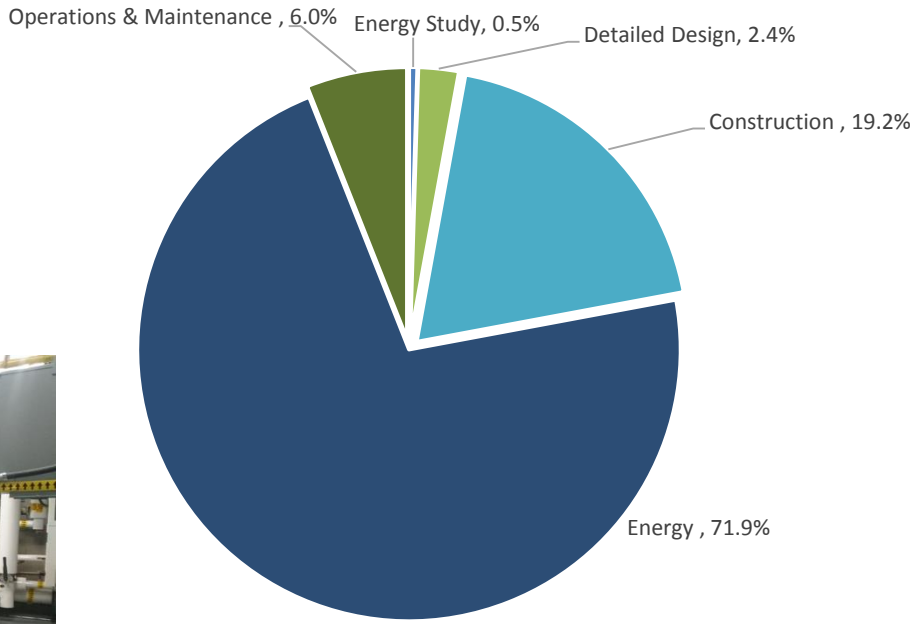
7

Contracting Issues


Initiate
Analyse
Define
Design
Build
Deploy
Operate
Project Timeline
Energy Study
Design Team
Contractor
Operations

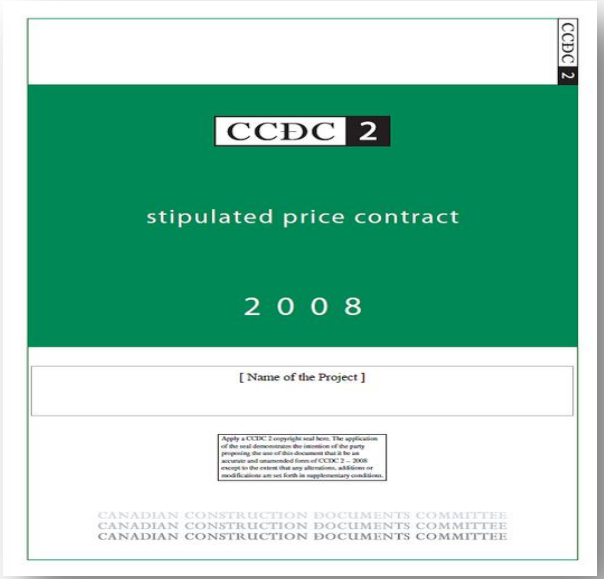
Project Lifecycle Costs

- Heating plant upgrade
- 25 year lifecycle
- $450k construction costs



Contract Forms

- Canadian Construction Document Committee (CCDC)
  - Develops standard form documents

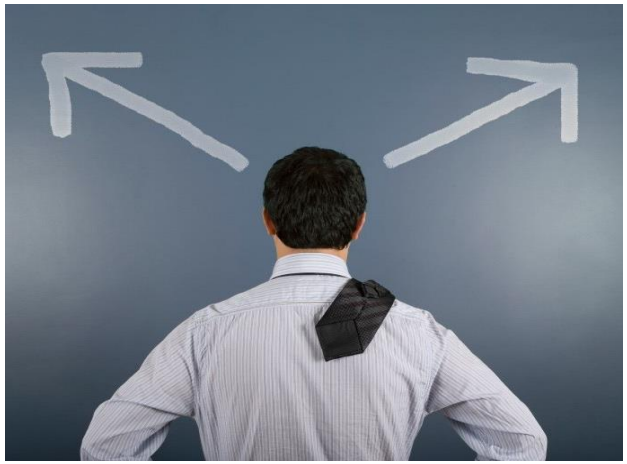


Contract Delivery Method

- Standard Contact types:
  - Design-Bid-Build
  - Cost Plus
  - Unit Price
  - Design-Build / Operate
  - Design-Build-Operate-Finance
  - Construction Management

Evaluation Criteria

- Price
- Experience
- Schedule
- Proposed Team
- Respondent Availability
- Work Plan
- Other



Holistic Energy Management
着眼于整体的能源管理

Projects
项目

Programs
计划

Net Zero

Benchmarking

BOMA BEST

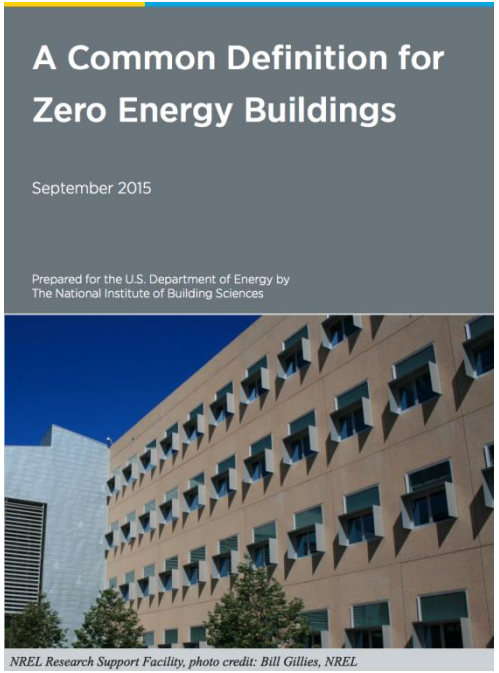
People
人员

PROGRAMS

What is Net Zero?

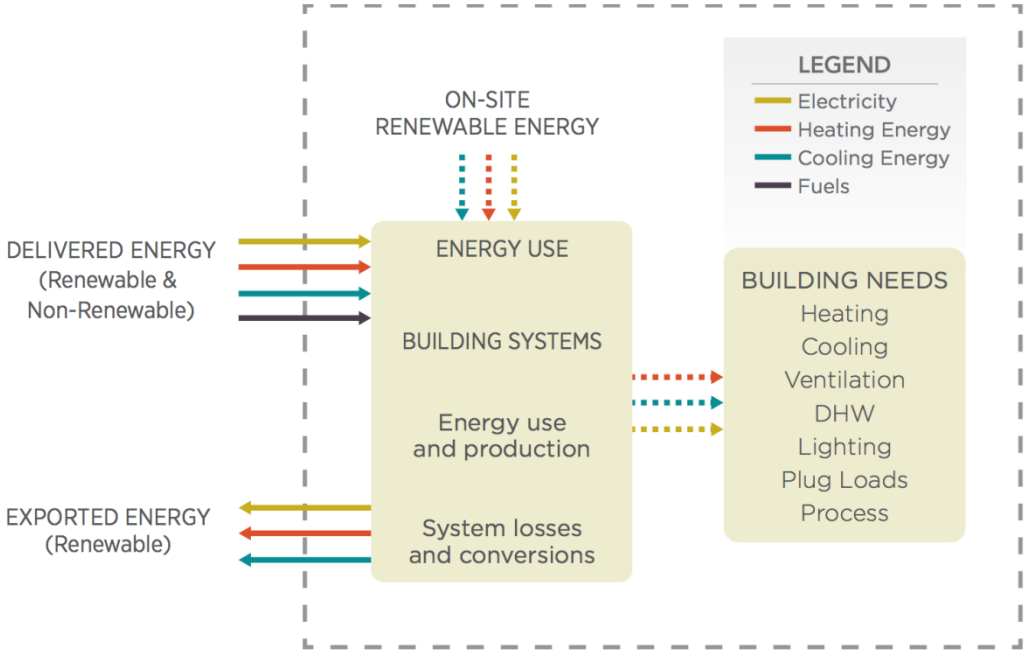
"An energy-efficient **building** where, on a **source energy** basis, the actual **annual delivered energy** is less than or equal to the on-site renewable **exported energy**."

Also applies to campuses, portfolios, and communities.



NREL Research Support Facility, photo credit: Bill Gillies, NREL

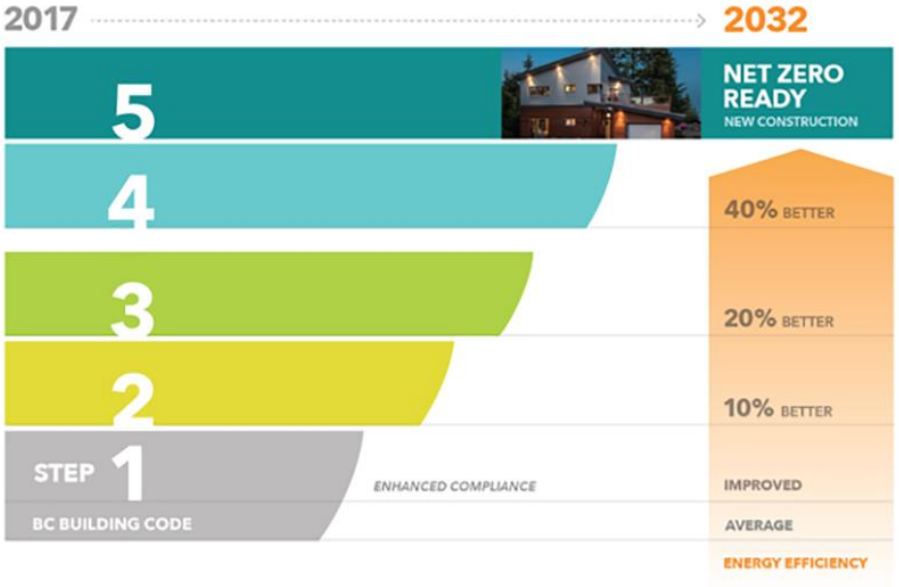
Figure 1 – Site Boundary of Energy Transfer for Zero Energy Accounting



Notes

1. The dashed lines represent energy transfer within the boundary
2. The solid lines represent energy transfer entering/leaving the boundary used for zero energy accounting

New Construction – BC Building Code



BOMA Canada's Net Zero Challenge

- Launched September 2017
  - ✓ Best In Class
  - ✓ Innovation
  - ✓ Most Improved

National Benchmarking

Score of 75 or more indicates top performance

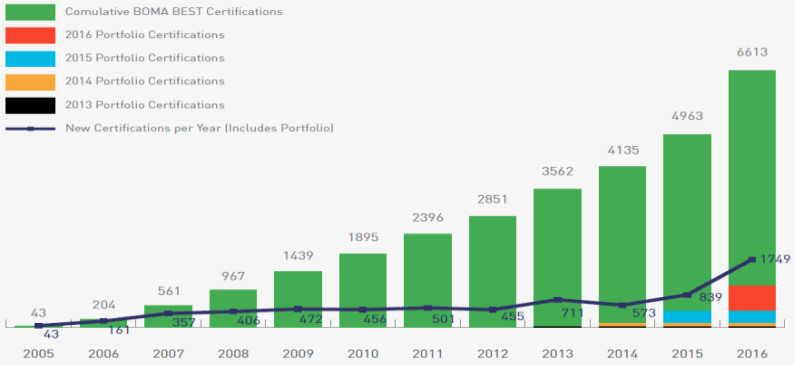
- K-12 Schools
- **Commercial office buildings**
- Hospitals
- Supermarkets and food stores
- Medical offices
- Senior care and residential care facilities
- Ice/curling rink
- Municipal buildings

BOMA BEST

2018 BOMA BEST National Green Building Report

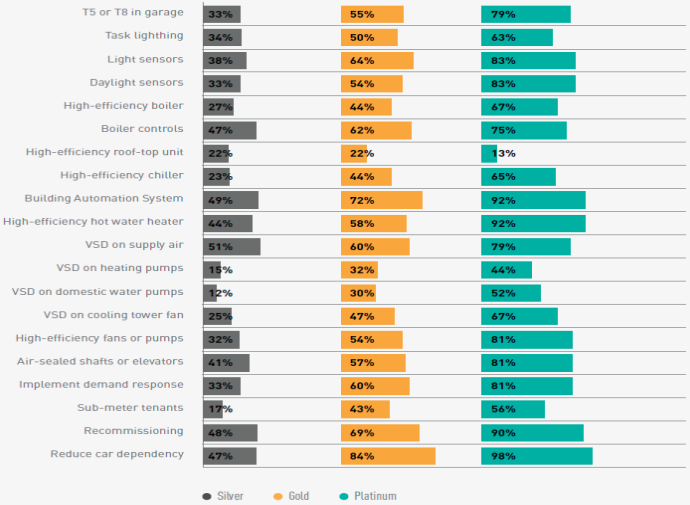
- Programs such as BOMA BEST help owners certify their performance.

Figure 1



Annual portfolio certifications are included in the total cumulative certifications from 2013 to present.

Figure 1: Cumulative Number of BOMA BEST Certifications (All levels of certifications)



Holistic Energy Management
着眼于整体的能源管理

Projects
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Programs
计划

People
人员

Training staff
培训员工

Engaging building occupants
鼓励楼宇住户积极参与

PEOPLE: TRAINING STAFF AND ENGAGING BUILDING OCCUPANTS
人员：培训员工并鼓励楼宇住户参与其中

BOMA eEnergy Training for Building Operations
BOMA 楼宇运营在线能源培训

- Delivered **online** in a self-learning format
  提供**在线**自学课程
- Highlights operational and capital project opportunities
  强调运营和资本项目机会
- Support available throughout the course
  在整个培训课程期间提供支持

High Performance Building Courses

- Skills to build to the Passive House standard
- Building enclosure optimization
- Construction fundamentals and proper sequencing
- Introduction to heat and energy recovery ventilators

Programs to get staff involved in saving energy
鼓励员工参与节能的项目

Training + Networking Events

Programs to get staff involved in saving energy
鼓励员工参与节能的项目

Prism's 7-Step Campaign Planning

Thank you. 谢谢！

Robert Greenwald, P.Eng., MBA, President

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Prism ENGINEERING

saving you energy