Welcome to…

THE 2016 RHODE ISLAND HIGH PERFORMANCE SCHOOLS SUMMIT

October 21, 2016

Rhode Island College

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SUMMIT CO-HOSTS

High Performance Schools Summit

RIDE Rhode Island Department of Education

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STATE OF RHODE ISLAND
OFFICE OF ENERGY RESOURCES

neep

COMMUNITY PARTNERS & PLANNING COMMITTEE

- Thank you to all our community partners and the RI High Performance Schools Working Group

HMFH ARCHITECTS

THE Apeiron Institute FOR Sustainable LIVING

LLB ARCHITECTS

COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

CHPS

Better buildings. Better students.

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Welcoming Address

Dr. Frank Sánchez – President, Rhode Island College

Dr. Ken Wagner – Commissioner, Rhode Island Department of Education

Governor Gina Raimondo

Looking, Hearing, Feeling – Sensing the Benefits of High Performance Schools

Opening Speaker:

- Dr. Joseph da Silva, RI School Building Authority

Panelists:

- Patti DiCenso, Pawtucket School Department
- Shélynn Riel-Osorio, Rhode Island College
- Chin Lin, HMFH Architects
- Erika Eitland, Harvard University

Facilitator:

- Manuel Cordero, RI School Building Authority

Photo Credit: SMMA Architects

Patti DiCenso, Pawtucket School District

Looking, Hearing, Feeling: Sensing the Benefits of High Performance Schools

•••

Environmental Implications in Language Development & Acquisition

Shélynn Riel-Osorio

Ambient Noise & Learning

Children are not as well-equipped as adults to cope with cacophony of modern life.

A child's ability to overcome the sensory demands created by background noise does not reach the adult level until the late teenage years (Johnson, 2000).

Learner Impact

The presence of noise in a learning environment can have cognitive and psychophysiological repercussions on young learners, demonstrated through:

- Delayed reading skills, speech perception, and memory (Maxwell & Evans, 2000).
- Increased cortisol levels and heart rate (Evans, et. al., 1995).

High-Risk Subpopulations

- SES/ Urban dwellers
- Hearing-impaired students, students with learning disabilities, students with language and attention disorders
- Language learners (and not just English learners!)

Creating a learning-conducive environmen

means catering to the myriad intelligences present in the student body...

The Silver Lining

Given the prevalence of background noise, it is likely that children rarely experience completely quiet environments when learning. However, **even limited listening opportunities in quieter environments may help children overcome** the deleterious effects of noisier environments (Fallon, et al., 2000).

Reference list

- Cohen, S., Glass, D. C., & Singer, J. E. (1973). Apartment noise, auditory discrimination, and reading ability in children. *Journal of Experimental Social Psychology, 9,* 407-422. doi:10.1016/S0022-1031(73)80005-8
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- Klatte, M., Bergstrom, K., and Lachmann, T. (2013). Does noise affect learning? A short review on noise effects on cognitive performance in children. *Front. Psychol.* 4:578. doi:10.3389/fpsyg.2013.00578
- Maxwell, L. E., and Evans, G. W. (2000). The effects of noise on pre-school children's pre-reading skills. *J. Environ. Psychol.* 20, 91-97. doi:10.1006/jevp.1999.0144


Chin Lin, HMFH Architects
Homework Folders
Finished

HARVARD
T.H. CHAN
SCHOOL OF PUBLIC HEALTH
Center for Health and the Global Environment

HEALTHY BUILDINGS

Schools for Health

Erika Eitland
Doctoral Student
Erika.Eitland@mail.harvard.edu
@ESEitland

SCHOOLS FOR HEALTH

A PLATFORM TO DISCUSS, RESEARCH, AND DISSEMINATE INFORMATION ON **HOW SCHOOL BUILDINGS IMPACT THE HEALTH** OF STUDENTS AND TEACHERS EVERY DAY

FOR HEALTH
forhealth.org

"Children Are Not Little Adults"

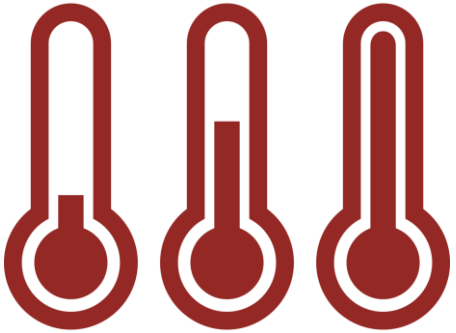
SCHOOLS
FOR HEALTH

Indoor Environmental Quality

Indoor Air Quality

Lighting & Views

Noise & Acoustics

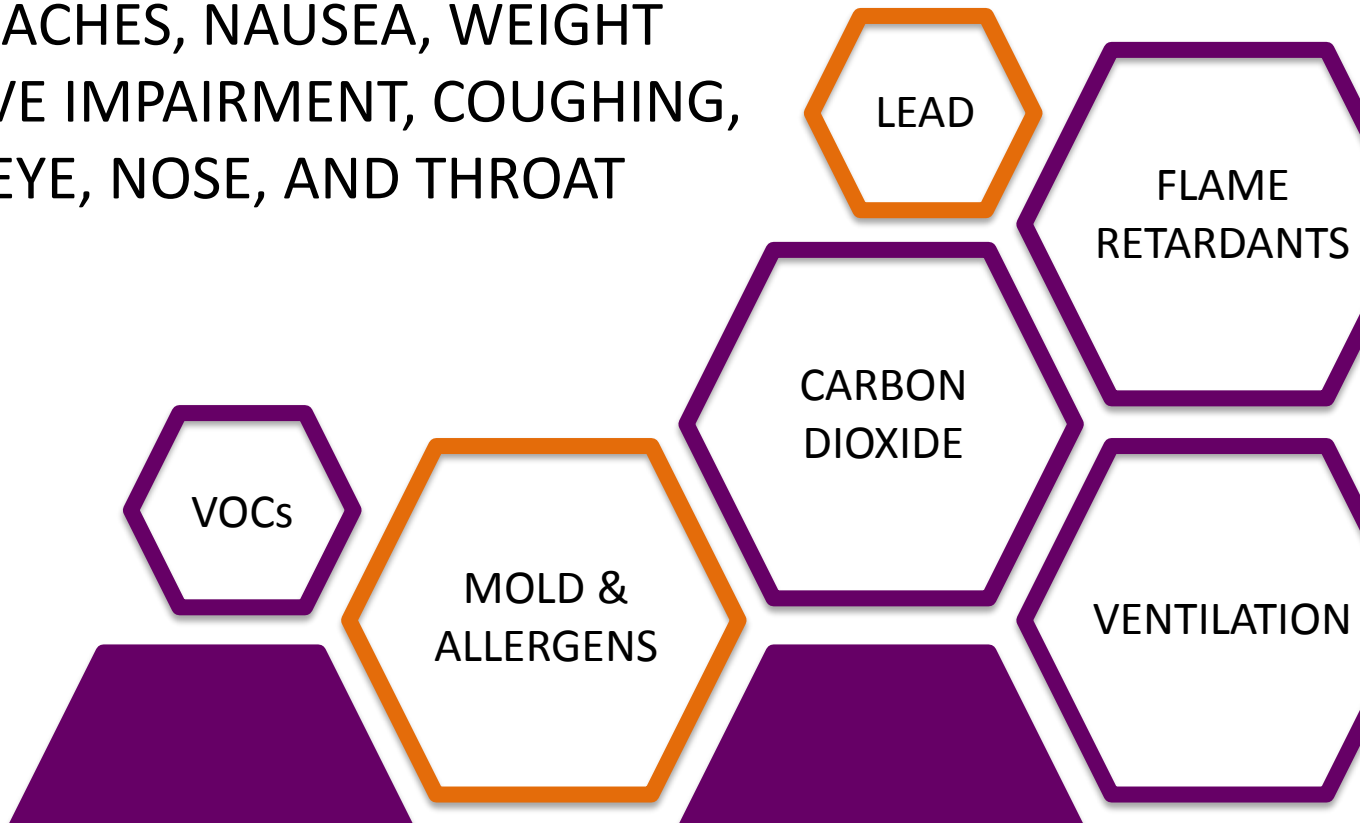


Thermal Health

SCHOOLS FOR HEALTH

MORE THAN 60,000 U.S.

PUBLIC SCHOOLS EXPERIENCE ENVIRONMENTAL CONDITIONS THAT CAUSE ASTHMA, HEADACHES, NAUSEA, WEIGHT GAIN, COGNITIVE IMPAIRMENT, COUGHING, AND GENERAL EYE, NOSE, AND THROAT IRRITATION.



SCHOOLS FOR HEALTH

Visual

172 U.S. third grade students tested the effect of high intensity glare-free "focus" lighting

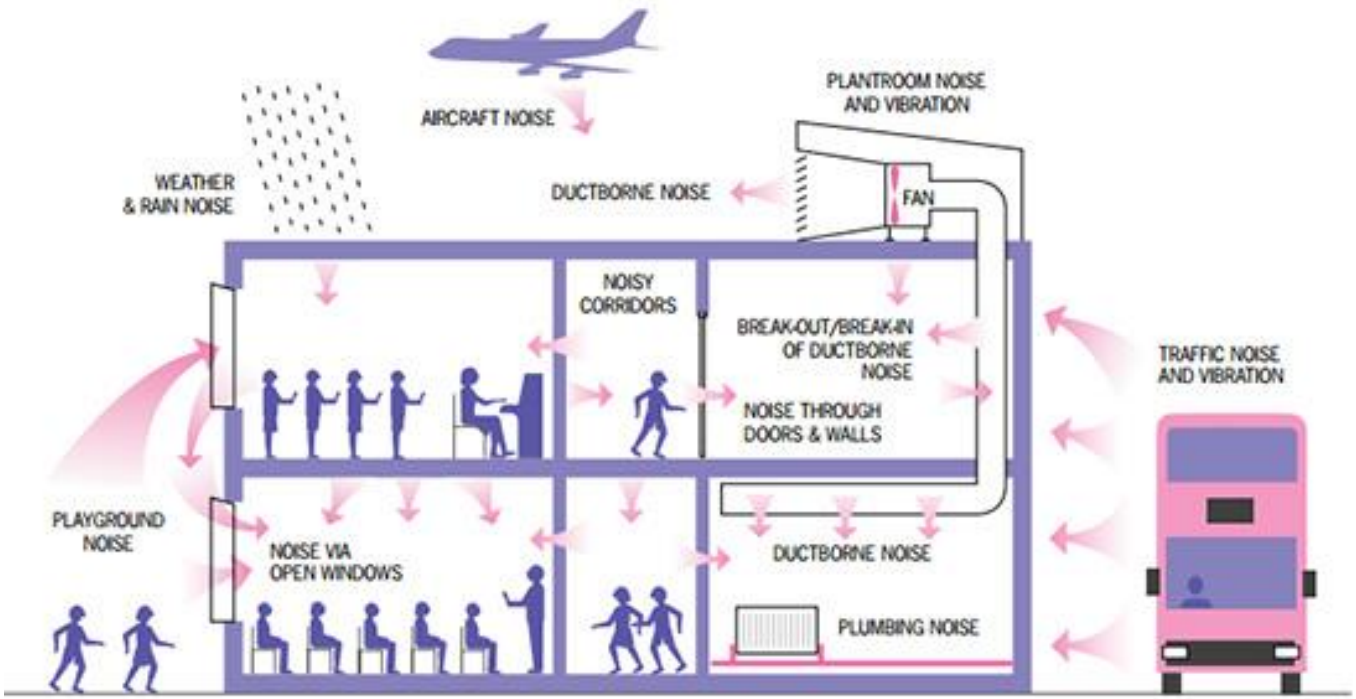
→higher % increase in oral reading fluency performance

Non-Visual

- Artificial Daylight (6500K)
  - Color temperature → Alertness, fewer errors, better computerized test scores
- Seasonal Differences in daylight exposure
  - Circadian Rhythm not stimulated → Need to supplement with artificial light

SCHOOLS FOR HEALTH

Absenteeism, Test Scores, Attention, Adequate Sleep



- Within schools highly exposed to aircraft noise
  - 86% of teachers reported keeping the windows closed even in warmer weather
  - 38 % of them indicated they undertook fewer outdoor activities with their students (Bergstrom et al., 2015)
- Hypertension, sleep disturbance, stress, annoyance, cardiovascular disease, higher blood pressure irritability, behavioral changes
  - Reductions in reading comprehension, memory & attention

SCHOOLS FOR HEALTH

FOR EVERY 1°F INCREASE, **TEST SCORES FELL BY 0.2%**

TAKING AN EXAM ON A 90°F DAY VERSUS 75°F DAY WOULD HAVE A **12.3% HIGHER LIKELIHOOD OF FAILING**

Jisung Park, Working Paper, 2016

SCHOOLS FOR HEALTH

SCHOOLS
FOR HEALTH

WHY DOES THE EDUCATIONAL ENVIRONMENT MATTER?

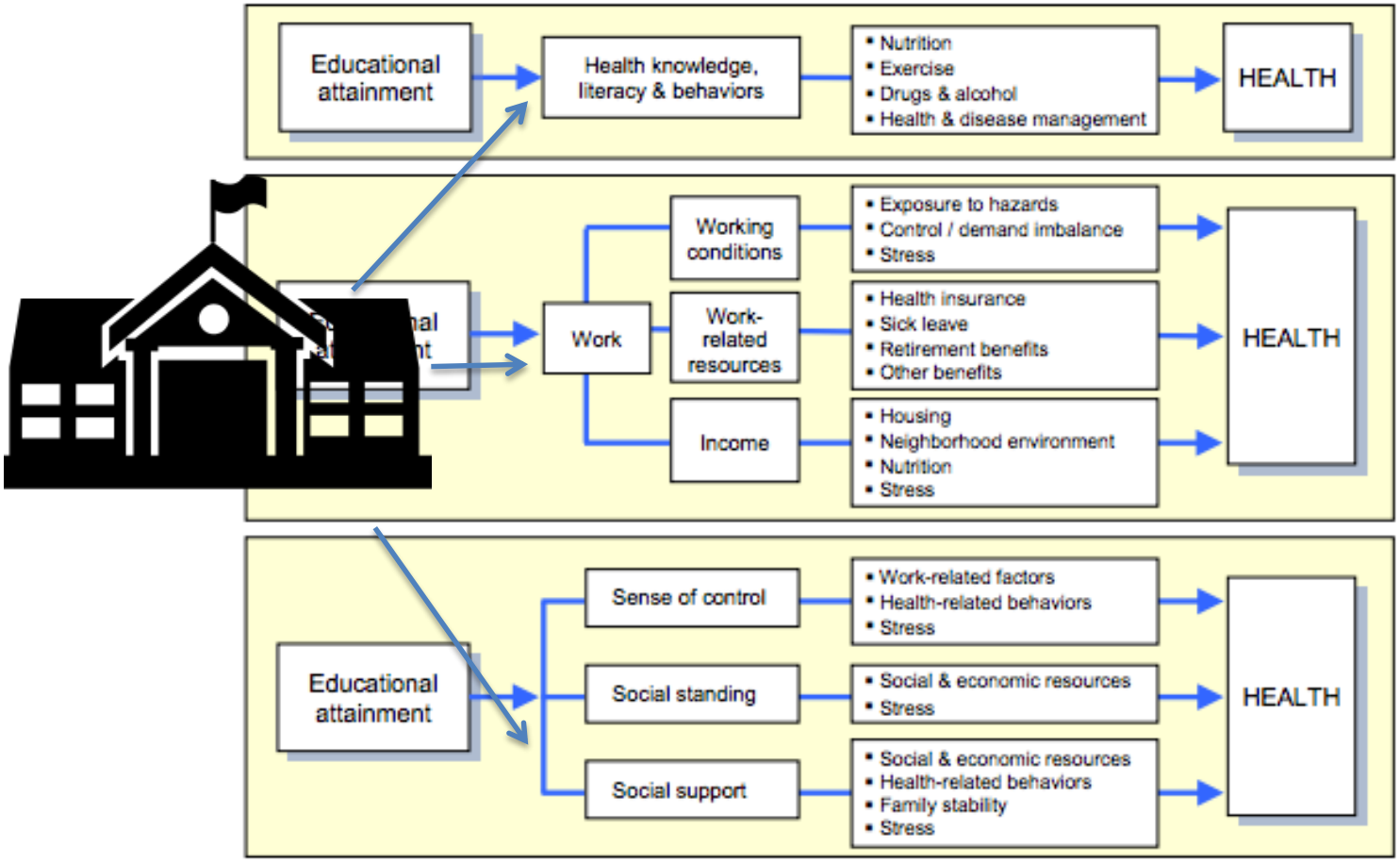


Figure 6. Interrelated pathways through which educational attainment affects health.

DISCUSSION

Panelists:

- Patti DiCenso, Pawtucket School Department
- Shélynn Riel-Osorio, Rhode Island College
- Chin Lin, HMFH Architects
- Erika Eitland, Harvard University

Facilitator:

- Manuel Cordero, RI School Building Authority

NETWORKING AND EXHIBITOR BREAK

10:30 – 11:00 AM

SIEMENS

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THE PATH TO ZERO ENERGY SCHOOLS

Opening Speaker:

- Commissioner Carol Grant, Rhode Island Office of Energy Resources

Panelists:

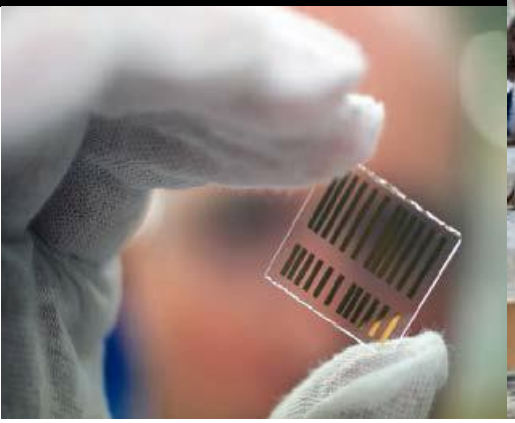
- Paul Torcellini, National Renewable Energy Laboratory
- Puja Vohra, National Grid
- Nicholas Valls, Jacobs Engineering

Facilitator:

- Becca Trietch, Rhode Island Office of Energy Resources

Photo Credit: Providence Journal

NREL
NATIONAL RENEWABLE ENERGY LABORATORY



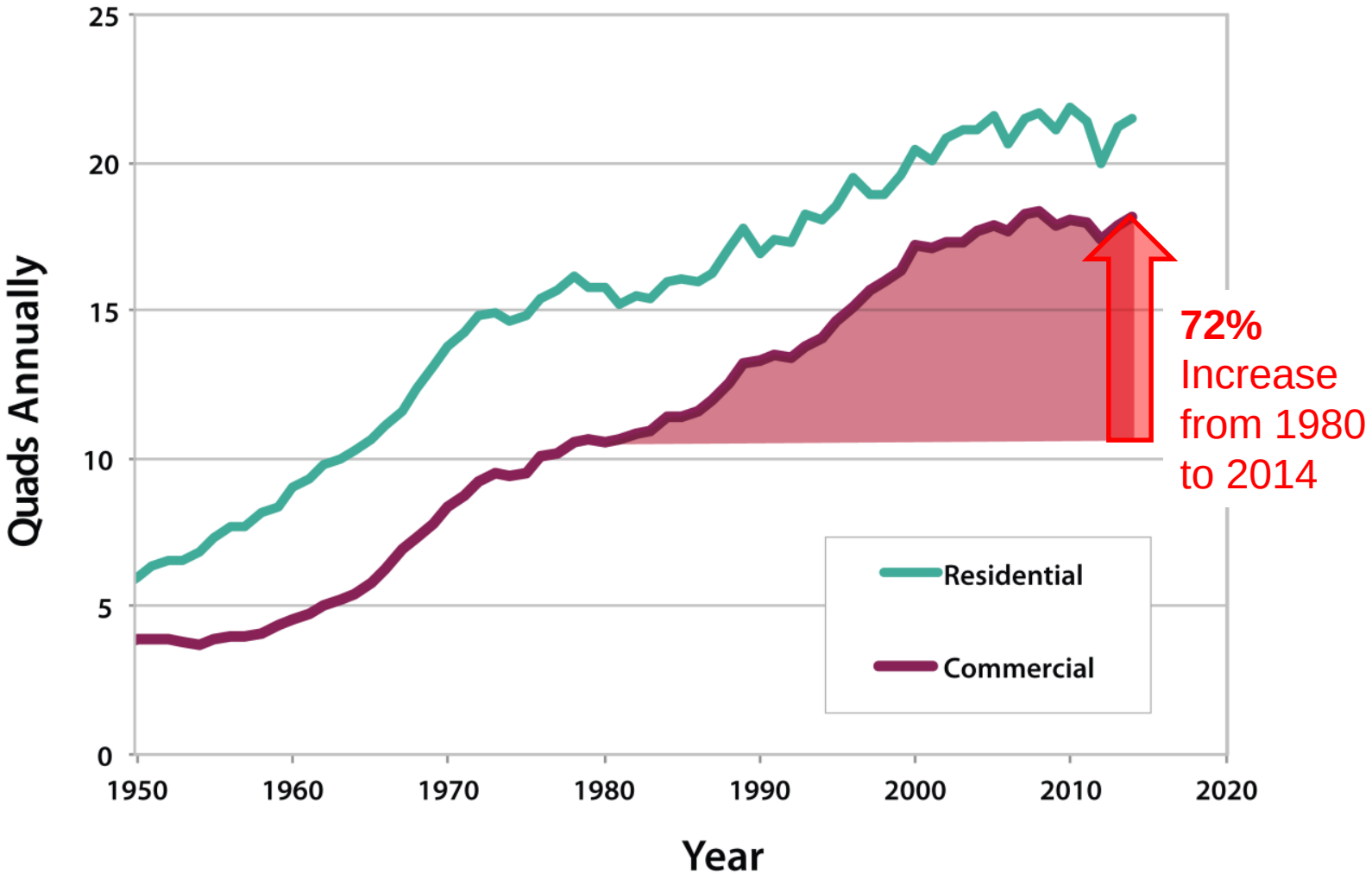
Designing to the Zero Energy Performance Target

Paul Torcellini, Ph.D., P.E.

National Renewable Energy Laboratory

October 21, 2016

U.S. Building Energy Consumption



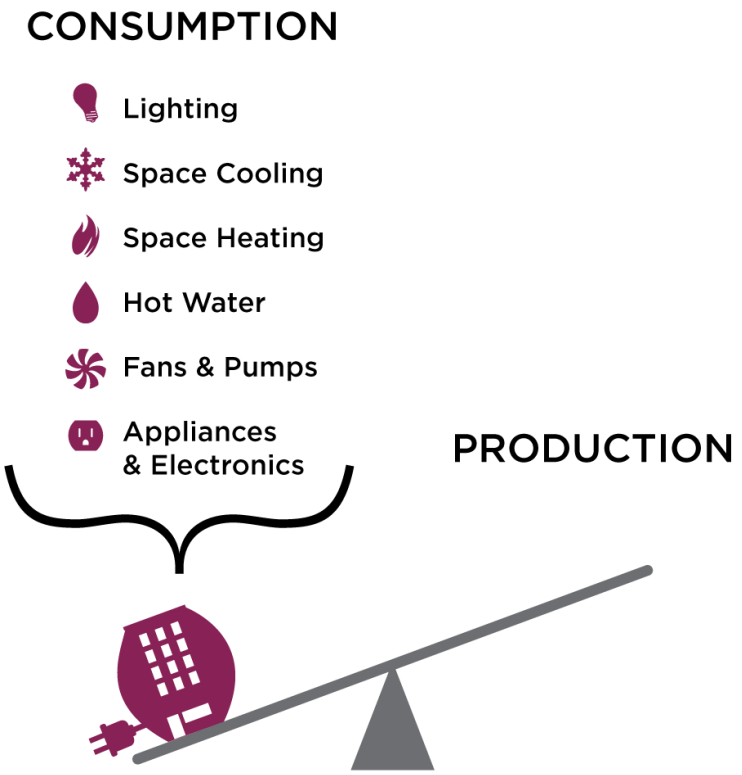
Trends of Commercial Sector

- Growth is faster than energy efficiency measures
- Every decision has an energy and environmental impact
- Buildings mortgage the energy futures of the world

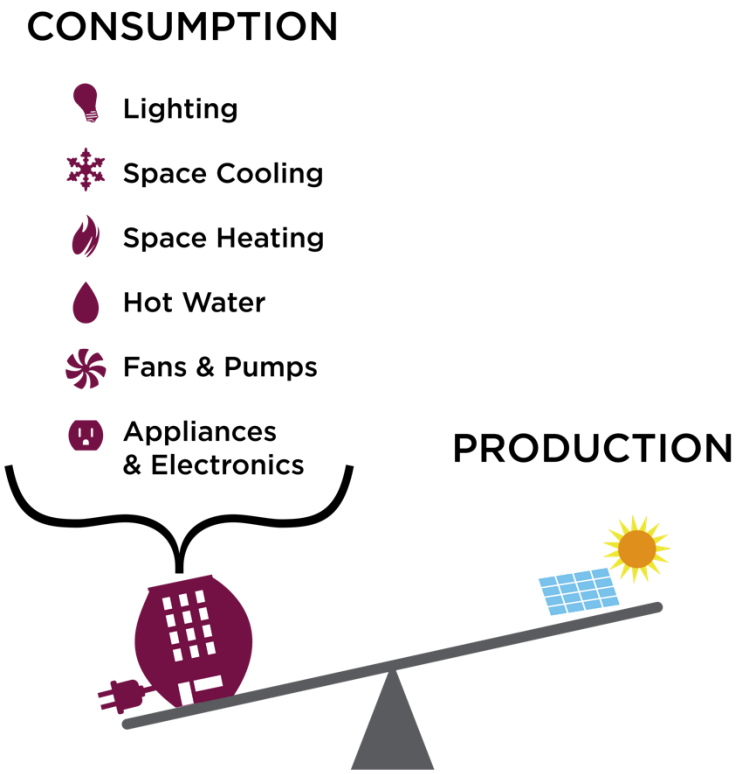
What are Zero Energy Buildings?

- Conceptually, a building that has no adverse energy [or environmental] impact [because of its operation]
- Energy consumption has been a long-term surrogate for environmental impact
- Boundaries and metrics
- What energy flows to measure

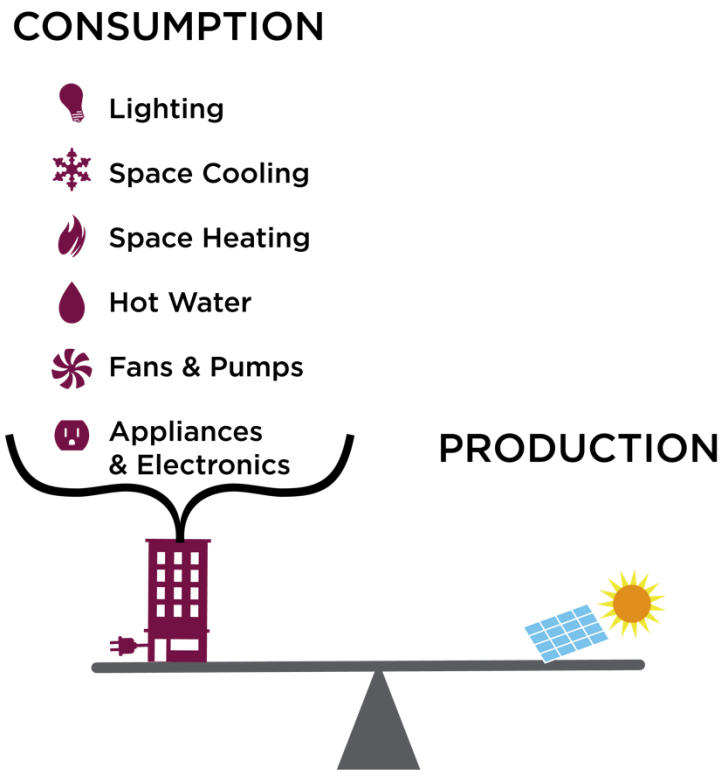
Zero Energy Building



Adding Renewables



Building on a Diet

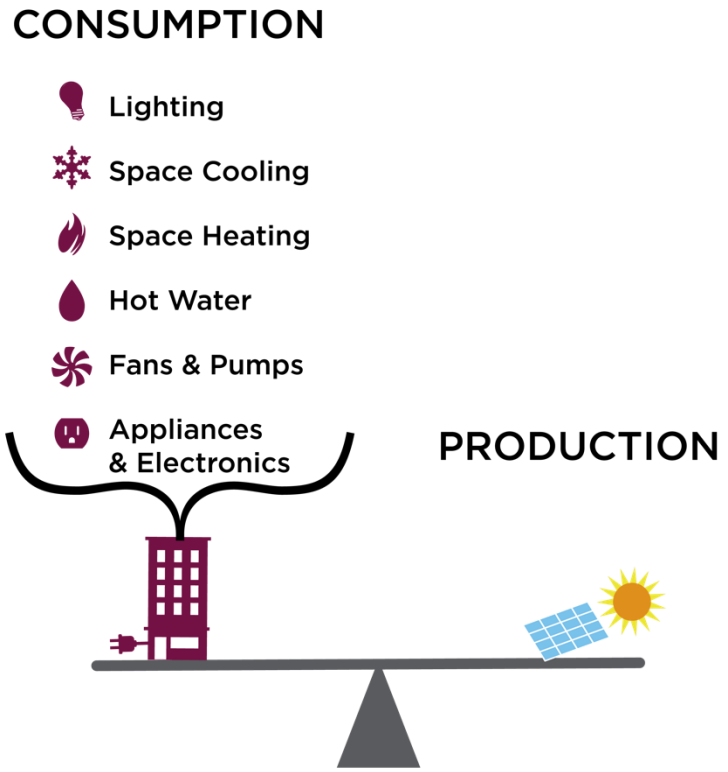


ZEB Concept

Goal 1:
Reduce Consumption

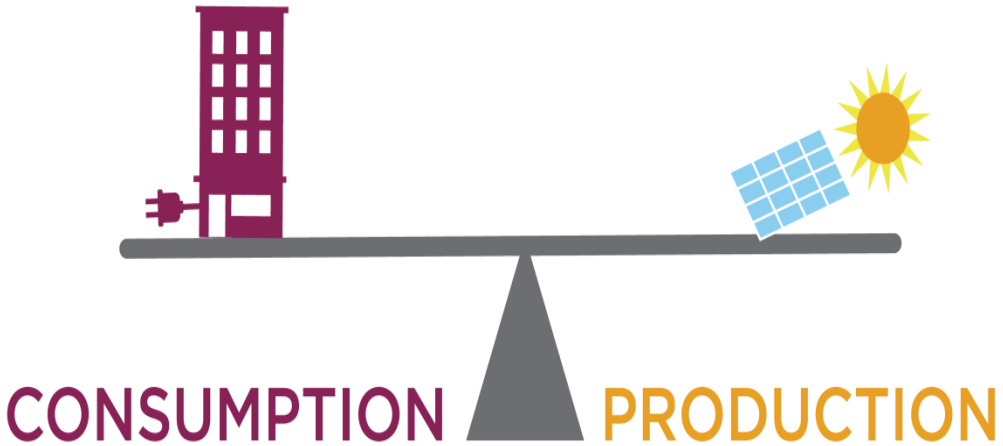
Goal 2:
Apply On-site Renewable Energy

BALANCE!

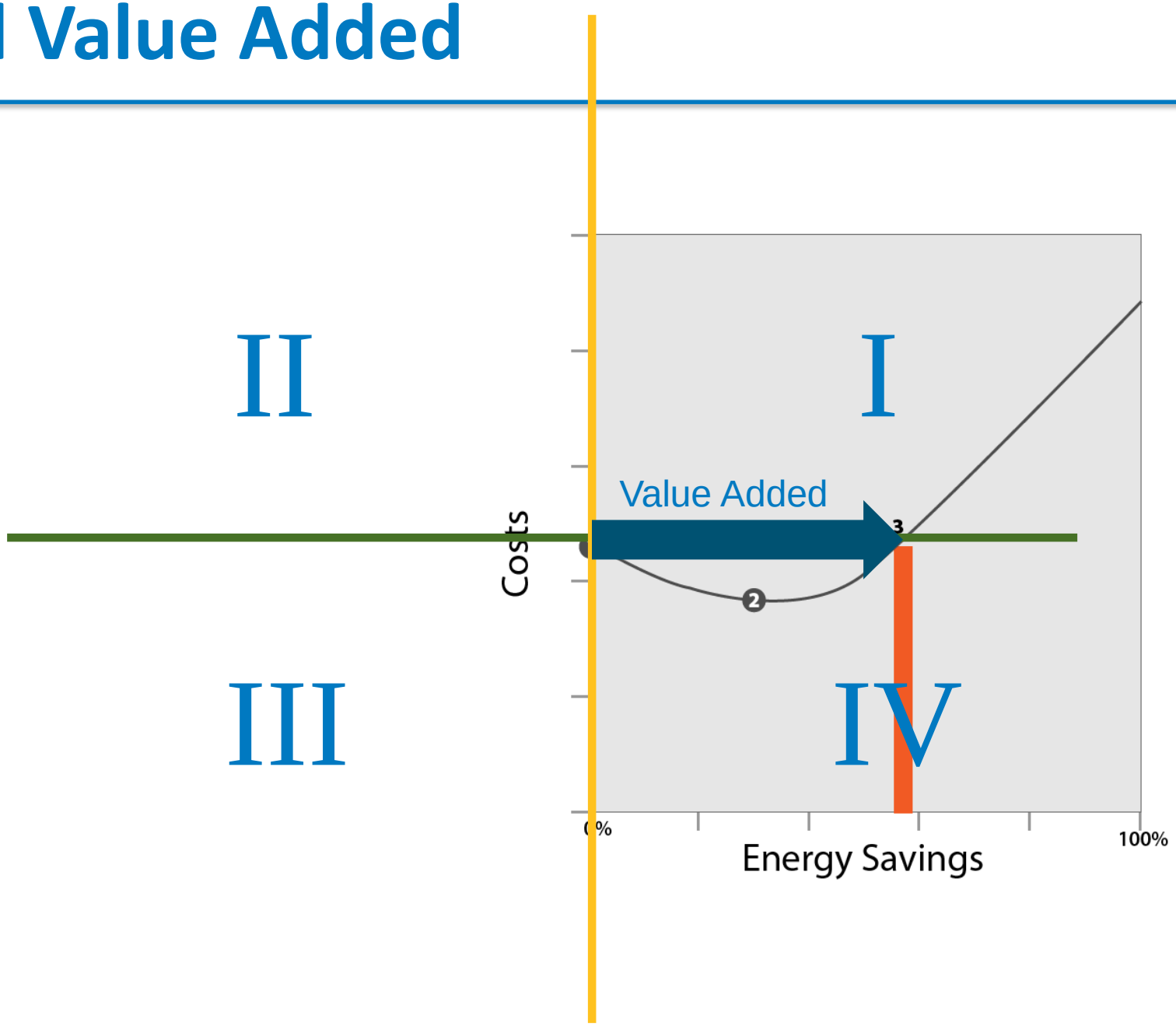


Zero Energy Building (ZEB) Definition

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.



Real Value Added



How Do We Get There?

- **Set measurable goals around energy efficiency**
  - Energy Use Intensity Goals
  - Zero Energy Building (even if it is a stretch goal—all projects should state this!)
- **While Technology is important—the real solution is in motivating design and contractor teams to make decisions aligned with the project goals.**
  - Performance Based Procurement

Questions?

Paul.Torcellini@nrel.gov

Send us zero energy school case studies!

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ZEB Pathway to 2035

A Whitepaper of the Rhode Island Zero Net Energy Building Task Force

By

Puja Vohra, National Grid

ZEB Task Force Background

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Mission:

- Define a 20 year pathway for Rhode Island to advance Zero Energy Buildings (ZEB) across all building sectors in support of the Rhode Island Energy Plan 2035.

Rhode Island Specific Issues

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- Awareness
- Higher upfront costs
- Cost of ownership
- Valuation and financing
- Technical know-how
- Alternatives for on-site generation
- Need for supportive utility infrastructure

Recommended State Goals

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Suggested State Goals

- New Construction: 100% by 2035
- Existing Buildings: 10% by 2035
- Across all sectors: Residential, Commercial, Public Bldgs

How do we get there

- State Policies & Legislations
- Utility programs & grid modernization
- Technical, Financial & Education Support
- Marketplace adoption/ Implementation

Net-zero Energy Should Start with schools

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Studies indicate that schools are a prime market for net-zero energy design and operation, in both new construction and deep energy retrofit projects of existing building. Net zero schools are more beneficial to districts, occupants and the environment.

Zero Energy Schools in Rhode Island

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Where we are today

- 2 Zero Energy Ready
- RIDE's Long-term goals includes ZEBs
- Numerous EE retrofits

What do we need to do next?

- Lead by example
- Demo projects
- Strategic partnerships

The Path to Zero Energy Schools Related to

Rhode Island Public Schools

School House

Energy Report Card

October 21, 2016

JACOBS

What We Did

- Surveyed 307 Schools
- 24.435 million ft2
- Derived Utility Cost Data from UCOA Data
- Benchmarked Energy Use for each school
- Assessed the Condition of Energy Consuming Equipment
- Identified Energy Conservation Measures
- Defined Action Plans to Achieve Net Zero Energy for Each School
- Identified Funding Sources & Execution Strategies

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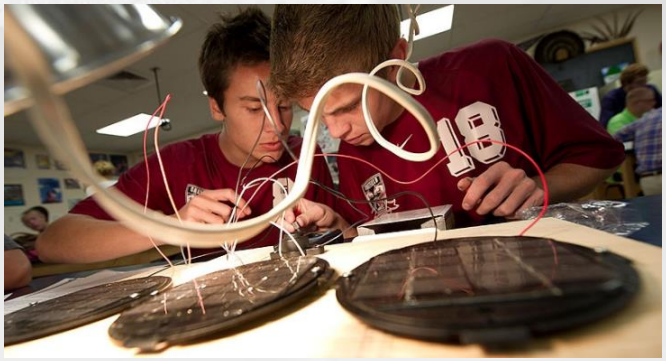
Why We Did This

- Significantly Reduce Energy $
- Net Zero Energy Schools
- Avoid Energy Volatility $
- Reduce O&M Costs
- Improve Cognitive Performance
- Improve Student Learning
- Create Living Laboratories
- Demonstrate Institutional Values
- Preserve Current Staff & Academic Programs



How Did We Do It

- 5 Teams Assessed 307 Schools
- Entered Conditions Data into MAPPS® via Handheld PC
- 4 Energy Engineers Filtered UCOA Utility Data
- Utility Consumption Derived from Cost Data based on Assumptions
- Calculated EUI & $/ft^2 for each School

- Identified Energy Conservation Measures
- Defined Action Plans to Achieve Net Zero Energy
- Estimated Costs, Savings & simple payback period
- Utilized Potential Contractors
- Solicited Incentives & Funding Sources

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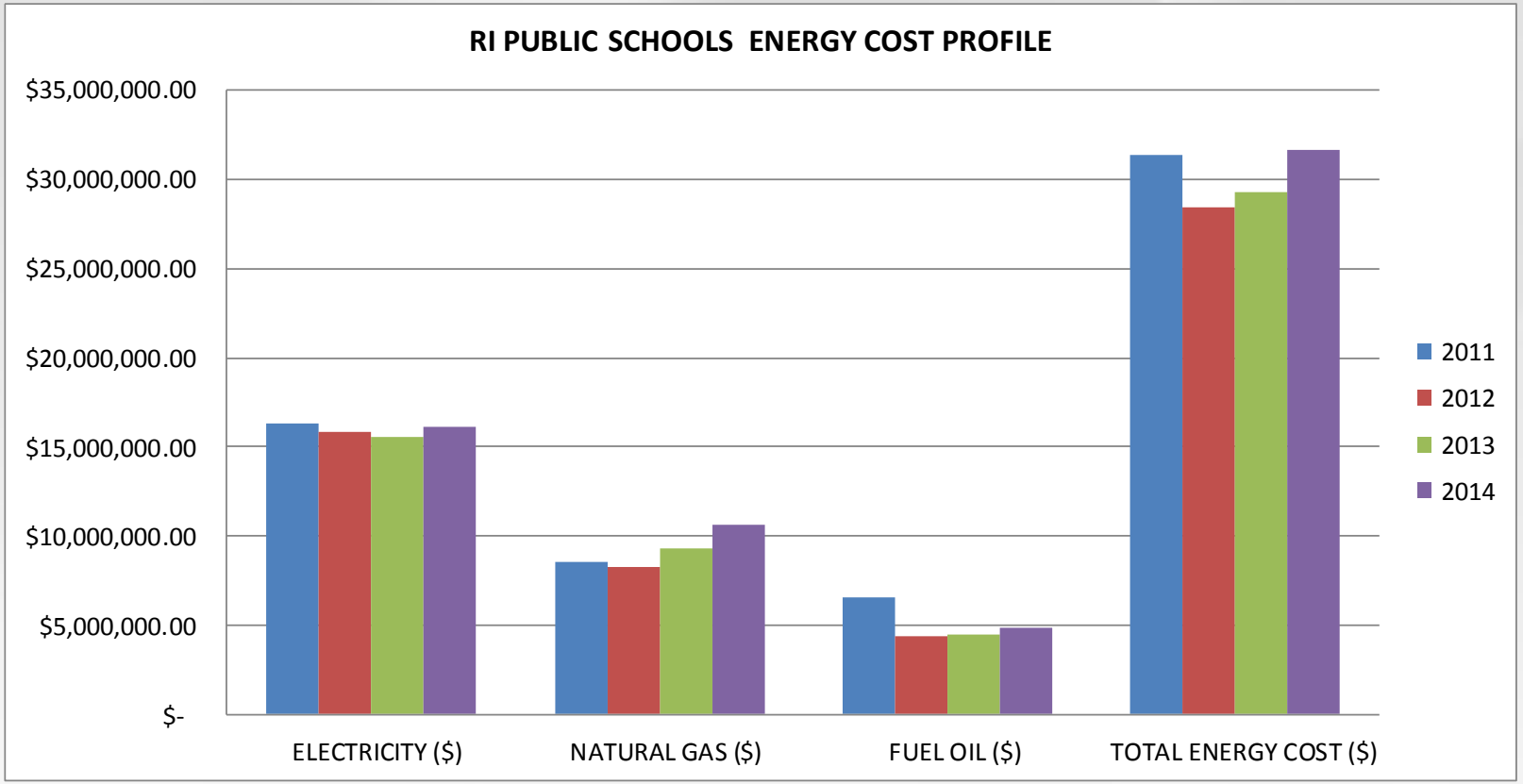
Findings

- Rhode Island 4th highest AVG. Electric Rate in US 18.69 cents/kWh
- Avg. EUI 45.2 -60.7 vs. US Avg. 58.2
- Energy Costs $33.6 Million
- Avg. Age of School 62 Years +/- 30
- Avg. School Energy Cost $1.48/ft^2



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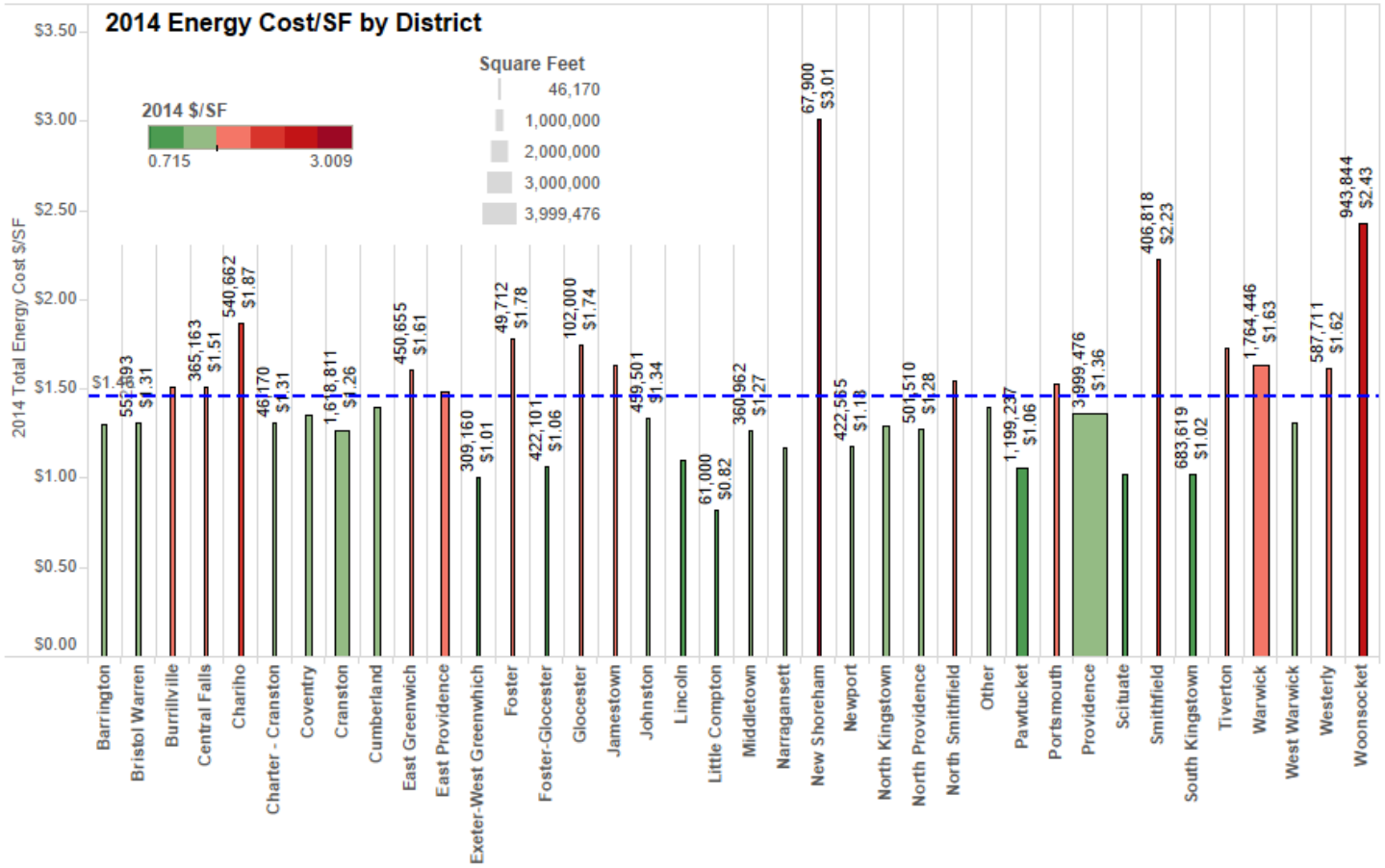
Rhode Island Dep't of Education Energy Consumption Findings

Map: $/SF by District	Chart: $/SF by District	Map: $/SF by School	Chart: $/SF by School	Energy Efficiency vs age



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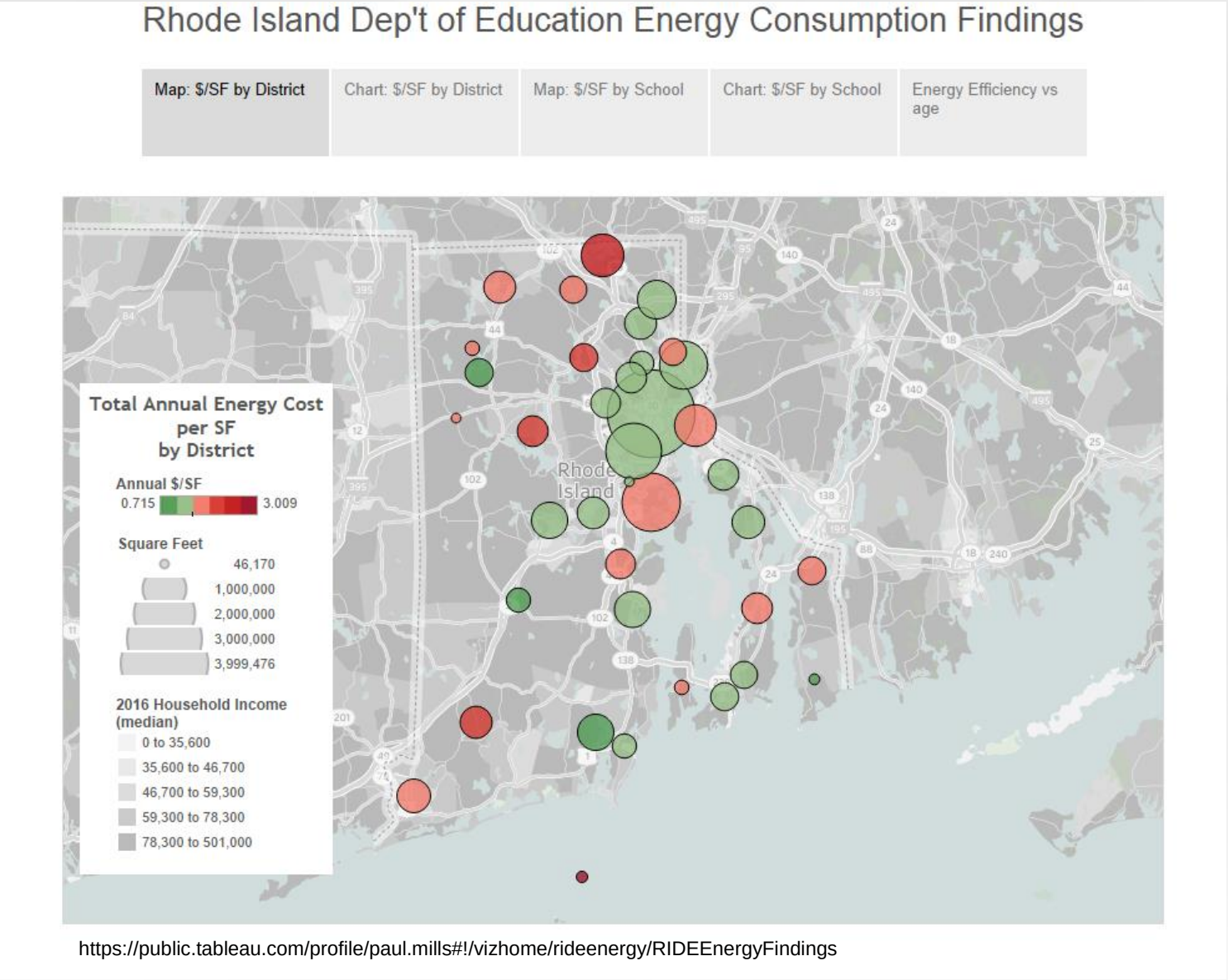
Rhode Island Public Schools Energy Cost ($/SF by LEA)



https://public.tableau.com/profile/paul.mills#!/vizhome/rideenergy/RIDEEnergyFindings

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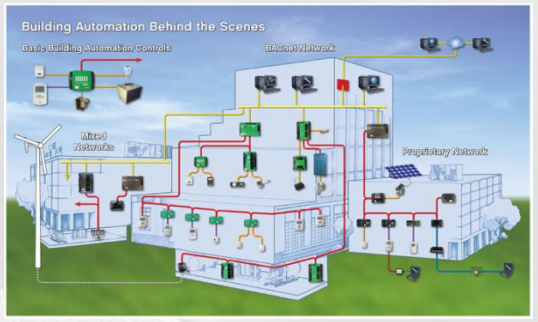
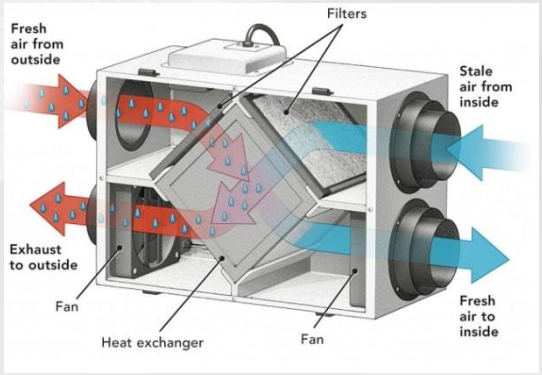
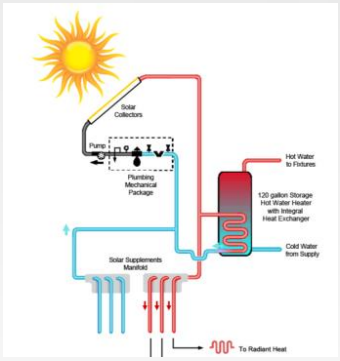
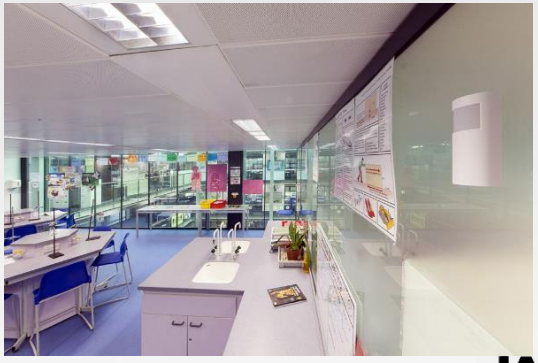
Next Generation of Energy Conservation Measures

- Broader Benefits
- Better for Student Learning
- Longer Pay Back Periods
- Building Automation Systems
- Energy Recovery Ventilation
- LED Lighting Retrofit
- Solar Assisted Domestic Hot Water









http://www.kmccontrols.com.hk/products/Understanding_Building_Automation_and_Control_Systems.html/

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Energy Conservation and Net Zero Energy Measures

Energy Conservation Measure	Cost to Implement	Annual Savings (Estimate)	Simple Payback (Years)	System Size
Building Automation System	$4,830,000	$149,920	32.22	
ERVs/DOAS	$6,855,500	$211,411	32.43	
Solar Hot Water	$14,340,000	$345,239	41.54	
Solar Photovotaics	$246,916,430	$13,527,620	18.25	125MW Array generating 150,000 MWH/year
LED Lighting	$64,121,905	$2,796,098	22.93	
Heat Pumps (Geo)	$389,677,907	$20,186,799	19.30	87,000 Tons of geothermal heat pump

Steps for Going Net Zero Energy

- **ASHRAE Level 2 & 3 Audits**
- **Bundle ECMs**
  - Building Automation System
  - Energy Recovery Ventilation
  - LED Lighting Retrofits
- **Utilize RIIB Efficient Buildings Fund**
- **Bundle Net Zero Energy Measures**
  - Solar Assisted Domestic Hot Water Heaters
  - Geothermal Heat Pumps
  - Solar PV
- **Prepare RFQs**
- **Get Projects Shovel Ready**
- **Prepare RFPs**
- **Obtain Approvals**
- **Execute, Monitor, Inspect, Cx, Train**

- **Understand Financing & Incentive Options**
  - Federal Incentives
  - State Incentives & Financing
  - Utility Incentives & Financing
  - Other Public Financing (Bonds)
  - Qualified Energy Conservation Bonds (QECBs)
  - Tax Except Lease- Purchase
  - Third Party Ownership (PPA)
  - Private Financing Options (Bond-PPA Hybrid or Morris Model)
  - ESPCs (Energy Service Performance Contracts)
  - Renewable Energy Credits (RECs)
  - National Grid Energy Efficiency Rebates & Incentives

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DISCUSSION

Panelists:

- Paul Torcellini, National Renewable Energy Laboratory
- Puja Vohra, National Grid
- Nicholas Valls, Jacobs Engineering

Facilitator:

- Becca Trietch, Rhode Island Office of Energy Resources

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FUNDING YOUR SCHOOL ENERGY EFFICIENCY IMPROVEMENT PROJECT

Opening Speaker:

- Treasurer Seth Magaziner, State of Rhode Island

Panelists:

- John McNamee, North Providence School Department
- Jeff Diehl, RI Infrastructure Bank
- Bob Donovan, RI Health and Educational Building Corporation
- Jerry Drummond, National Grid

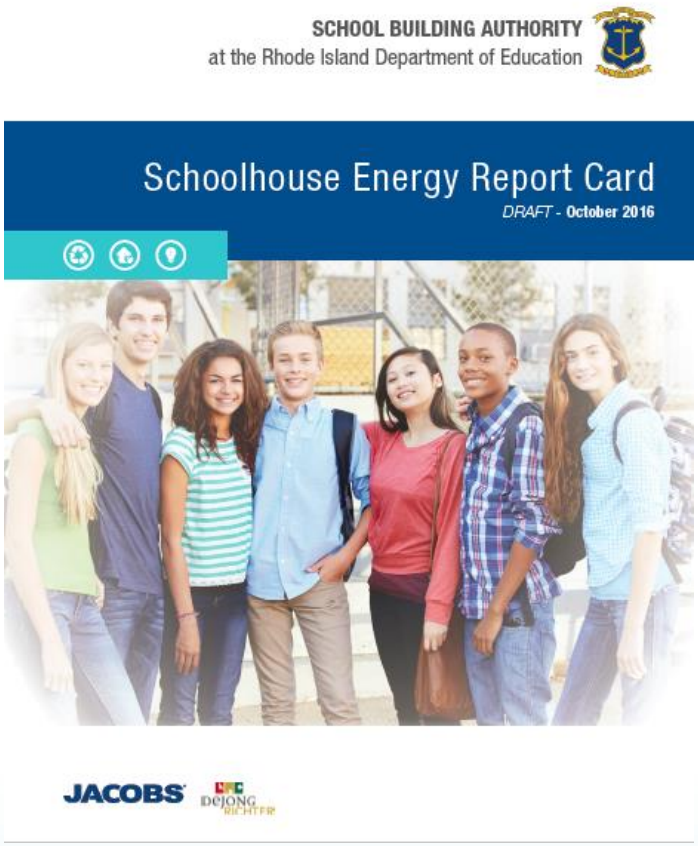
Facilitator:

- Rachel Sholly, Rhode Island Office of Energy Resources

RHODE ISLAND HIGH PERFORMANCE SCHOOL AWARDS

- Celebrating the success of creating high quality, sustainable learning environments in Rhode Island

SCHOOLHOUSE ENERGY REPORT CARD



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Michael McAteer

Director Strategic Business, Policy and Evaluation - Rhode Island

Overview

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- Changing landscape in Energy and Utility
- Where we are today in Rhode Island
- How do we get to the future

Our world is changing….fast!

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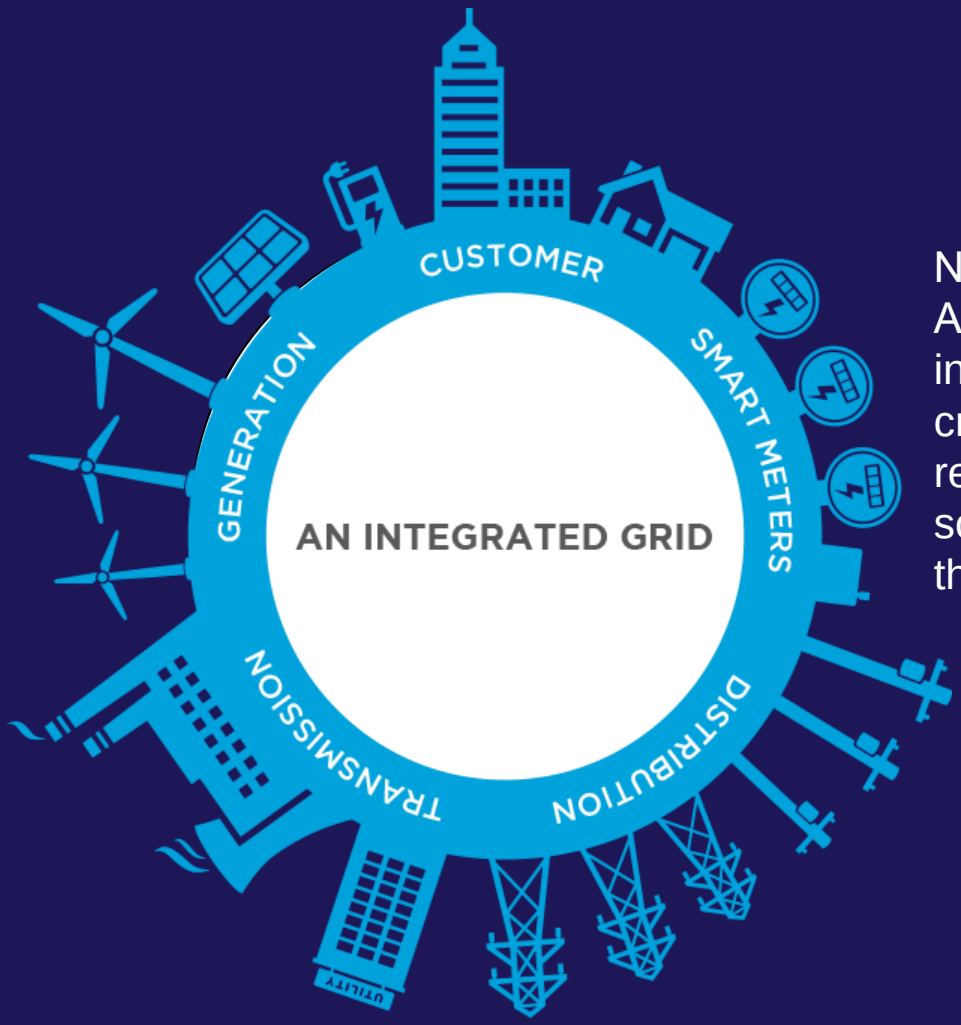

National Grid's blueprint to drive advances in America's natural gas and electricity infrastructure:
creating a more customer-centric, resilient, responsive, efficient and environmentally sound energy network to meet the needs of the 21st century.

1. **Energy Efficiency**
2. **Gas Growth**
3. **Distributed Generation & Storage**
4. **Grid Modernization**
5. **Vehicles**

Affecting Change

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National Grid has spent **$1.96 Billion** on Energy Efficiency since 2009

What we've saved

- **4,173 GWh**
- **11, 855 dth**
- **525,205 kW**

statewide since 2009

Future for Schools in Rhode Island

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Towards Zero Emission (or net positive) with High Performance Indoor Environment

Photo credit : http://blog.usa.skanska.com/:

Where we are Today in RI: New Construction

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- **High performance building design assistance for integrated energy efficiency in lighting and mechanical systems**

Claiborne Pell Elementary School

Where we are Today in RI: Deep Energy Retrofits

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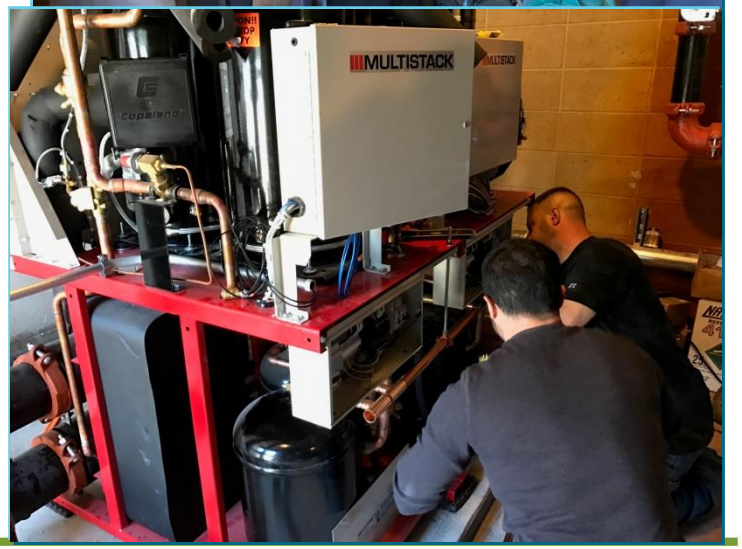
Edgewood Highland School Cranston RI



Deep EE Retrofit including maximizing air ventilation for improved indoor air quality

Ongoing Leadership in Rhode Island to Support High Performance Schools

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- RIDE's mission towards net zero and improved IAQ, based on recently released energy report card.
- National Grid EE Programs providing technical services, trainings and incentives/financing for high performance schools
- Rhode Island Infrastructure Bank
- Policy & program development with State Energy Office for pathways to Zero Energy Buildings by 2035!

THANK YOU!

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