



Real World Learning in CleanTech & Sustainability

January 20, 2022





Shawnee Caruthers



Tom Vander Ark

Agenda

- 1 Welcome and Overview of MVAs
- 2 National Perspective
- 3 Local Perspective
- 4 Closing



Regionally-recognized Market Value Assets (MVAs)



work experiences

- Internships
- Client Projects



entrepreneurial experiences

- Solve compelling market problem



college credit

- 9+ hours



industry-recognized credentials

- Employer verified industry recognized credential

Climate Crisis...and Opportunity



While the climate crisis presents incredible challenges, it is also the greatest economic opportunity for innovation, job creation, new businesses, and investment in our communities. It goes hand in hand with restoring justice and building an equitable, inclusive, and just future for all.

--[Climate Power](#) letter to President Biden

Speed and Scale are Required



1.0 Electrify transportation

2.0 Decarbonize the grid

3.0 Fix food

4.0 Protect nature

5.0 Clean up industry

6.0 Remove carbon

John Doerr outlines the climate solution in **Speed & Scale**: a plan for net zero by 2050.

Accelerants include social movements, public policy, investment and innovation.

Opportunity for 25 million net new jobs in this decade.

A Real Life Crisis Deserves Real World Learning



As the most pressing global issue and biggest impact opportunity, the climate crisis is an important topic for:

- Client connected projects
- Internships, and
- Entrepreneurial experiences

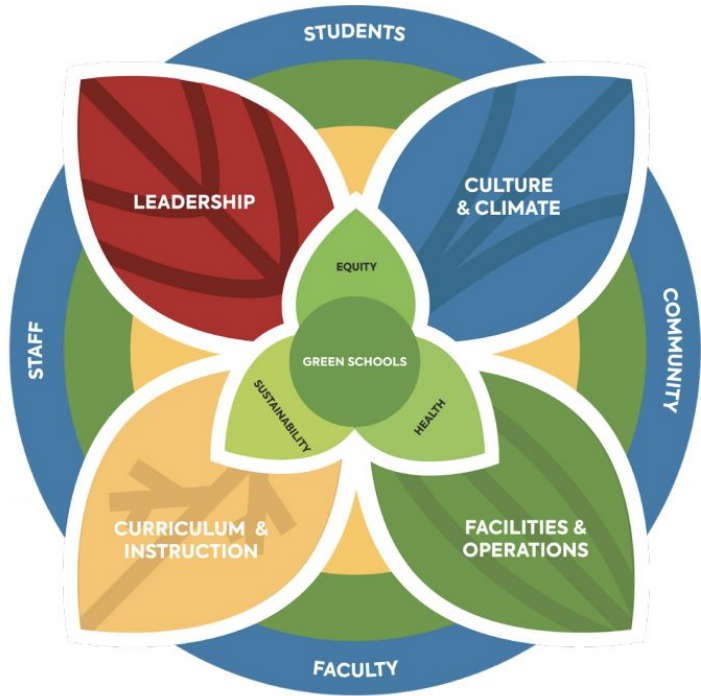
These RWL experiences can be embedded in classes, blocks, academies or whole school models.



Jennifer Seydel

Green School National Network

A Greenprint for becoming a Healthy, Equitable, and Sustainable School



A framework for whole school transformation that promotes best practices in leadership, curriculum and instruction, culture and climate, and facilities and operations.

4PBL: Phenomenon, Place, Project, and Problem Based Learning

Elementary: Growing Place Based Environmental Stewards

- Encinitas, CA: Air quality; Water Quality; Materials Science

Middle School: Understanding Your Community

- South Los Angeles, CA: Creating a Sustainable Community: Urban Planning, Environmental Justice and Gentrification

High School: Creating a Just, Equitable, and Sustainable Society

- San Diego, CA: Plastic Pollution; Growing Food Locally; Housing First; Eco-Carts; Solar Powered Community Station
- Marin County, CA: Sustainable Business Development

Green Schools National Network Project Examples

Carson City School district added a project based Environmental Science high school course and have added Sustainable Development Goals to K-12 curriculum maps.

Nicolet High School (WI) art and science students maintain a beehive and conduct projects about bees and with bee products

Oak Park High School (CA) freshman conduct a project on reducing human contribution to climate change. Sustainable solutions are taught in all four years.

Many schools use The School Grounds as a 3-D Textbook and leverage the facility design and energy efficiency to teach energy concepts and engage students in implementing energy conservation projects.

Green Schools National Network: Supporting Whole Systems Change

Virginia Beach City Public Schools has created a two year [Environmental Studies Program](#). Students have worked on the district's plan use electric buses and partner with Dominion Energy to understand the community's reaction to offshore wind energy.

Because they are not attracting a diversity of students to this program, the district's K-8 curriculum is now focused on ensuring that ALL students have the opportunity to learn about their role as ecological citizens by using their place in the Chesapeake Bay Watershed as an integrated theme across all grade levels.



Andrew Miller

Green Tech Academy

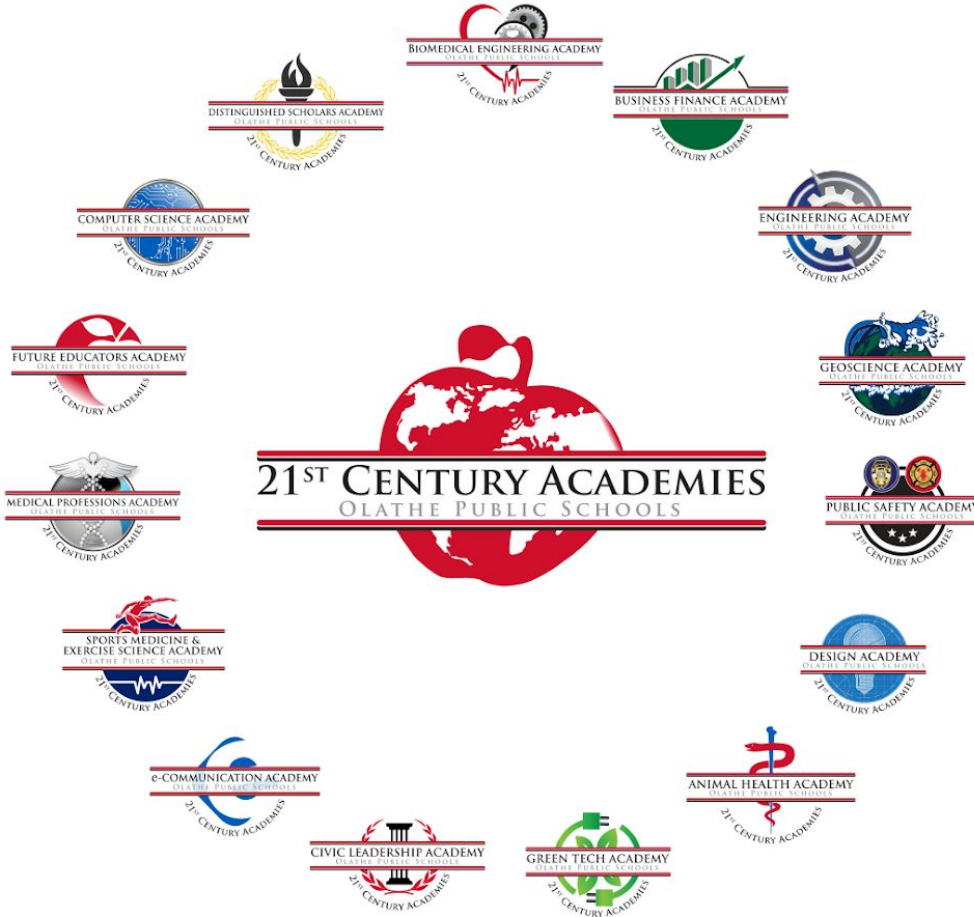


21st Century Academies

- 15 Academies
- Interview 8th graders
- Capstone Project
- Seeking Endorsement

Career & Technical Education

- Energy Pathway
- Sustainability Pathway





Academy Coursework

Freshmen Year

Sophomore Year

Junior Year

Senior Year

Renewable Energy Specialization

Energy, Power,
and Society

Energy Industry
Fundamentals

Senior Capstone
Renewable Energy

Investigations in
Green Tech

Sustainable Agriculture Specialization

Sustainable
Resource
Management

Plant & Animal
Science

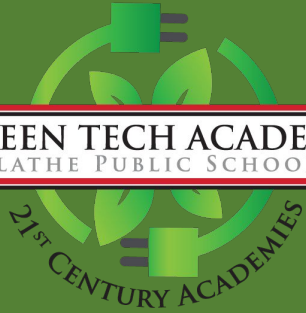
Senior Capstone
Sustainability

Freshmen decide their
specialization before their
Sophomore Year

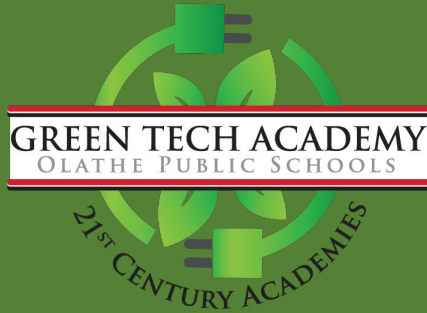
AP Environmental
Science- Required
Coursework

Events

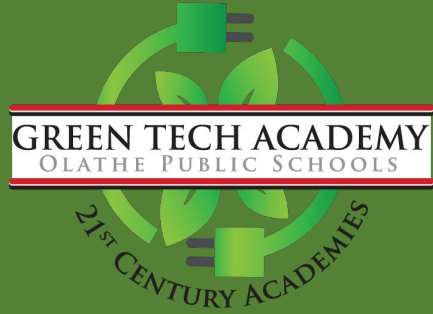
GREEN TECH ACADEMY
OLATHE PUBLIC SCHOOLS



Competitions



Field Trips



Careers

GREEN TECH ACADEMY
OLATHE PUBLIC SCHOOLS

21ST CENTURY ACADEMIES



SPORTING
SUSTAINABILITY

Why does this matter?

GREEN TECH ACADEMY
OLATHE PUBLIC SCHOOLS

21ST CENTURY ACADEMIES

Students can graduate with work experience through our capstone process, internships with community partners.

CleanTech is an up and coming industry and our program allows students to graduate with background knowledge to help solve the complex issues.



Provide students the opportunity to receive industry-recognized credentials, sets them apart.



Students are allowed to explore THEIR passions

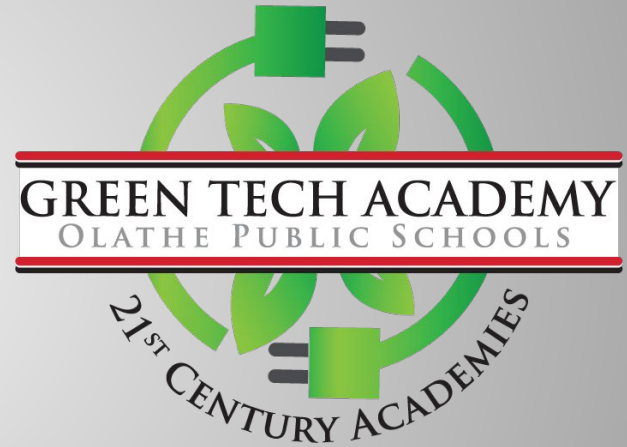


What our students say...
“The Green Tech Academy has helped me develop a further passion for Green Technologies and to help be on the forefront of a sustainable future. I plan on taking my knowledge and opportunities given to me in the Green Tech program and turning it into a career.”

-Peyton Phillips Class of 2023

Questions?

- Email: armiller@olatheschools.org
- Follow us on Twitter: @OlatheGreenTech





Adam Arnold

1898 and Co.



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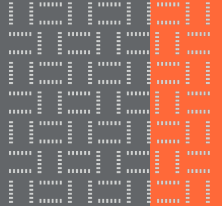
Kaufman Foundation
1/20/2022



Introduction

Adam Arnold

- Grid Modernization Consultant
- Model Development
- System Protection and Load Flow
- Electrical engineer for an EV company before joining 1898.



BURNS  MCDONNELL®

Burns & McDonnell Overview

At a Glance

7,600+

Incredible People

30+

Years of Employee
Ownership

350+

Service Areas

Founded In
1898

55

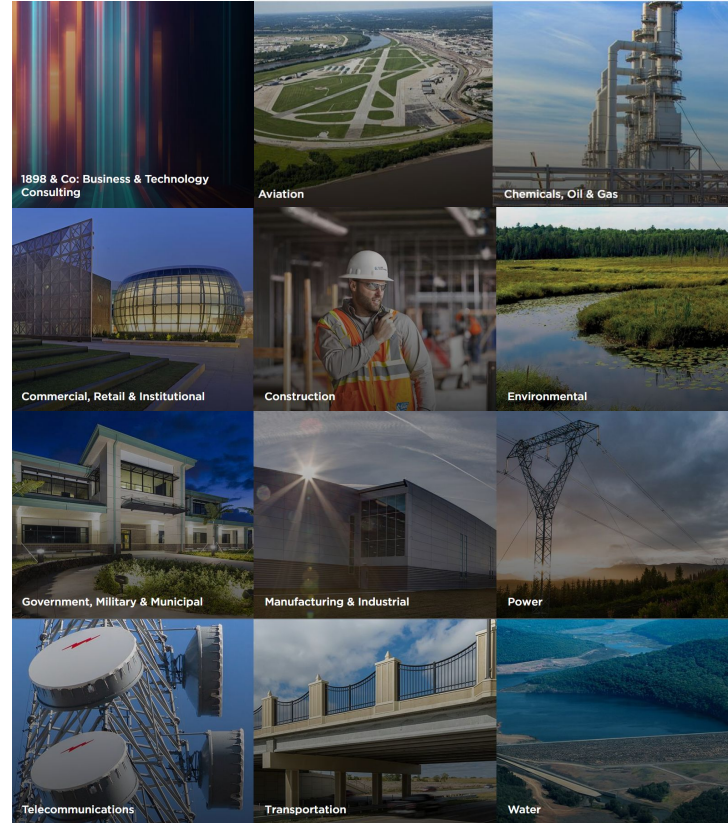
Offices Worldwide

FORTUNE
100
BEST
COMPANIES
TO WORK FOR®

BURNS  **MCDONNELL**®

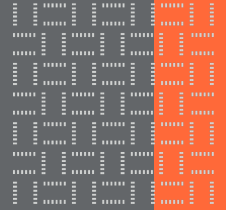
Industries We Serve

Making Our Clients Successful



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1898 & Co. is Our Consulting Arm

con·sult·ing

/kənˈsəltiŋɡ/ 

adjective

adjective: **consulting**

1. engaged in the business of giving expert advice to people working in a specific field.
"a consulting engineer"

What is Consulting?

Need for a consultant

- 1) Inability to get there on their own
- 2) Want to get there faster
- 3) Want a proven system or roadmap
- 4) Advice from someone who's done it

**Current
State**

**Desired
State**

Role of a consultant

- A) Pair-of-Hands
- B) Collaborative
- C) Expert

Utility Consulting and Planning

The primary goal of utility consulting is to provide a variety of analysis, including both **technical** and **economic** evaluations, that assist a utility's ability to plan in both the near-term and long-term horizons.

We help the utilities make near-term decisions that position them for long-term success in a changing environment.

Transformation of the Power Grid

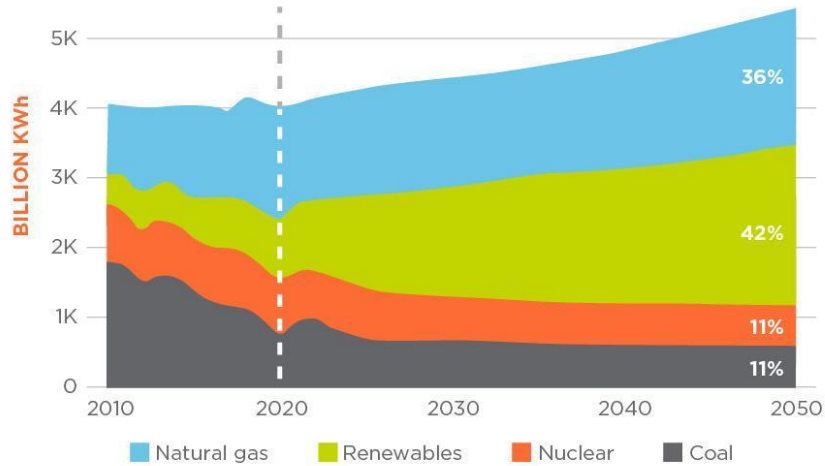


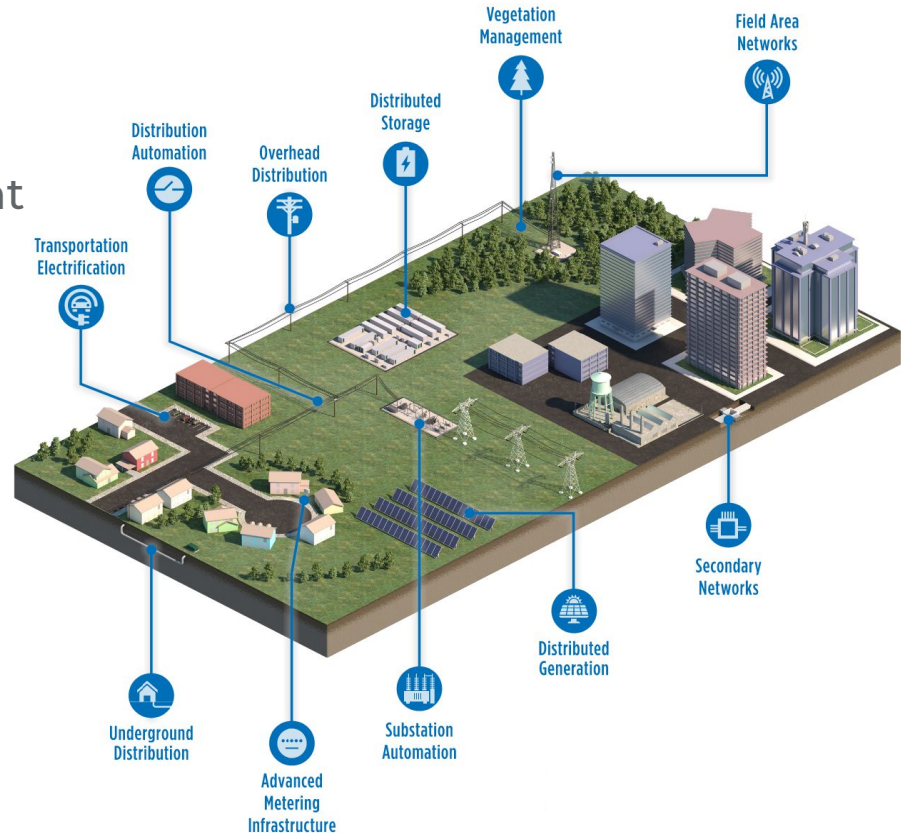
Figure 1: Historical and projected electricity generation. Source: U.S. Energy Information Administration, Annual Energy Outlook 2021 (AEO2021).



Grid Modernization

What do we do?

- Strategic System Planning
- Data Analytics & Model Development
- Traditional Power System Studies
 - System Master Plans
 - Protection Coordination
 - Device Placement Optimization
- Advanced Power System Studies
 - Reliability Analysis
 - Volt-VAR Optimization (VVO)
 - Arc Flash Assessment
 - Generator Interconnection Studies
- Forecast Development
- Economic Evaluations



The Distribution System

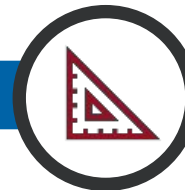
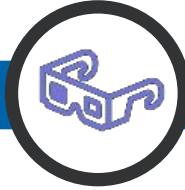
Distribution System Planning

- Effective implementation of models & data to drive decision-making
- Investment in Infrastructure (rebuilt, reconductor, devices)
- Planning Criteria and Philosophy
- Relevant datasets include:
 - Historic Load & Billing Information
 - Historic Outage Records (Reliability)
 - Forecasts (emergent tech, weather, & usage trends)

**Problem Definition &
Data Aggregation**

**Develop Models, Analyze, &
Test Solutions**

**Measure Solution Efficacy
against Criteria**



The Distribution System

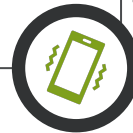
Then:

- Largely static, radial systems
- One-way power flow: Source → Load
- Planning for Seasonal peaks almost exclusively
 - Static Models
- Volumetric Rates



Now:

- Dynamic, self-healing networks
- Multiple Generation Sources
Source ↔ Load
- Planning for variety of Operating & Load Scenarios
 - Time-Series, quasi-dynamic models
- Time-of-Use Rates



Evolving:

- Device Complexity & Communications Capability
- Usage Trends, Demand Response/Load Control
- Evolution in System Planning:
 - Data Aggregation & Analytics
 - Model Complexity



Opportunities to Innovate

The Distribution System

Major Drivers for Innovation

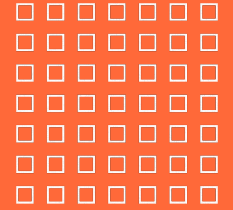
- Consumer Habits & Load-Side Devices
 - Electric Vehicles
 - Thermostats & Household Electrification
 - Distributed Generation
- Aging Infrastructure & Reliability Improvements
 - Increasing Investment in Distribution Networks
 - Consumer Sensitivity to Outages (*see table*)
 - Smart Grid Devices
 - Recent Storms
 - Grid Autonomy



Percentage of Devices able to Ride Through Momentary Interruption

Device	0.5 sec	2 sec	16.7 sec
Digital Clock	70%	60%	0%
Microwave	60%	0%	0%
VCR	50%	37.5%	0%
Computer	0%	0%	0%

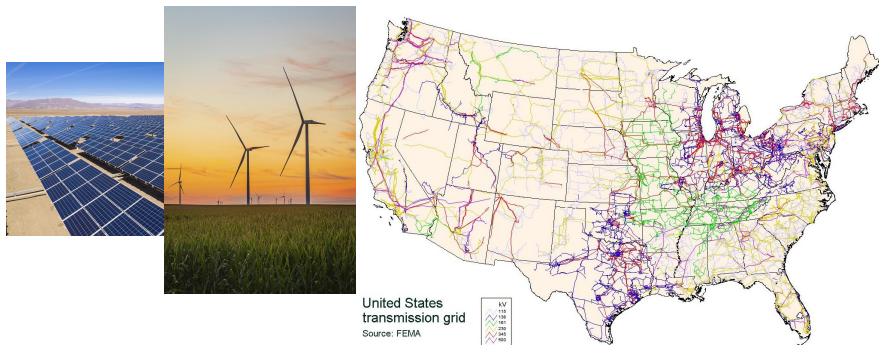
Source: Bowes, K.B., "Effects of Power Line Disturbances on Electronic Products," Power Quality Assurance Magazine, vol. Premier V, pp. 296-310, 1990.



Project Examples

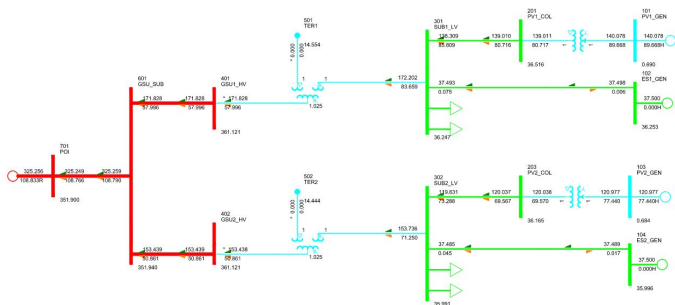
Generation Interconnection Studies

Multiple Clients (AECI, Southern Company)



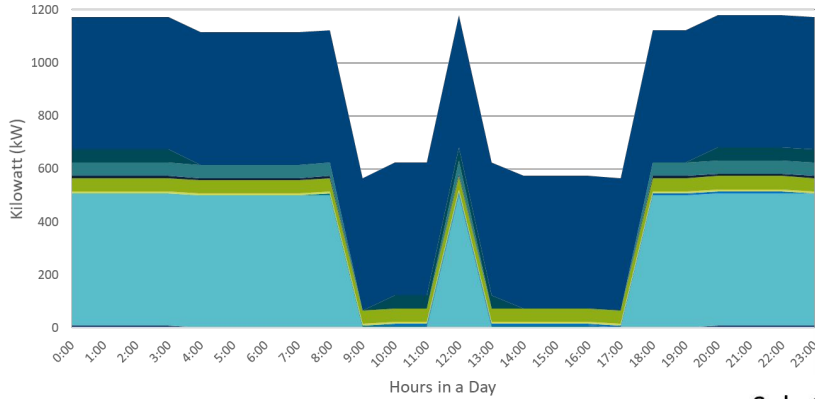
Types of Analysis

- Steady state
- Dynamic stability
- Short circuit
- Reactive power compensation



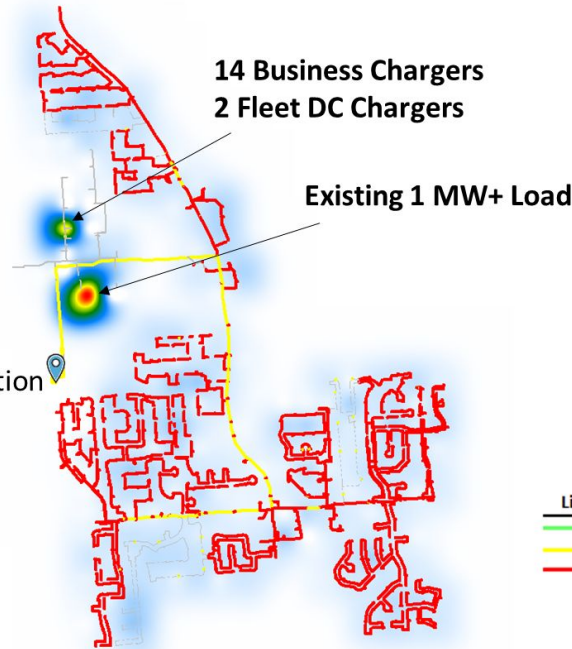
Electric Vehicle Impact Study

Detroit Edison Energy (DTE)



- Res. AC2
- Fleet DC2
- Business AC2
- Retail AC2
- Shiftwork AC2
- Shiftwork DC1
- Fleet AC2
- Fleet DC1
- Private Shuttle DC1
- Mass Transit Authorities

Typical circuits have multiple chargers of each type, so this profile is not representative of actual load



Charger	Count
Residential AC2	1,621
Business AC2	203
Retail AC2	233
Fleet AC2	4
Fleet DC1	13
Fleet DC2	3

Color	Load Density
Blue	Zero
Green	Low (25%)
Yellow	Moderate (50%)
Red	High (75%)
Dark Red	Maximum (100%)

Line/Device Color	Abnormal Condition
Green	Overvoltage
Yellow	Overload (Current)
Red	Undervoltage



Sempra

Auwahi Wind Project

Location: Hawaii

Size: 24 MW

Services:

- Root cause analysis
- Independent technical support
- Commercial negotiations

Differentiators:

- Accurate definition of root cause, differing from supplier
- Mitigated other plant failures

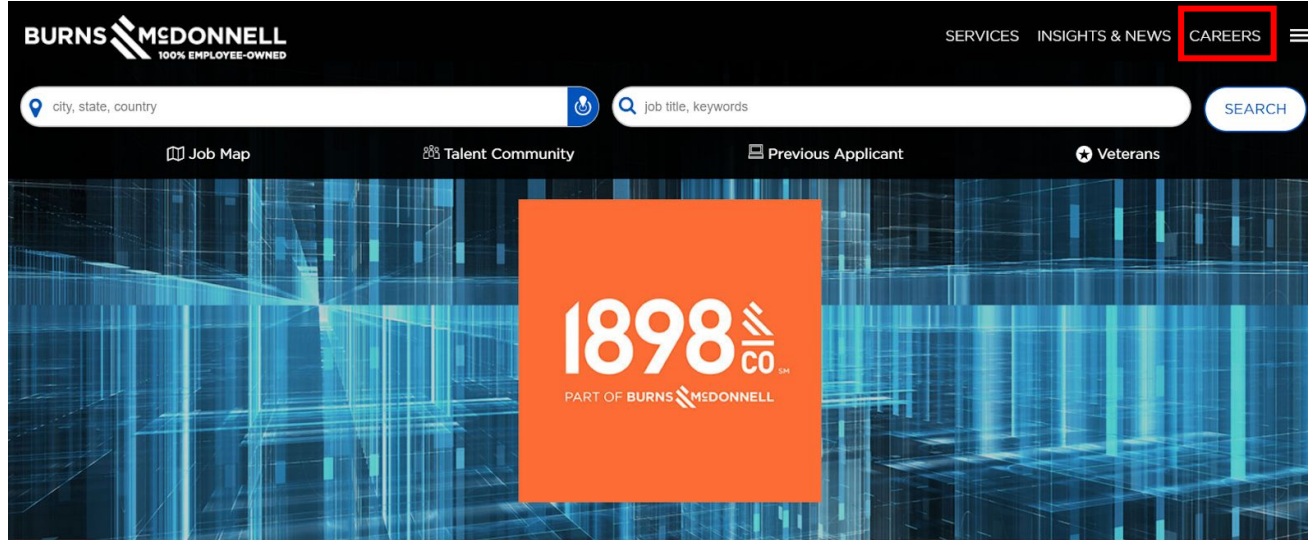
Areas of Interest

Power systems

Alternative energy

Electrification

1898andco.burnsmcd.jobs



Questions

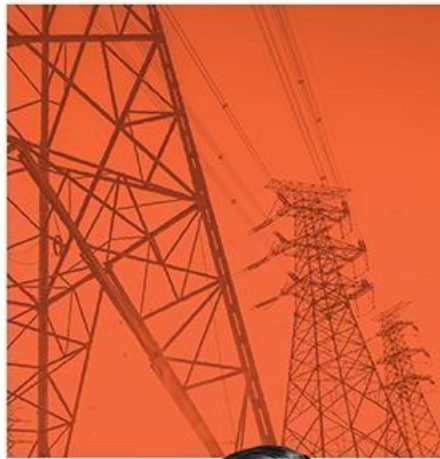
Email:

- adam.arnold@1898andco.com

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Scott Pashia

DLR Group





Why is sustainability important for teaching and learning today?

Scott Pashia, AIA

Thursday, January 20, 2022

Environmental stewardship is a DLR Group core value.

DLR Group believes that true sustainable design is the outcome of an integrated design process.

 **DLRGROUP**

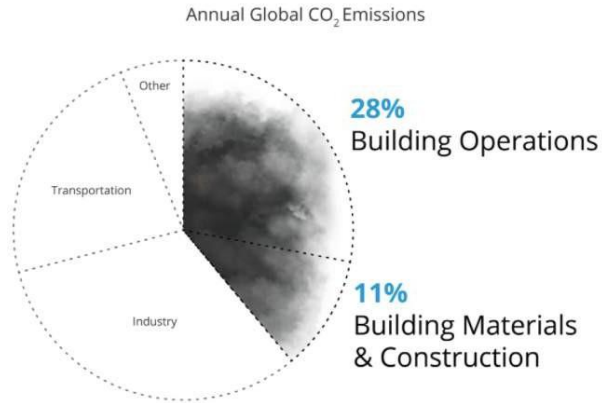




WHY THE BUILDING SECTOR?

We must eliminate all CO₂ emissions from the built environment by 2040 to meet 1.5°C climate targets.

www.architecture2030.org



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Data Sources: Global ABC Global Status Report 2018, EIA

Buildings generate nearly 40% of annual global CO₂ emissions.

Of those total emissions, building operations are responsible for 28% annually, while building materials and construction (typically referred to as embodied carbon) are responsible for an additional 11% annually.

Source: <<https://architecture2030.org/why-the-building-sector/>>

In 2040, **2/3 of the global building stock** will be buildings that exist today.
Without upgrades, they will still be emitting GHGs.



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Data Source: IEA Energy Technology Perspectives 2020, February 2021 Revised Edition

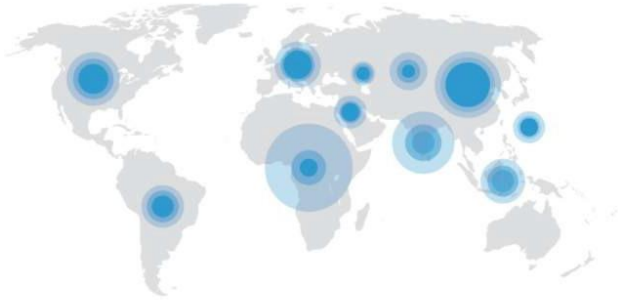
Approximately 2/3 of the global building area that exists today will still exist in 2040.

Without widespread existing building decarbonization across the globe, these buildings will still be emitting CO₂ emissions in 2040 and we will not achieve the Paris Agreement's 1.5°C target.

Achieving zero emissions from the existing building stock will require leveraging building intervention points to accelerate the rate of energy upgrades (increasing energy efficiency, eliminating on-site fossil fuels, and generating and/or procuring 100% renewable energy).

Source: <<https://architecture2030.org/why-the-building-sector/>>

Global building floor area is expected to **double** by 2060.



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Data Sources: Global ABC, Global Status Report 2017

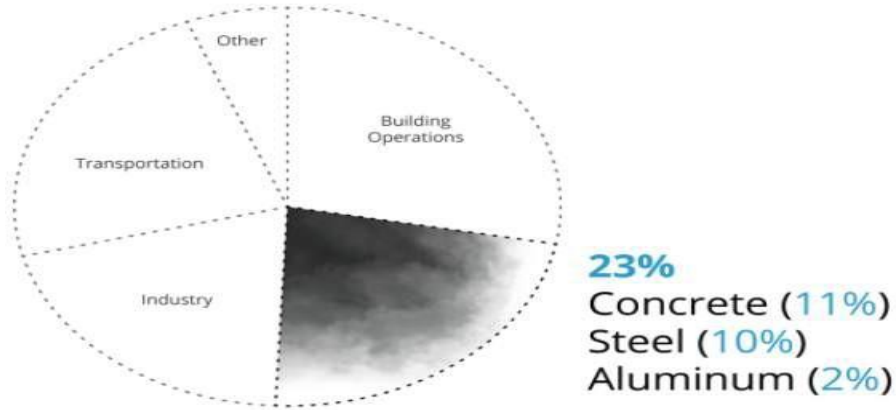
Global building floor area is expected to double by 2060.

To accommodate the largest wave of urban growth in human history, we expect to add 2.4 trillion ft² (230 billion m²) of new floor area to the global building stock, **the equivalent of adding an entire New York City to the world, every month, for 40 years.**

Achieving zero emissions from new construction will require energy efficient buildings that use no on-site fossil fuels and are 100% powered by on- and/or off-site renewable energy.

Source: <<https://architecture2030.org/why-the-building-sector/>>

Annual Global CO₂ Emissions



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Data Sources: Global ABC Global Status Report 2018, EIA

Just three materials – concrete, steel, and aluminum – are responsible for 23% of total global emissions (most of this used in the built environment).

There is incredible opportunity for embodied carbon reduction in these **high-impact** materials through policy, design, material selection, and specification.

Source: <<https://architecture2030.org/why-the-building-sector/>>

Defining Sustainability

Design & Sustainability

Our design choices have an impact at all levels.

Our design choices impact all categories.

Environment is everything around us including us while the ecology describes how all those work.

Ecology looks at the interaction between everything.



VALUES – what are we talking about?



ACCESS + MOBILITY

How can your project advocate and celebrate transit-oriented design, connections between transit hubs, and walkable communities?


Decarbonization
Transit-Oriented
Multi-Modal
Transportation
Accessibility and Safety



COMMUNITY CONNECTOR

How can your project support its surrounding community, build community partnerships, and connect residents to shared resources?

Community Access
Community Partnerships
Neighborhood Vitality
Transparency
Decision-Making



CULTURE + IDENTITY

How can your project celebrate its history and cultural context to develop a strong sense of place that speaks to the identities of occupants and surrounding communities?


History & Inspiration
Historical Context
Place Making
Inclusivity
Multi-Cultural Awareness
Operational Transformation



OUTDOOR ENVIRONMENTAL QUALITY

How can your project's outdoor spaces restore ecology, build community, and create a strong sense of place?

Building Ecology
Decarbonization
Operations
Recreation Services
Public Space
Site Strategy



EQUITABLE DEVELOPMENT

How can your project promote affordability, provide access to opportunity, and advocate for those in need?

Climate Justice
Economic Development
Programming
Equitable Development
Hiring
Quality
Land-Use
Social Justice



HEALTH + WELL-BEING

How can intentional design features actively promote users' emotional and physical well-being and encourage them to make healthier choices?

Air Quality
Bicycle
Incentives
Measurement
Play



INDOOR ENVIRONMENTAL QUALITY

How can your project support user comfort and productivity?


Acoustics Control
Air Quality
Thermal Comfort
Visual Comfort



MATERIALS IMPACT

How do your materials choices support healthy ecology, communities, and economies?


Concrete Material
Sourcing
Decarbonization
Decision-Making
Design for Disassembly
Manufacturing
Product Care Justice
Transparency
Material Improvements



ENERGY

How can changes in energy infrastructure support your broader mission, reduce costs, and build a healthier planet?

Building Systems
Incentives
Renewable Energy
Sustainability Change
Energy Efficiency
Energy Storage
Energy Meter Reduction



RESILIENCY

How can your project help its users and community adapt to and recover from unexpected situations?

Building Resiliency
Community Resiliency
Economic Resiliency
Emergency Planning
Operational Resiliency
Risk Management & Mitigation



PROCUREMENT + OPERATIONS

How can procurement, building operations, and management practices support your broader project goals?

Construction Cleaning
& Greenhouse Gas
Supplier
Operational Optimization
Resilience Performance
Safety & Security
Transparency Building
Performance
Reuse



WATER

What connections to water are important to your users and neighboring communities?

Stormwater
Water Management
Hydrological Balance
Potable Water Quality
Water Control of Flow
Water Self-Sufficiency

Viewing Architecture through the Lens of User Experience and Sustainability



Access and Mobility

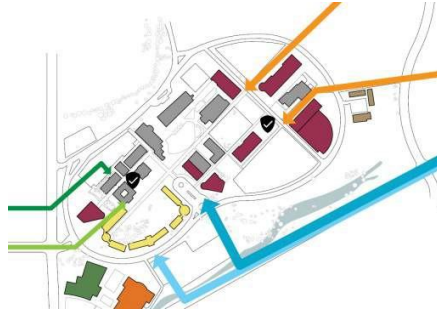
Walkable Networks
Completed Streetscape
Multiple Modes
Electric Vehicles





Community Connector

Neighborhood Vibrancy
Transparency
Partnerships
Community Access





Culture and Identity

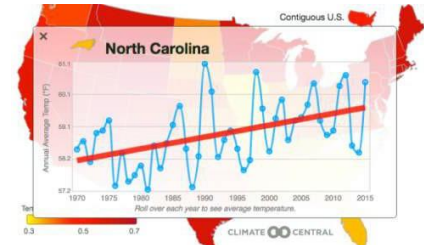
Beauty
Inspiration
Context of Place
Multi-Cultural





Equitable Development

Land Use
Economic Health
Environmental Justice
Equity





Outdoor Environmental Quality

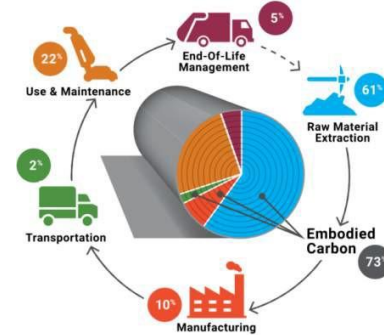
Biodiversity
Ecosystem Services
Public Space
Ecology





Materials Impact

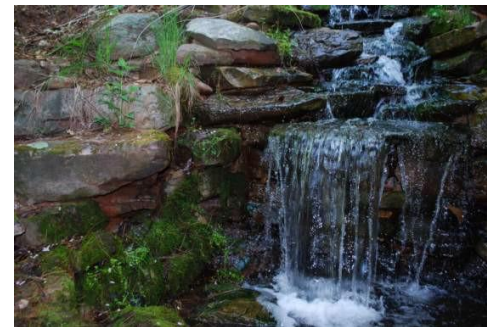
Transparency
Reuse
Human Health
Supply Chain





Water

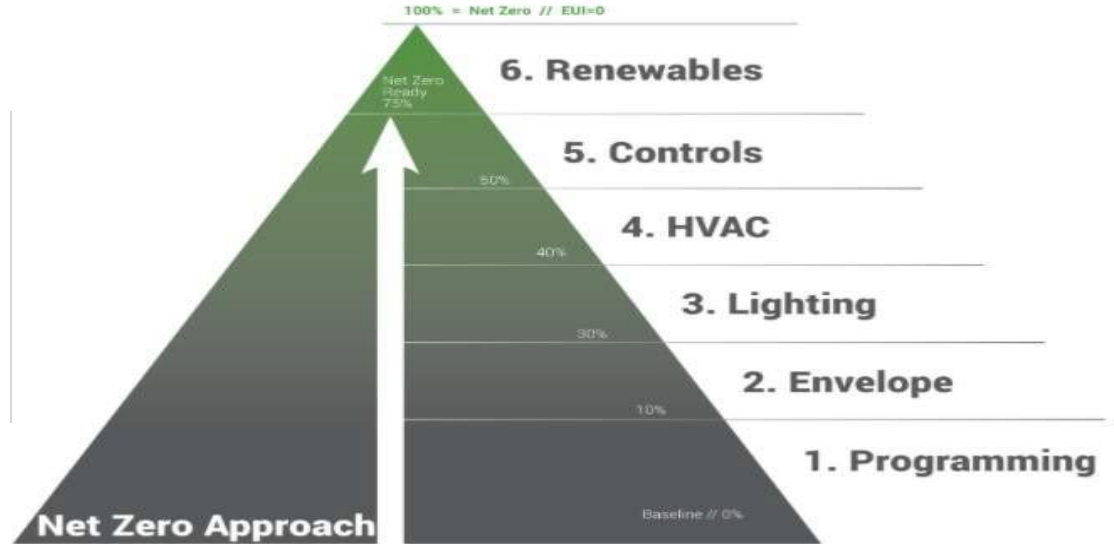
**Water Quality
Hydrologic Cycles
Management
Context of Place**





Energy

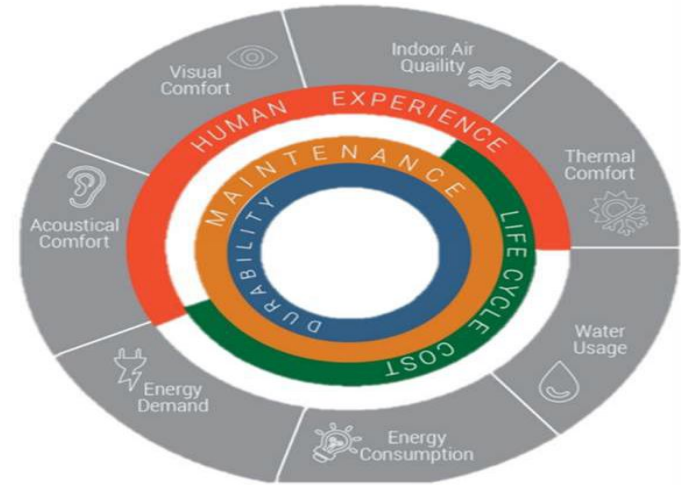
**Reduction
Renewable
Building Systems**





Indoor Environmental Quality

Air
Sound
Light
Heat
Comfort





Health and Well-being

Nourishment
Active Spaces
Beauty – Biophilia
Play – Choice





Resiliency

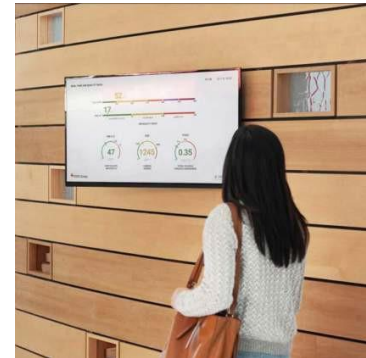
Emotional
Community
Economic
Physical





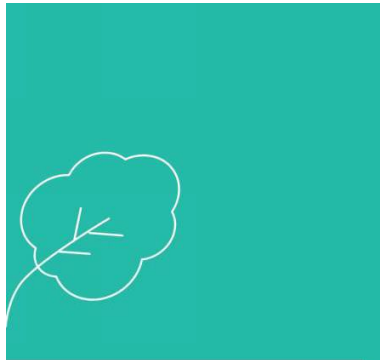
Procurement + Operations

Safety & Security
Building Performance
Goods & Supplies
Cleaning
Regulatory Partners





Resiliency



RESILIENCY

How can your project help its users and community adapt to and recover from unexpected situations?

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BUILDING RESILIENCY

What intentional design features in a facility can enable residents to and support the primary functions for users during and after an unexpected event?



COMMUNITY RESILIENCY

What measures and features can your project provide to the target community of users during and after an unexpected event?



ECONOMIC RESILIENCY

How can your project create a supportive balance of uses and revenue sources to ensure continued economic vitality in the face of unexpected events?



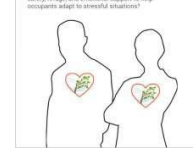
EMERGENCY PLANNING

How can we define a clear plan of action for opening your building site during a short term or long term hazard event?



EMOTIONAL RESILIENCY

What aspects of the project can provide safety, refuge, and emotional support to help occupants adapt to stressful situations?



RISK ADAPTION + MITIGATION

How can we proactively identify and mitigate the risks that could prevent you from providing the primary functions of your facility?



Why is this important?

Resource Conservation
Ecological Future
Human Health

Community Health
Behavior Awareness





Energy

ENERGY

How can changes in energy infrastructure support your broader mission, reduce costs, and build a healthier planet?

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BUILDING SYSTEMS SELECTION

What is your appetite for investing in and maintaining innovative building systems (such as new HVAC, lighting, or material subchoices)?

DECARBONIZATION: ENERGY

Where is your project sourcing its energy from? How can your project replace fossil fuels with low- to no-carbon energy sources?

ENERGY COST REDUCTION

How can your project optimize peak demand from the grid to reduce operational costs and right-size mechanical systems?

● Storage Charging ● Peak Demand Reduction

ENERGY NEED REDUCTION

How can you make intentional design choices to reduce the energy needs of your project and optimize performance?

Why is this important?

Resource Conservation
Ecological Future
Human Health

Community Health
Behavior Awareness



Materials Impact



MATERIALS IMPACT

How do your materials choices support healthy ecology, communities, and economies?

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CONSCIOUS MATERIAL SOURCING

How can we source materials that support local economies and protect local ecology?



DECARBONIZATION: MATERIALS

How can material selection reduce embodied carbon and operational carbon consumption to mitigate global warming?



DESIGN FOR DISASSEMBLY

How can we think and design beyond a building's lifespan to create a cycle of material recovery, value retention, and meaningful reuse?



HANDPRINTING

How does a material impact people, communities, and ecosystems along the supply chain?



PURPOSE OVER SURPLUS

How do purposeful design choices reduce material consumption and the generation of construction waste?



TRANSPARENCY: MATERIAL INGREDIENTS

How can material transparency highlight material ingredients to make healthier choices for building occupants?



Material Facts	
Building for Society 1	
Building Year: 2024	
% Study Value	
Material	
Health Product Declaration	
Supplier Code	
Supplier Code	
Supplier Code	
Supplier Code	
Supplier Code	

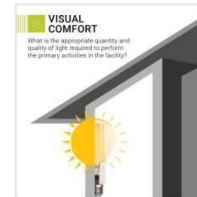
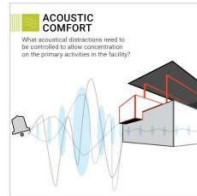
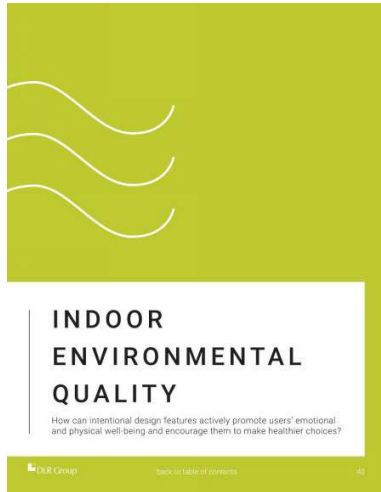
Why is this important?

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Indoor Environmental Quality



Why is this important?

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Thank you!

Scott Pashia, AIA

Thursday, January 20, 2022

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 **DLRGROUP**

Question and Answer



Upcoming High School Action Team Sessions



March 3: RWL Conference

April 28: School Tours

- District-wide representation
- Strong takeaways and follow-up conversations
 - Networking opportunities

Upcoming RWL Webinar Sessions

February 17, 8:00 am

Part One: Emerging Issues in Clean Tech, Artificial Intelligence, Sustainability and Data Science for RWL

March 8:00 am

Part Two: Emerging Issues in Clean Tech, Artificial Intelligence, Sustainability and Data Science for RWL

ThankYou!

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Things to Consider



Entry points: start where you can with school/community issues

Staffing: lean on community expertise to support projects

Pathways: as more students engage in sustainability projects, consider pathways: academies, microschools