CampusEnergy2020
THE POWER TO CHANGE
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THE ROLE OF ENVIRONMENTAL ATTRIBUTES FROM CHP & CARBON REDUCTION PROJECTS ON A COLLEGE CAMPUS

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Blue Delta Energy

MULTIPLE ATTRIBUTE VALUE STREAMS

- **SOURCES** - CHP, Renewable Energy, Green Gas & Carbon Reduction Projects generate Environmental Attributes
  - Campus – attribute generator
  - Off-campus – external projects important
- **VALUE** - Colleges & Universities have optionality in extracting benefits from Attributes (how to account?)
  - Revenue source ($$)
    - Financial support - for what use?
      - Campus projects (clean energy or other)
  - Mechanism for GHG reduction and clean energy accounting
    - Retire? Sell? Caution, double counting
  - Investment vehicle to support external projects – diversify endowment?
- **CHALLENGE** – How to optimize Environmental Attributes? Greatest value lies in integration with diverse campus goals

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ENVIRONMENTAL ATTRIBUTE LANDSCAPE

Diverse & rapidly changing due to cities, states & voluntary demand

- **Renewable Energy Credit (REC)** = 1 MWh of renewable energy generated
  - Electricity – wind, solar, CHP, biogas, hydroelectric
  - Renewable Thermal – district energy, solar, biomass, geothermal

- **Renewable Gas Credits** = Attribute from RNG, in MMBtus – upgraded, pipeline quality biogas for energy use/renewable thermal
  - Landfill methane capture, sewerage (WWTPs), farms, food waste (heating needs, not just for transportation)
  - Green Gas for utilities & end users - college campuses

- **Clean Peak Credits** – Massachusetts, with credit multipliers
  - Energy storage, new renewables, demand response

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ENVIRONMENTAL ATTRIBUTE LANDSCAPE

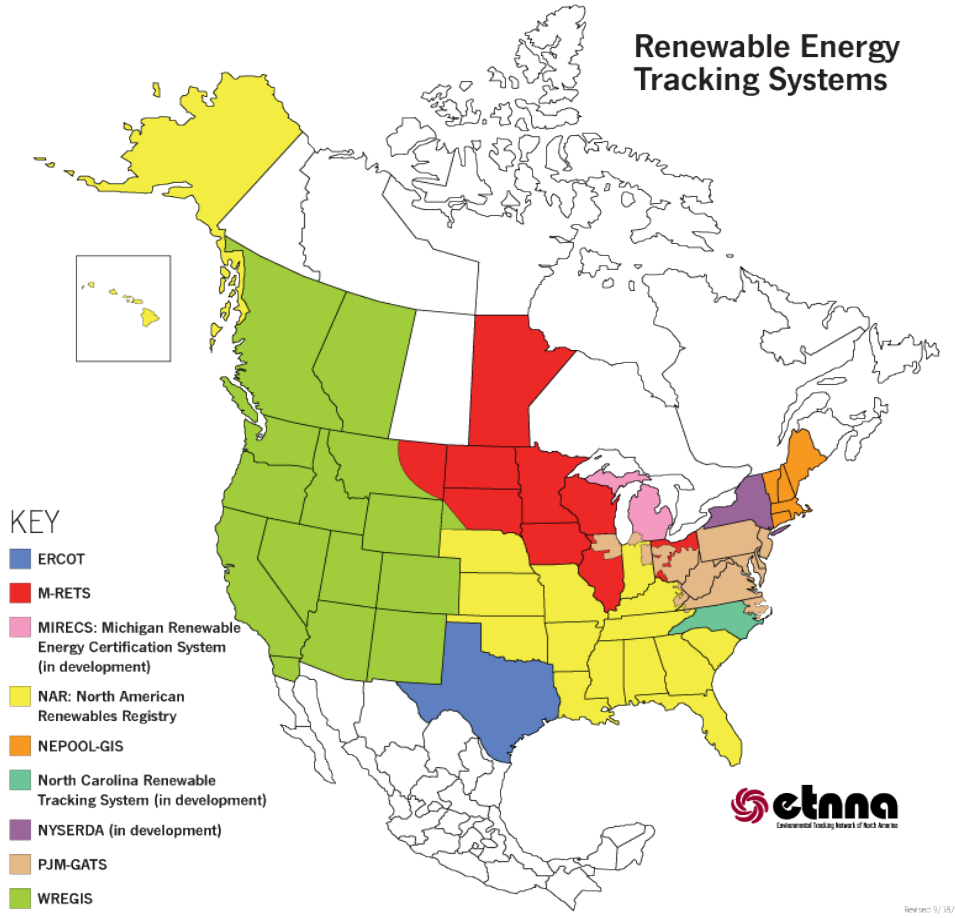
RECs for more frequent generation - hourly?

Carbon Offset = 1 Metric Tonne CO2 reduced

- Landfill methane gas capture, forest management, animal waste
- 2018 - Significant increase in voluntary offset demand

Renewable Fuels Credits – RINs, LCFS

Electronic Tracking Systems provide secure mechanism to create and manage attributes



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ROLE OF ENVIRONMENTAL ATTRIBUTES FOR COLLEGES & UNIVERSITIES

How is an Attribute accounted for? Carbon Reduction Value? Revenue Generator? Investment?

MULTIPLE BUCKETS

1) Created on site by clean energy & carbon reduction projects

- RECs, Offsets, Offsets from RECs
- Monetize – use the markets to generate revenue for other campus projects, Green Revolving Fund
  - Cannot claim GHG reductions once attributes are sold.
  - Temporary, year-by-year means to leverage additional longer-term carbon reductions if revenue is used to fund even larger GHG reduction projects (net positive environmental benefit)
- Swap – exchange for higher carbon reduction value attributes (RECs for high quality carbon offsets)
- Retire - Some/all retired for sustainability goals using carbon reduction & clean energy reporting value

ROLE OF ENVIRONMENTAL ATTRIBUTES FOR COLLEGES & UNIVERSITIES

2) Created off-site & retired to meet annual sustainability goals

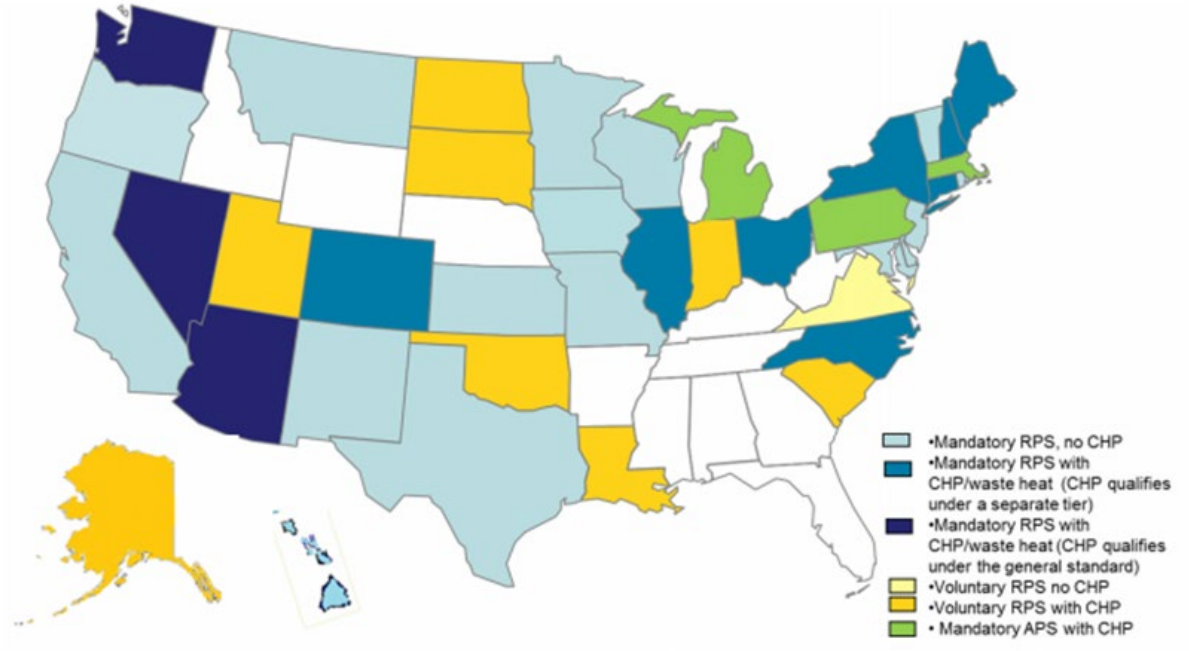
- Voluntary RECs and offsets purchased to green annual electricity usage and offset GHG emissions

3) Created off-site & used as investment vehicle to generate revenue for endowment

- As attribute markets mature, increased liquidity = greater access & tracking ability, accountability & transactional ease
  - Scaling up of attribute exchanges (ie. airline focus)
- Diverse investment portfolio can span multiple technologies and projects – carbon reduction, renewable electricity & thermal, transportation
- Longer-term investment in projects beyond volumes needed for retirement to meet campus carbon reduction goals
- Projects with co-benefits – attributes for both retirement and investment

ENVIRONMENTAL ATTRIBUTES FROM CHP

- 29 States + D.C. have a Renewable Portfolio Standard (RPS)
- CHP and/or WHP – called out in 20 states as eligible under RPS type program – qualified to generate RECs or thermal equivalent (convert MMBTUs to MWh)



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CHP IN RPS PROGRAMS

- Eligibility can be divided into “typical CHP”, “renewable fueled CHP” and “waste heat to power”
- CHP qualification varies based on factors including size, efficiency threshold and fuel use
- Some states may allow CHP to qualify if using an eligible, renewable fuel (ie. biomass) only, others allow natural gas as feedstock
- Natural Gas fired CHP qualified in both Connecticut and Massachusetts
  - CT – Electric RECs only, overall system efficiency of 50% per quarter or fail
  - MA – REC calculated based electrical and thermal output (1.5 multiplier over CT)

CHP REC REVENUE – 2 STATES, 1 TECHNOLOGY

CONNECTICUT - 3 MW QUALIFYING CHP UNIT	
Load (MW)	3.0
Hours per Year	8,760
Capacity Factor	75%
Approximate Yearly REC Generation	19,710
Net Generation (Remit 25%)	**14,782**
Indicative 2020 Class III REC Value	$22.00
Annual REC Revenue	**$325,204**

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CHP REC REVENUE – 2 STATES, 1 TECHNOLOGY

PENNSYLVANIA - 3 MW QUALIFYING CHP UNIT	
Load (MW)	3.0
Hours per Year	8,760
Capacity Factor	75%
Approximate Yearly REC Generation	19,710
Indicative 2020 Tier II REC Value	$0.45
Annual REC Revenue	**$8,869.50**

Pennsylvania CHP is an undervalued resource within the RPS structure

- Worth the effort & costs to register?
- What is the intention of this RPS tier?
- What is the battle to restructure?
  - Compete with waste coal and large scale hydro
  - PA has abundance of natural gas – do the politics support increased usage of gas in-state via CHP?

UCONN & CHP

UCONN QUALIFYING CHP UNIT	
Load (MW)	24.9
Approximate Gross REC Generation/Yr	124,000
Net Generation (Remit 25%)	93,000
Indicative 2020 Class III REC Value	$25.00
Approx. Gross Annual REC Revenue	**$2,325,000**

- Main campus energy need - 100% met with CHP
  - Technically tri-generation - thermal via steam driven chillers is used in summer months

- **Class III REC revenue - into Green Revolving Fund for energy and water conservation efforts & projects which would otherwise not be funded**

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UCONN & ENVIRONMENTAL ATTRIBUTES

- Not claiming carbon reduction value of CHP (selling RECs & environmental claims)
  - Met 20% reduction - Energy Use Intensity by 2020 goals through CHP & conservation efforts (partially funded by REC revenue) despite campus growth!

- UCONN not only creates RECs – off-site generated RECs are purchased & retired to meet sustainability goals
  - 100% renewable power purchased for regional & health care campuses (TEXAS WIND RECs)

- More renewable self-generation under evaluation to meet aggressive goals by 2030

- January 2020 – UCONN named world's 11th greenest institute of higher education worldwide (1 of 2 in U.S.)

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CREATING CAMPUS CARBON OFFSETS

- Universities can create carbon offsets on campus and engage voluntary carbon market for carbon revenue stream
  - 2018 voluntary carbon demand – Approx. 98.4 MM tonnes with market value of $295.7 million, significant increase, tipping point for large growth?
  - Current Voluntary Carbon Offset Pricing – average of approx. $3/metric tonne, with “unique” projects up to $6-$8/tonne

- Methodologies developed for campus energy efficiency projects that reduce GHG emissions
  - Verra/VCS – validation, verification and registration
  - LEED projects
  - Evaluates performance for new ee and re projects across campus – using performance metrics

Verified Carbon Standard
A VERRA STANDARD

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CREATING CAMPUS CARBON OFFSETS

- Ball State University teamed up with Chevrolet (2012) to create methodology
  - District-scale geothermal ground source heat pump (GSHP) heating and cooling
  - 2 energy stations, 47 buildings
  - Chevy committed to three year contract for offsets (110k)
  - More $$ for campus wide ee projects
  - **Report sales accurately to avoid double counting** – income used to reduce GHG impact more greatly/at a deeper level in the long-term – sell for years up to “anchor year” – sell some, retire some….

- Carbon revenue can take from Business as Usual to GHG reduction leadership

- Valencia College, University of Illinois Urbana Champaign

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BIOGAS/RNG ON CAMPUS

- Natural Gas use on campus - fuel equipment, provide hot water & steam, affordable, supports energy resiliency
- Renewable Natural Gas (RNG)
  - Pipeline quality gas fully interchangeable with conventional natural gas
  - Anaerobic digestion most common (landfill gas, animal manure, wastewater, food waste in digester) creates biogas - upgraded to RNG for common carrier pipeline injection
  - Mainly transportation (RFS, LCFS) – increasingly replace natural gas (renewable thermal)
  - Diversity of gas supply provides more energy security
- Switch to RNG directly avoids carbon emissions, not by offsetting AFTER CO2 emissions have occurred
- Achieve carbon neutrality in gas consumption & thermal load, power EV stations
- Create and capture **Carbon Offsets** from certain projects
- **Emerging Renewable Gas Attributes**
  - Quantify benefits of RNG - carbon reduction/neutrality, positive environmental impact, revenue stream

BIOGAS/RNG ON CAMPUS

- **University of California System**
  - RNG as part of commitment toward 40% natural gas from renewables by 2025, buildings and vehicle fleet

- **Duke University**
  - approx. 50% of operations rely on natural gas
  - teamed up with Google and Duke Energy to fund swine waste to energy anaerobic digestion project – **receiving some of the carbon offsets for campus sustainability to meet GHG reduction goals**

- **Middlebury College**
  - Cow manure, locally sourced food waste – RNG via pipeline (50% of campus heating & cooling)

UNIVERSITY OF CALIFORNIA

1800 Middlebury

Duke UNIVERSITY

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CONCLUSIONS

- Environmental Attribute landscape – diverse & changing
- Quantifiable efforts toward campus clean energy & carbon reduction = measure, manage, monetize, swap, retire, invest
- Monetization of Attributes = no GHG reduction claims
  - Revenue stream can fund larger, long-term GHG reduction projects
- State policies influence value of Attributes
  - CHP – could be better recognized with increased attention of placement within RPS structures
- Voluntary Carbon Market – strong & getting stronger!
  - Important for campuses generating, buying, **investing in** offsets
- Questions? Viable addition to endowment strategies?

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