Shekóli

Solar Deployment on Tribal Facilities

Department of Energy
Tribal Energy Program Review
Denver, CO
November 14-17

Michael Troge

Oneida Nation

AGENDA

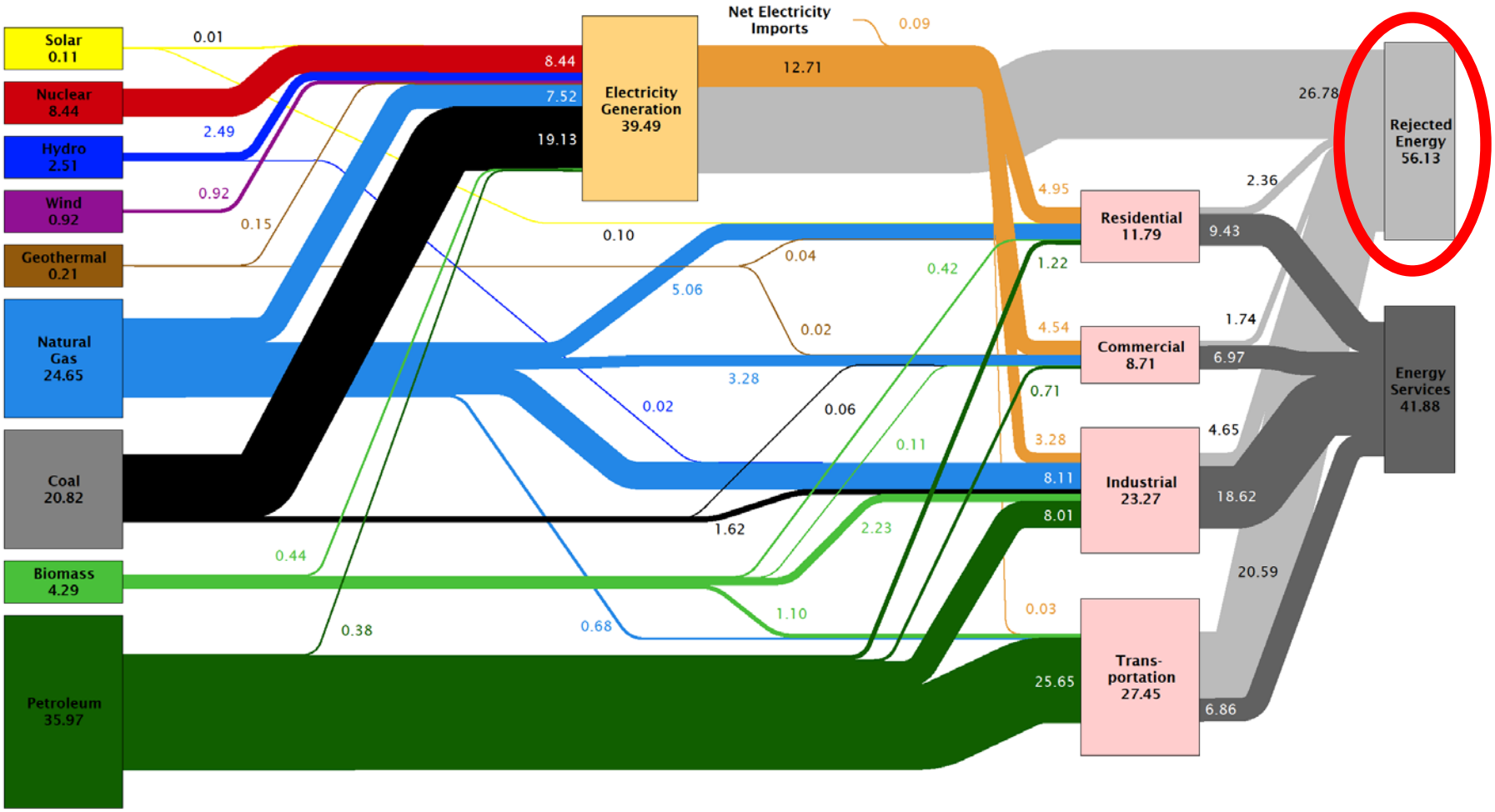
- **Past work**
- **Solar project update**
- **MTERA**

Thank you!

- **Department of Energy, Tribal Energy Program, Office of Indian Energy, & National Renewable Energy Lab.**
- **Larger Team: Oneida Tribe Energy Team, Business Committee, Land Commission, Finance, Legal, Land Management, Public Works, Engineering, Environmental Division, Environmental Resource Board, Planning, Staff**
- **Project Team: Oneida Engineering, Oneida Legal, OEI/NREL (START program), Ater Wynne, BDO Consultants**
- **Investor partner: SunVest, Inc.**

Estimated U.S. Energy Use in 2010: ~98.0 Quads

Lawrence Livermore National Laboratory



Source: LLNL 2011. Data is based on DOE/EIA-0384(2010), October 2011. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for hydro, wind, solar and geothermal in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." (see EIA report for explanation of change to geothermal in 2010). The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

1 QUAD is enough energy to power 32 million homes

https://flowcharts.llnl.gov (Lawrence Livermore National Laboratory)

Pre-Oneida Energy Team

- **1995 to 2005**
- **Support received from Tribal contribution, DOE, WI Focus on Energy, others**
- **11 + 2 kilowatts solar electric demonstration**
- **Solar hot water on 18 residences**
- **Residential energy audits**
- **Some facility work**
- **Education**

Some lessons learned…

- **Anticipate budget needs for life of projects.**
- **Maintenance, maintenance, maintenance!**
- **1 big project or many small projects?**
- **The right project,**
  - **in the right place,**
    - **for the right application!**
- **Follow up.**

Oneida Energy Team

- **Formed in 2007**
- **EE & RE an important combined strategy**
- **Supported Brown County, WI (2008)**
  - **Energy Independent Community, RPS25 by 2025**
- **Wind study (2009 – 2011; TC, FOE)**
- **SHW upgrades (2010; FOE)**
- **Energy Crop Study (2011 to present; TC, DOE, EPA, UWGB)**
- **Pellet boiler at Conservation Dept. to supplement LP (2014 to present; Focus on Energy)**

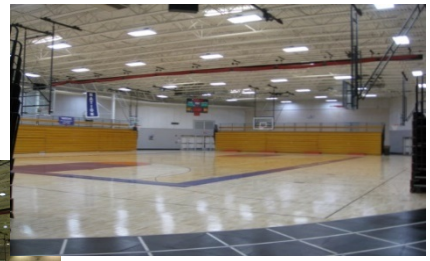
Oneida Energy Team (continued)

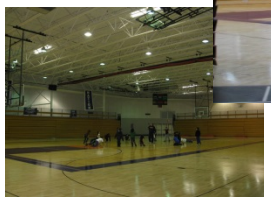
- **Anna John Resident Centered Care Community SHW (2009-2013; TC, EECBG, WPS, FOE, TC)**
- **Energy Audit Program (2012-2014, DOE)**
- **Energy Optimization Model, EOM (2012-2014, First Steps)**
  - **No obvious RE winner – solar, wind, bio, ground**
  - **Grants and financial creativity**
- **Solar Deployment on Tribal Facilities (2015 to now)**

Energy Team Projects

Energy Audits & Upgrades

- Improved lighting
- Decreased energy use





Turtle School Gym

Energy Crop Study

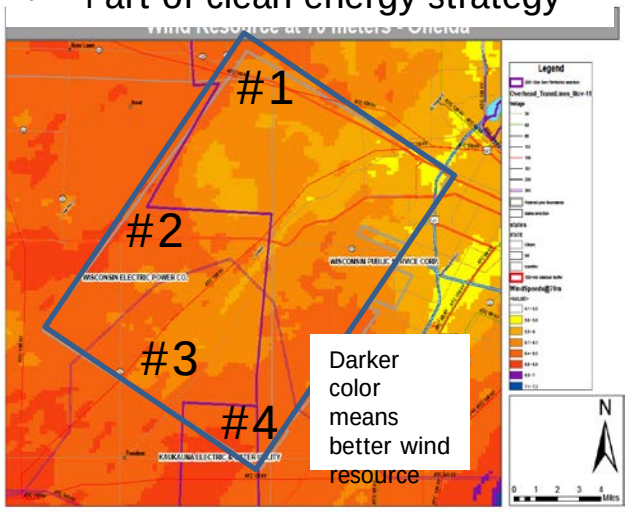
- Locally grown energy crop for heat, fuel
- UWGB partner

Anna John Solar

- 48 collectors, 75% of hot H2O
- 75% grant funded

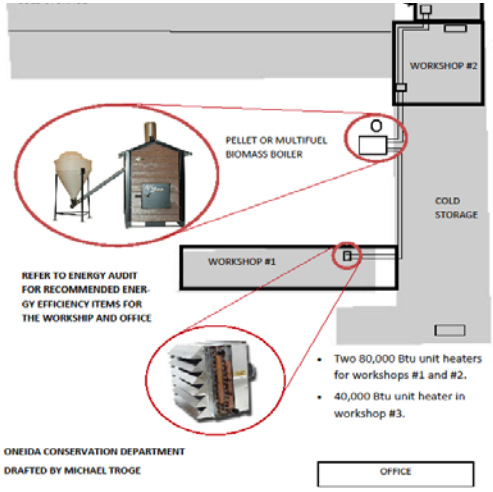
Wind Power Study

- Wind best in the west
- Part of clean energy strategy



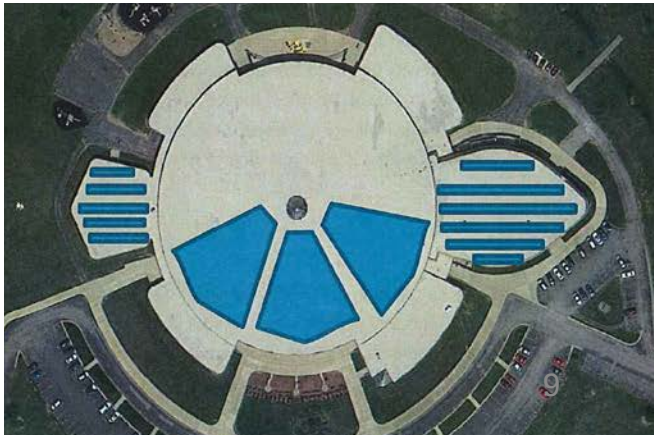
Biomass Energy

100,000 Btu biomass boiler Demonstration



Solar Deployment Project

- Application to DOE for $1 M
- Solar electric on 9 buildings



More technical lessons…

- **Provide and pay for training for facility personnel.**
- **Find someone on the inside that has "feelings" for the technology.**
- **Form project team early, and get commitment.**

More financial lessons…

- **Oneida is in a place with "cheap" natural gas and electricity.**
- **RE at mercy of market forces.**
- **So much depends on if the utilities want to play ball.**
- **Grants aren't likely to last forever.**
- **Real need for project managers to become financial "experts"**
- **Tribe gets skiddish with large, "mysterious" monetary commitments/deals!**

Watching where we spend!

- **Finance Operations (our CFO)**
  - A tight ship
  - Due diligence
  - Fiscal responsibility
  - 3-bid procurement
  - Audit trail
  - Maximize value to the Tribe
  - “trust, but verify”

Staying Competitive

- **Economic path**
  - **"Economy strong, gaming strong"**
  - **"Economy weak, gaming weak"**
  - Tied to a global economy
  - Economic collapse of 2007/8 was a direct hit
  - Need diversification
  - Need savings

Oneida Energy Situation
(results from EOM RFP)

Current Tribal community energy usage as of 2011 = 412,000 MMBtu.
= 121 million kWh

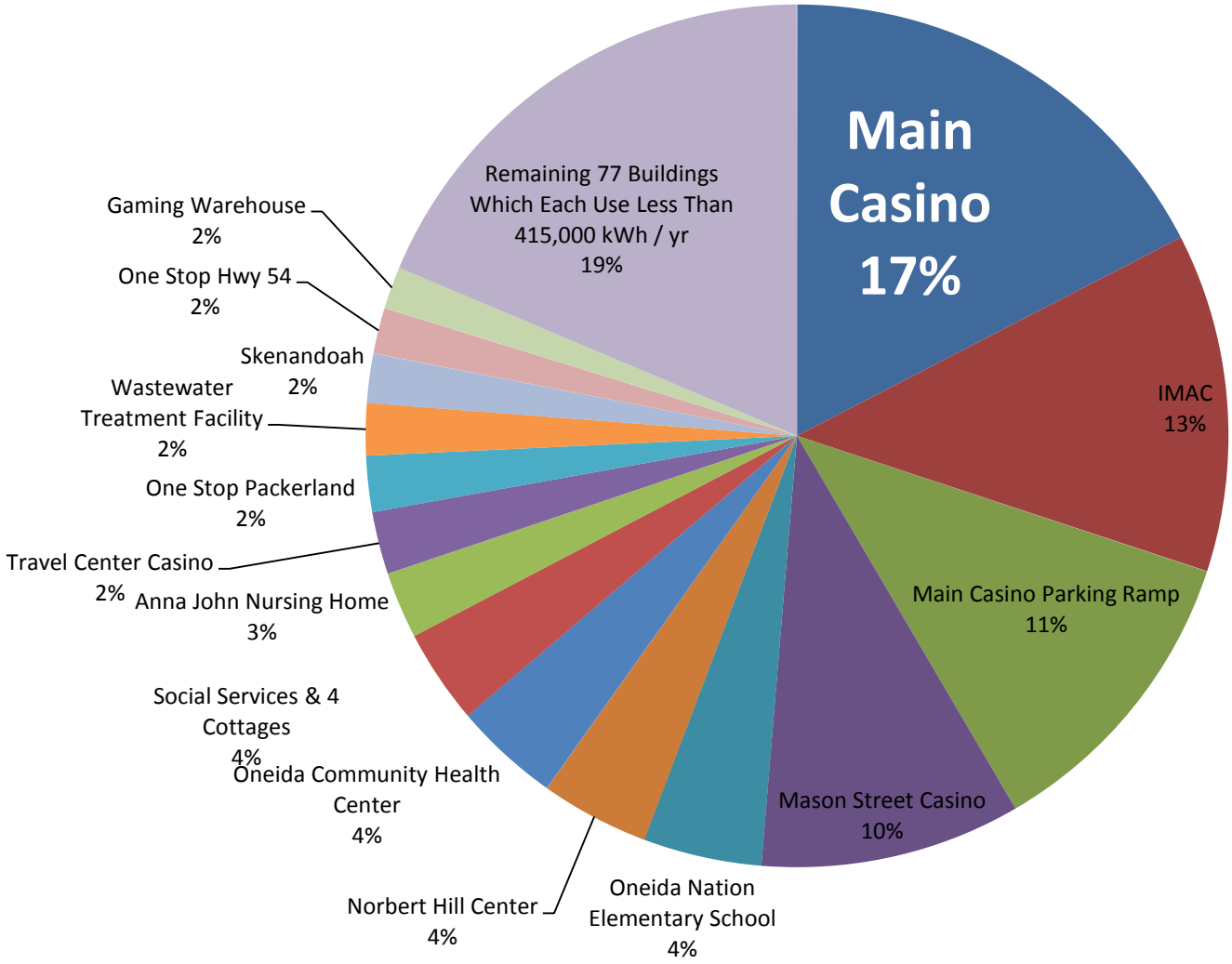
Institutional electricity:	31,000,000 kilowatt-hours	=	105,000 MMBtu
Institutional natural gas:	540,000 therms	=	54,000 MMBtu
Institutional transp fuel:	145,000 gallons	=	5,000 MMBtu
Housing electricity:	16,000,000 kilowatt-hours	=	48,000 MMBtu
Housing natural gas:	2,000,000 therms	=	200,000 MMBtu

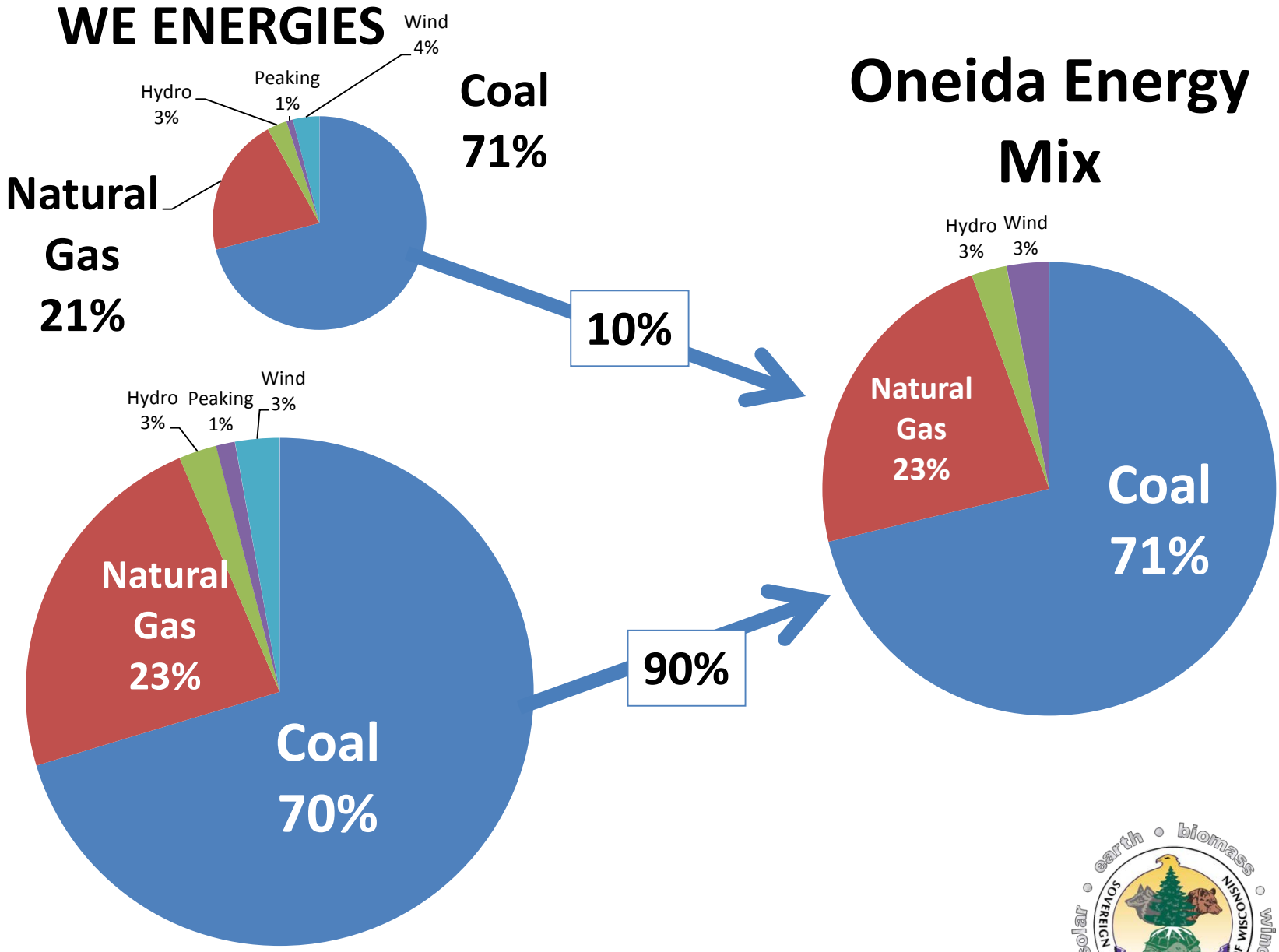
5% RPS = 20,600 MMBtu = 6 million kWh

10% RPS = 41,200 MMBtu = 12 million kWh

20% RPS = 82,400 MMBtu = 24 million kWh

Electricity Use by Building (not therms)




WE ENERGIES
Wind 4%
Peaking 1%
Hydro 3%
Natural Gas 21%
Coal 71%
10%
Oneida Energy Mix
Hydro 3%
Wind 3%
Natural Gas 23%
Coal 71%
Hydro 3%
Peaking 1%
Wind 3%
Natural Gas 23%
Coal 70%
90%
WISCONSIN PUBLIC SERVICE

Project Proposal

Oneida Energy Team Emerging Issues

Oneida Tribe of Indians of Wisconsin

Project Title:
SOLAR ELECTRIC DEPLOYMENT ON TRIBAL FACILITIES IN THE ONEIDA RESERVATION

System size = 695 KW on 9 facilities
That's enough energy for 100 homes.

Turtle School proposal

Example of facility solar electric in Wisconsin.

Kohl's Dept. Stores is an EPA Green Power Partner.

Photo of Milwaukee store with a 200 kilowatt array on the roof.

PHOTOVOLTAIC DEPLOYMENT ON TRIBAL FACILITIES

1 = Irene Moore Activity Center, 170 kw
2 = Turtle School, 100 kw
3 = Community Health Center, 100 kw
4 = Norbert Hill Center, 90 kw
5 = Gaming Warehouse, 80 kw
6 = Elder Services, 95 kw
7 = Department of Land Management, 20 kw
8 = Food Distribution Center, 20 kw
9 = Oneida Police Department, 20 kw

Contact Information
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BE SAFE...LIVE WELL... ENJOY THE LAND

September, 2014

Solar Deployment on Tribal Facilities

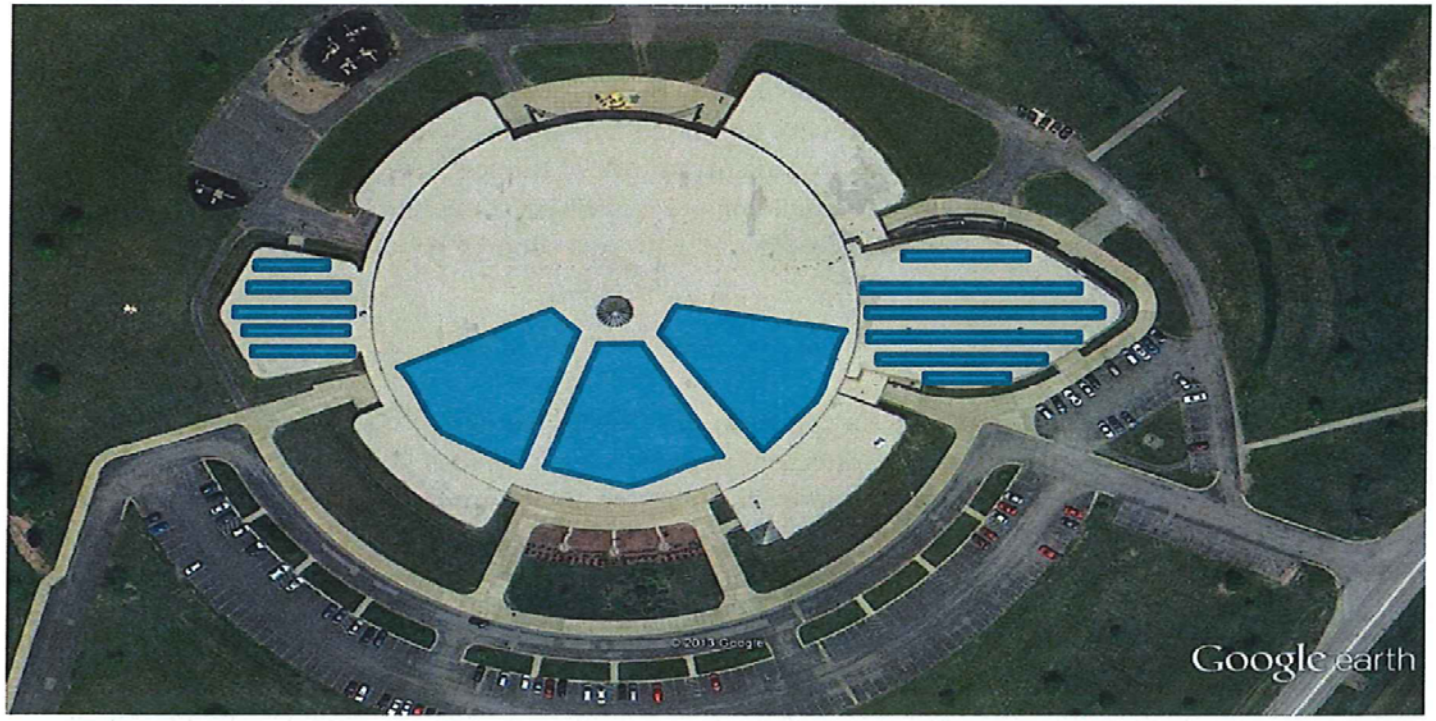
- Application — Oct, 2014
- Notification — Apr, 2015
- Acknowledged — Sept, 2015
- RFP — Nov, 2015
- ITC extended — Dec, 2015 (**planned!**)
- Selection — Mar, 2016
- Final site list — (Dec, 2016)
- PPA documents — (Jan, 2016)
- Approvals — (Apr, 2016)
- Installation — (Summer, 2016)

Grant Application Prep

- **Project**: 700 kilowatts for $2 million
- **Budget**: DOE $1M + Investor $1M + Oneida $45k
- **Project plan**: initial project proposal
- **Soft cost budget items**:
  - Set aside grant funds for Electrician training (?)
  - Set aside grant funds for Legal consultant (????)
  - Set aside grant funds for Finance consultant (????)
- **TC**: Set aside enough staff in-kind time to match soft cost budget items
- **Project team**: convene main stakeholders
- **Contracts**: Meet all grant and contract requirements
- **Tribe**: Due diligence

Oneida Elementary (Turtle) School

Facility	Usage	Size PV	Cost	% of Usage
Turtle School	1,373,600 kWh	550 kw	$1.65 million	49%



662 kW total, 510 kW on the shell, 107 kW on the head, 45 kW on the tail.

Assumptions: 60 cell modules (avg. 265 watts each), 25 deg tilt, ballasted design, no inverter site constraints

Elementary School

Benefits

- Favorable utility
- Favorable rate
- Large load
- Large roof
- In Central Oneida
- High visibility
- Excellent educational opportunity

Challenges / Unforseeables

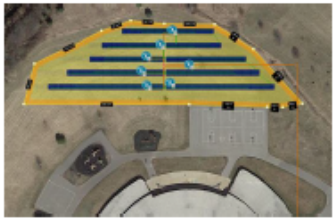
- Facilities folks leery of roof mount and warranties
- Snow and drifting
- Existing roof maintenance challenges
- Limited space for ground mount (1.6+ acres)
- Only modest support from the school board
- BIA/BIE agreement for energy compensation

School options

DRAFT

SOLAR ELECTRIC CONCEPT DESIGN
Oneida Nation Turtle Elementary School
N7125 Seminary Road, Oneida, WI 54155

date: 9/19/2016



	Roof mount 368 kW option #1	Ground mount 368 kW option #1	Ground mount 322 kW option #3	Ground mount 322 kW option #4
Array location	South half of roof	North field; north of basketball courts	North field; north of basketball courts	South lawn; between parking lot and road
Number of arrays	3	1	1	1
Infrastructure location	Roof & Attic	Trench and boring east of building	Trench and boring east of building	Trench and boring south of building
System footprint	43,000 sq ft	80,000 square feet (1.8 acres)	70,000 square feet (1.6 acres)	70,000 square feet (1.6 acres)
Power rating (kilowatts)	368.6	368.6	322.6	322.6
Number of modules	1,152	1,152	1,008	1,008
Array height above surface	6 inches above roof	36 inches above ground	36 inches above ground	36 inches above ground
Array tilt	10 degrees	30 degrees	30 degrees	30 degrees
Number of inverters	8	8	7	8
Inverter location	on roof	at each sub-array	at each sub-array	at each sub-array
Production (kWh/kW)	1,218	1,283	1,291	1,327
Production/year (kilowatt-hours, kWh)	448,955	472,914	416,477	428,090
Annual value @ $0.07/kWh	$31,427	$33,104	$29,153	$29,966
Preliminary cost estimate				
modules	$ 381,372	$ 381,372	$ 332,529	$ 332,529
inverters	$ 83,744	$ 82,146	$ 73,437	$ 73,437
racking	$ 98,441	$ 110,569	$ 103,822	$ 103,822
electrical balance	$ 147,732	$ 153,583	$ 150,708	$ 150,708
shipping	$ 3,766	$ 8,613	$ 7,438	$ 7,438
other	$ 15,181	$ 17,244	$ 17,250	$ 17,250
fencing	NA	$ 36,192	$ 36,192	$ 36,192
underground electrical	NA	$ 29,687	$ 26,598	$ 26,598
labor	$ 223,077	$ 226,735	$ 212,407	$ 212,407
TOTAL	$ 953,312	$ 1,046,141	$ 960,380	$ 960,380
Installation costs ($/kW)	$ 2,586	$ 2,838	$ 2,977	$ 2,977
Installation costs ($/kWh)	$ 2.12	$ 2.21	$ 2.31	$ 2.24
Security	roof mount discourages free access	chain link fence	chain link fence	chain link fence
Maintenance	Annual inspection of all components; Annual roof inspection; Inverter replacement at year 12 to 15.	Annual inspection of all components; Mow between sub-arrays; Inverter replacement at year 12 to 15.	Annual inspection of all components; Mow between sub-arrays; Inverter replacement at year 12 to 15.	Annual inspection of all components; Mow between sub-arrays; Inverter replacement at year 12 to 15.
Maintenance costs @ $13/kWh	$ 4,792	$ 4,792	$ 4,194	$ 4,194
Inverter replacement costs	$ 96,573	$ 96,573	$ 84,521	$ 84,521

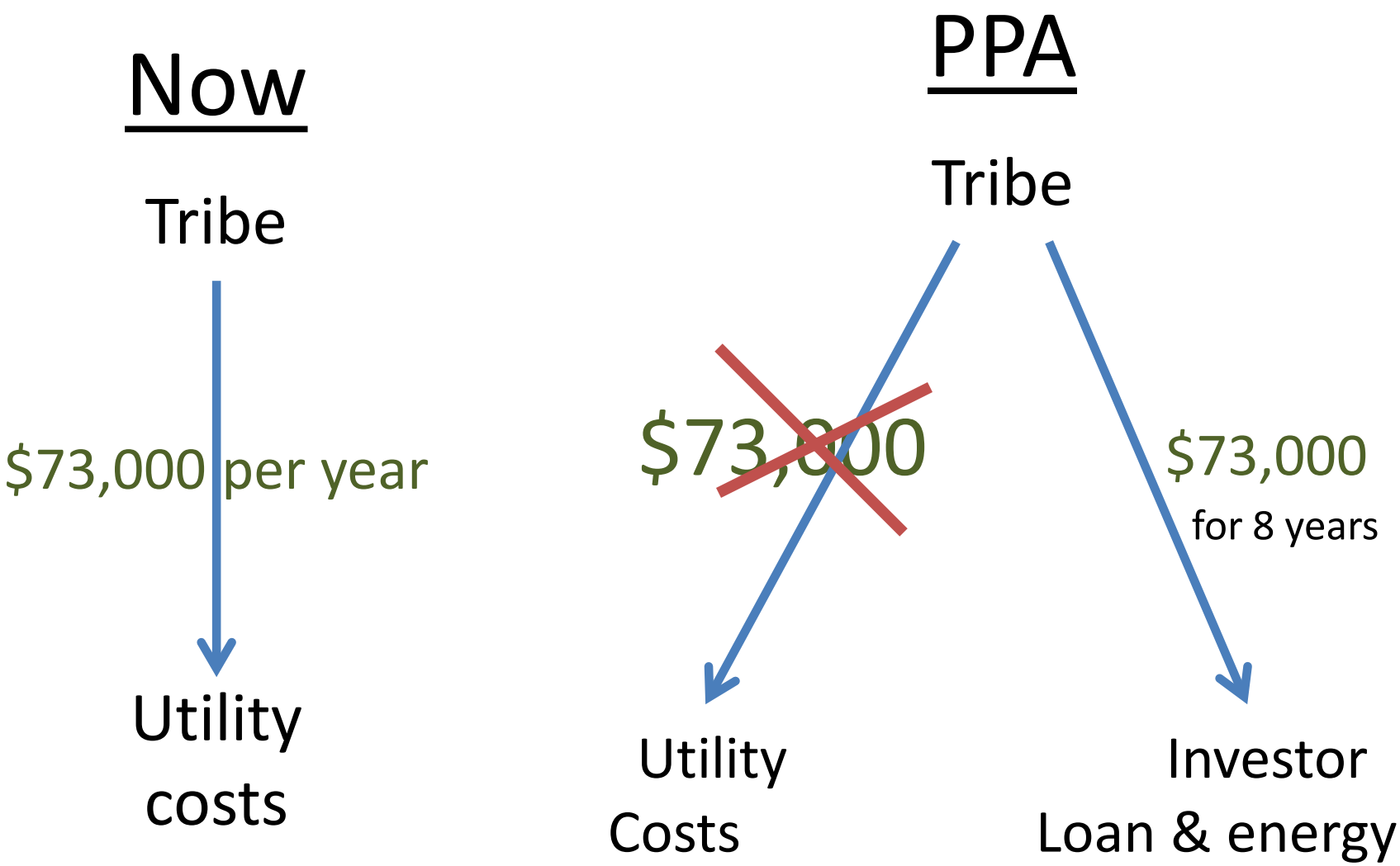
Other challenges/lessons

- **Project**: Financial consultant contract was delayed
- **Project**: Some personnel changes
- **Tribe**: Concerns coming to the surface
- **Tribe**: Long-term maintenance questions
- **Utility**: Different interconnection terms between utilities
- **Utility**: Few buildings in the favorable service territory
- **Overall**: Despite the suspected benefits of ITC, a relationship between taxable and non-taxable entities is not a certainty.
- **Overall**: Fortunately, the ITC extension allowed us to push construction to 2017.
- **Lesson**: The longer the project, the more expensive it gets!

Latest Project Details

- **Project design**: 800 kilowatts on 6 buildings
- **Project hard costs**: $1.96 million
- **DOE grant**: $1 million
- **Investor/partner**: $1 million
- **Tribe's contribution**: $80,000/yr for 8 years
  - **Estimated maint**: $20,000/year (maint. agreement & TC)
  - **Tribal solar costs**: $60,000/year
- **Install cost**: $2,556 / kilowatt
- **Flip**: year 9
- **Selling point**: solar costs = utility costs

Funding Diagram



Renewable Energy Funding Matrix

	Financing Method	Risk	Likelihood of Success	Rates of Return
Tribe Self-Funds Projects	Cash	Low	High	Low
	Bond/Debt	Low	High	Low
Grants	DOE Tribal Energy Grant	Low	Low	High
	Focus on Energy (State-Level) Grant	Low	Medium	High
Partnership with Taxable Investor	Sale Leaseback	Medium	Medium	High
	Partnership Flip	Medium	Medium	High

Main reasons these technologies are not adopted…

- Competitive markets don't recognize social/env. Benefits.
- Utilities don't want to play – RE a competitor.
- Fossil fuel industry firmly established.
- Price we pay for energy does not reflect the cost of producing it.
- How can RE be cost competitive in a stacked system?
- Subsidies, taxes, policies are supremely inconsistent.
- WI uses Canadian hydro to fulfill its RPS.

Exploring other support mechanisms

- ***GET CREATIVE!***
- 3rd party ownership
- Bulk purchase programs
- Community investment
- Solar gardens
- Renewable Energy Credits
- PACE – Property Assessed Clean Energy
- Energy efficiency is still the primary goal

M T E R A

- Midwest Tribal Energy Resources Assoc.
- Voice for Tribes & Midwest energy
- Increasingly difficult for individual Tribes to pursue energy projects.
- Recent DOE grant
- Aim to provide cost-share for activities leading up to construction.
- Presentation on Thursday morning
- Will be advertising for an Executive Director
- Looking for members

Yaw^ko!

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