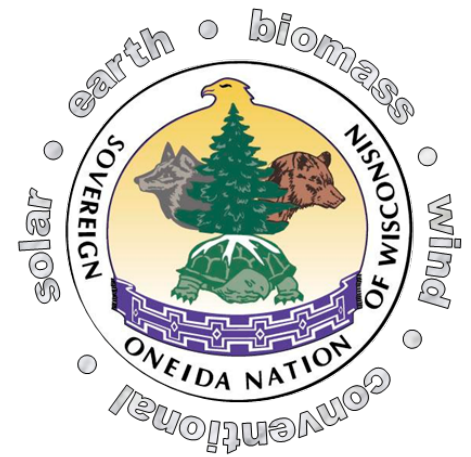




Shekóli
Oneida Nation
Solar Deployment
on Tribal Facilities

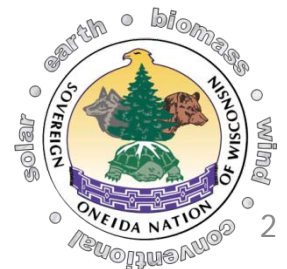


**Department of Energy
Tribal Energy Program Review
Denver, CO
November 14, 2017**

Michael Troge
Oneida Nation

AGENDA

- Past work
- Solar project
- Training

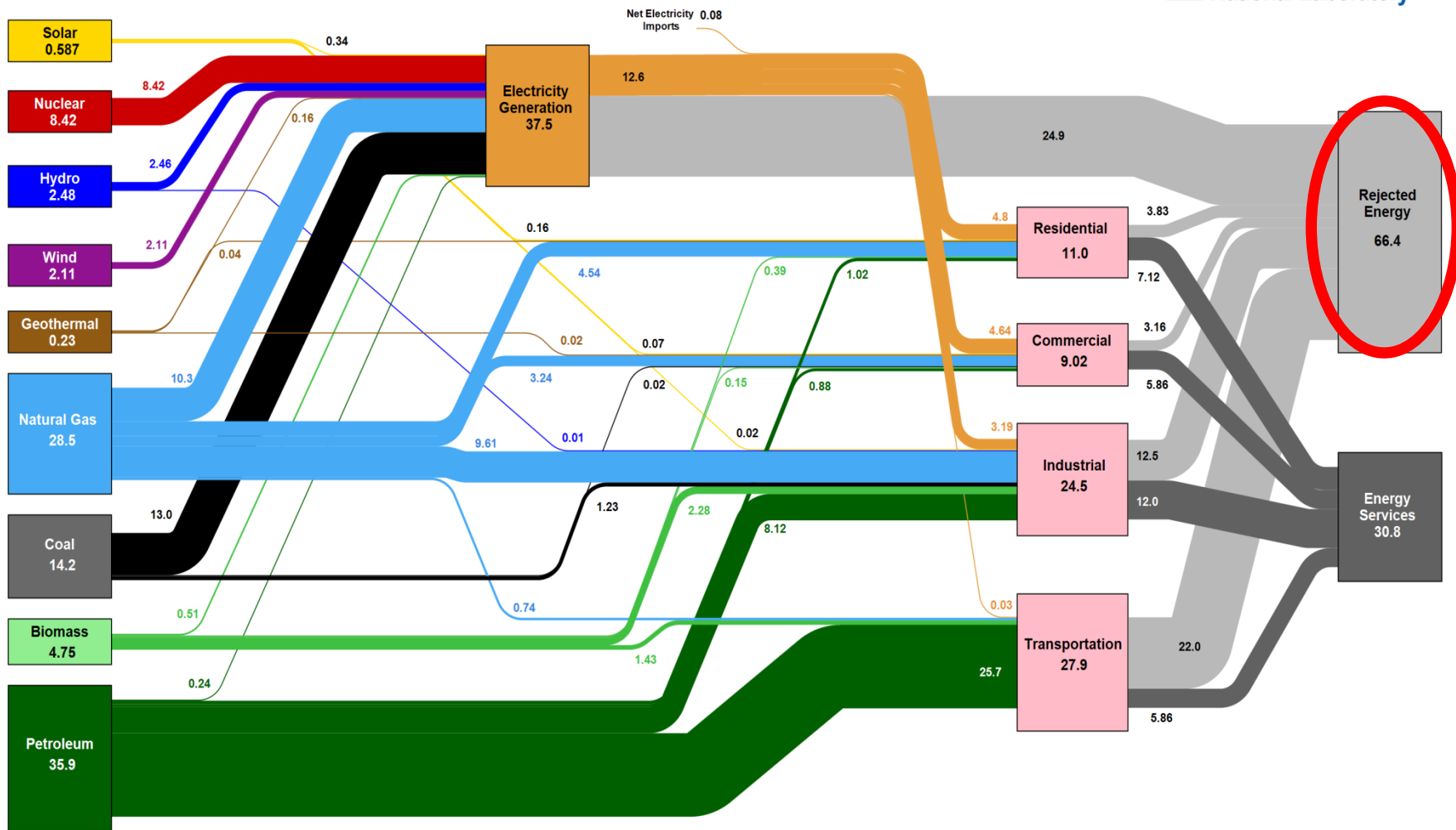


Thank you!

- **Department of Energy, Tribal Energy Program, Office of Indian Energy, National Renewable Energy Lab, START**
- **Oneida Team: Oneida Nation Energy Team, Business Committee, Land Commission, Finance, Legal, Land Management, Public Works, Electrical, Zoning Engineering, Environmental Division, Environmental Resource Board, Planning, Staff**
- **Project Team: Oneida Electrical, Zoning, Legal, OEI/NREL (START program), Ater Wynne, BDO Consultants**
- **Investor partner: SunVest, Inc.**
- **Midwest Partners: Office of Energy Innovation, Midwest Renewable Energy Association, Midwest Tribal Energy Resources Assoc, Northeast WI Tech College**



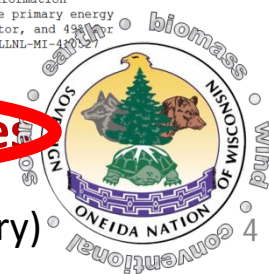
Estimated U.S. Energy Consumption in 2016: 97.3 Quads



Source: LLNL March, 2017. Data is based on DOE/EIA MER (2016). 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. This chart was revised in 2017 to reflect changes made in mid-2016 to the Energy Information Administration's analysis methodology and reporting. 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 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector, and 43% for the industrial sector which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-17-017

1 QUAD is enough energy to power 32 million homes

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



Oneida Energy Team

- **Formed in 2007**
- **EE & RE an important combined strategy**
- **Supported Brown County, WI (2008)**
 - **Energy Independent Community, RPS 25 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



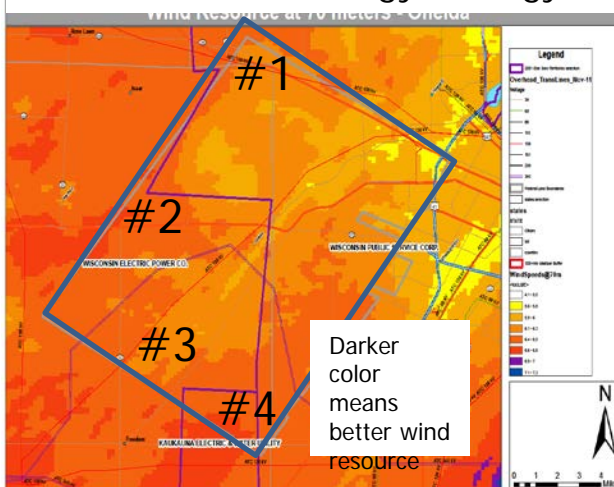
Anna John Solar

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



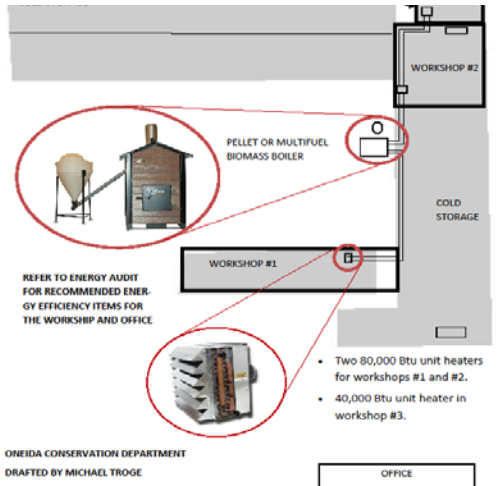
Wind Power Study

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



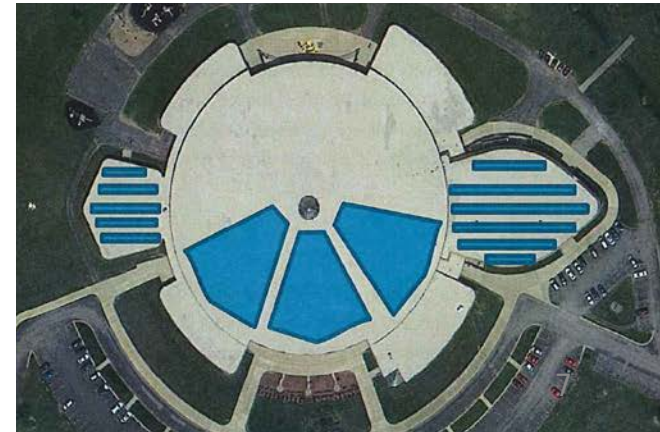
Biomass Energy

100,000 Btu biomass boiler Demonstration



Solar Deployment Project

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



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 |

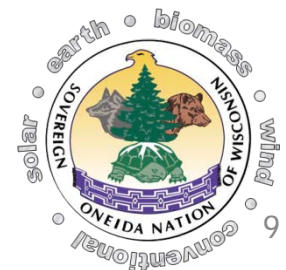
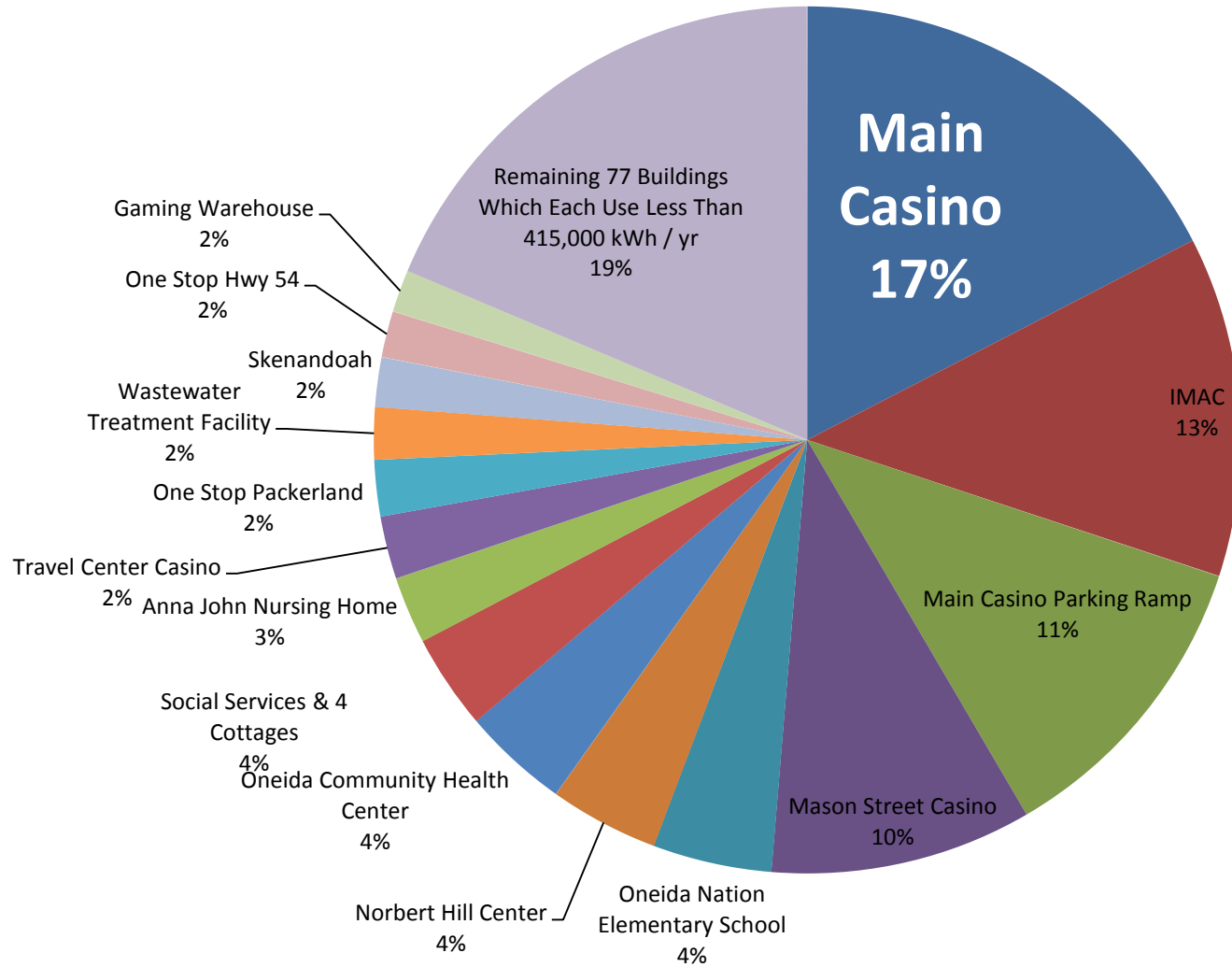
5% RPS = 20,600 MMBtu = 6 million kWh

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

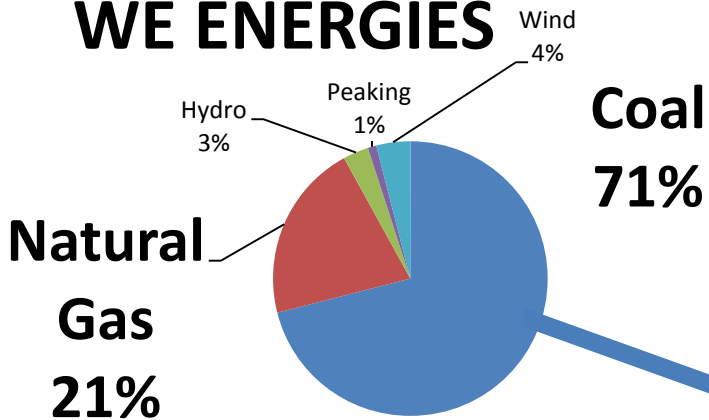
20% RPS = 82,400 MMBtu = 24 million kWh



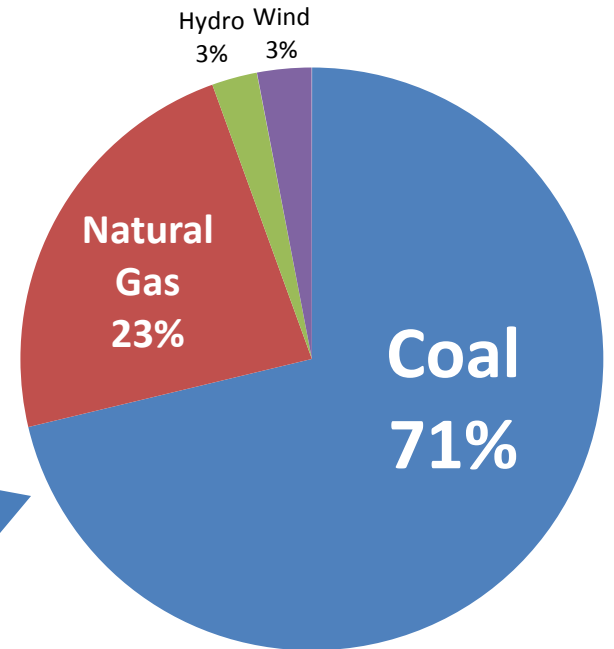
Electricity Use by Building (not therms)



WE ENERGIES

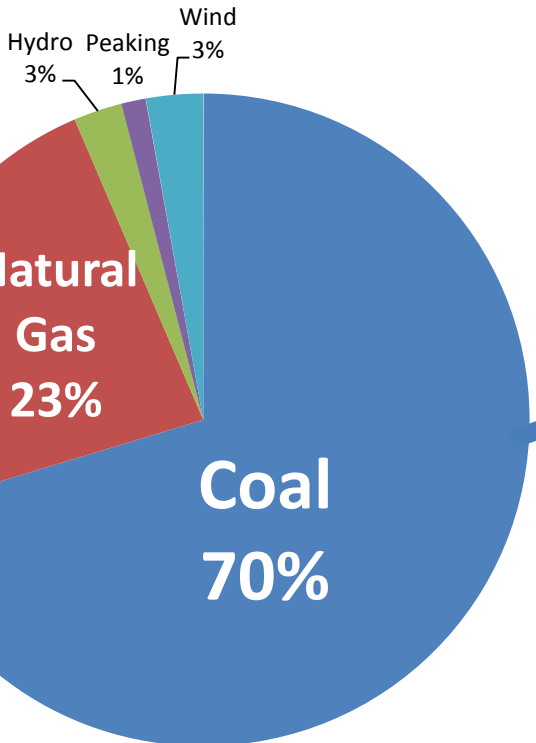


Oneida Energy Mix



10%

90%



WISCONSIN PUBLIC SERVICE



Solar Deployment on Tribal Facilities

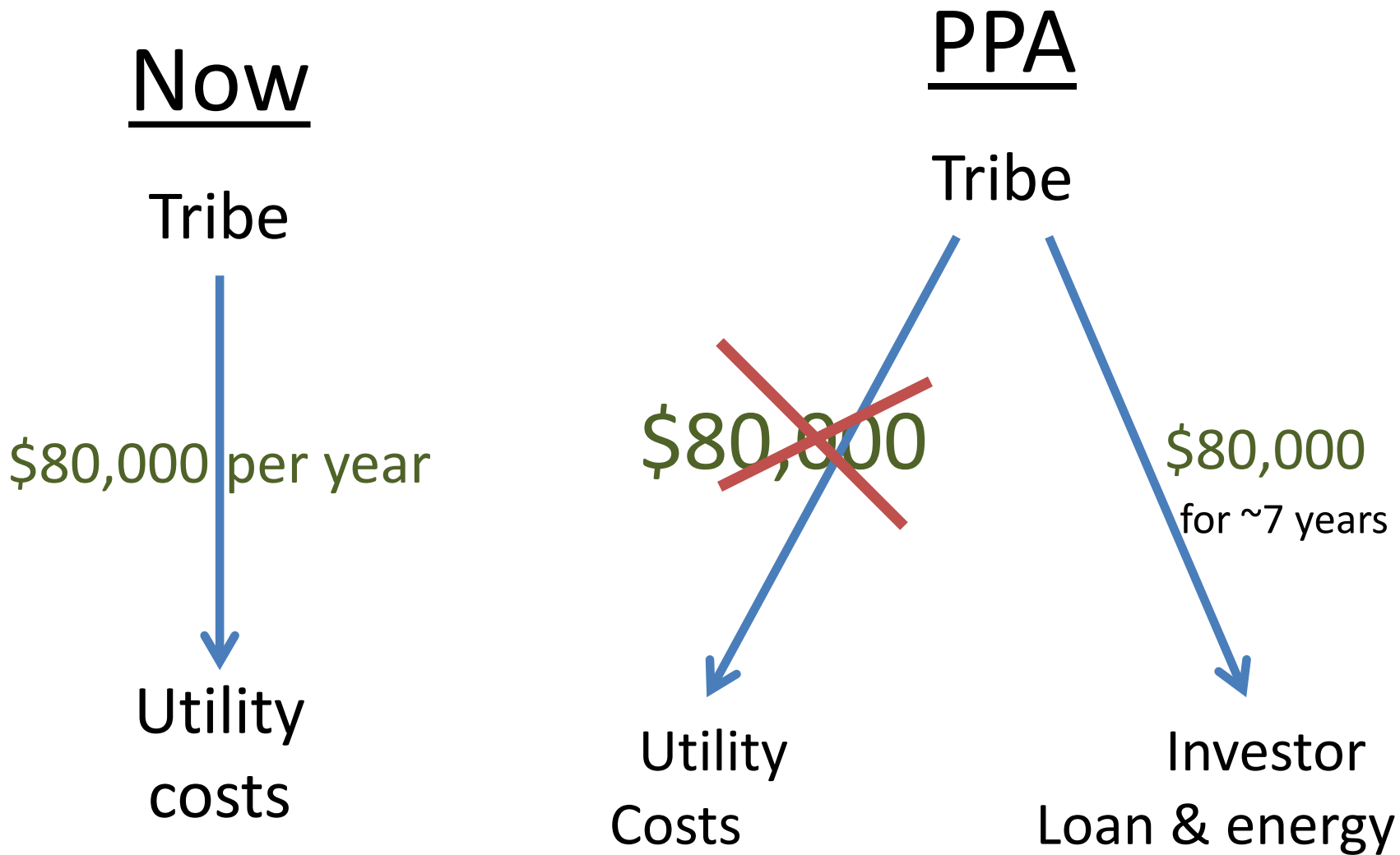
- Application Oct, 2014
- Notification Apr, 2015
- Acknowledged Sept, 2015
- RFP Nov, 2015
- ITC extended Dec, 2015
- Selection Mar, 2016
- Final site list Dec, 2016
- PPA documents Jan, 2017
- Approvals July, 2017
- Installation Fall, 2017



Grant Application Prep

- **Project:** 800 kilowatts for \$2 million
- **Budget:** DOE \$1M + Investor \$1M + Oneida \$60k + state OEI \$23,000
- **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 match and staff in-kind time to match soft cost budget items
- **Project team:** Stakeholders
- **Contracts:** Meet all grant and contract requirements
- **Tribe:** Due diligence

Funding Diagram



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

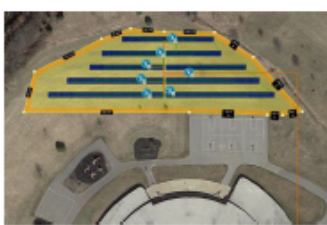
SOLAR ELECTRIC CONCEPT DESIGN
Oneida Nation Turtle Elementary School
N7125 Seminary Road, Oneida, WI 54155

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:** Long-term maintenance questions
- **Utility:** Different interconnection terms between utilities
- **Utility:** Few buildings in the favorable service territory
- **Utility:** 3rd party.....
- **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!

checklist

- ✓ Consultant contracts and amendments
- ✓ O&M plan
- ✓ Training
- ✓ Early participation
- ✓ Budget planning & adjustments
- ✓ Agreements
- ✓ Capital calls
- ✓ Grants, invoices, and timing
- ✓ Equipment availability
- ✓ Qualified personnel
- ✓ Stakeholder communication
- ✓ Permitting
- ✓ Construction scheduling
- ✓ Inspection scheduling
- ✓ Accurate capital analyses
- ✓ FAA and airport approval
- ✓ Utility agreements
- ✓ Warranty issues
- ✓ Structural analysis
- ✓ Backup plans
- ✓ Staging plan
- ✓ Grant extensions

Latest Project Details

- **Project design:** 800 kilowatts on 6 buildings
- **Project hard costs:** \$2 million
- **DOE grant:** \$1 million
- **Investor/partner:** \$1 million
- **Tribe's contribution:** \$80,000/yr for 6-7 years
 - **Estimated maint:** \$20,000/year (maint. agreement & TC)
 - **Tribal solar costs:** \$60,000/year
- **Install cost:** \$2,556 / kilowatt
- **Put-Call:** year 5 to 7
- **Selling point:** solar costs = utility costs

STAGING





ANNA JOHN
RESIDENT CENTERED
CARE COMMUNITY

168 KILOWATTS



GENERATOR MADE THINGS
INTERESTING!



PV + SHW

INSPECTION WITH SOLAR
DESIGNER

DRONE SHOT



ANOTHER VIEW.....





HEALTH CENTER

169 KILOWATTS



DRONE SHOT.....



COUNTY H RECREATION CENTER, 41 KILOWATTS



ELDER SERVICE APARTMENTS

68 KILOWATTS



IRENE MOORE ACTIVITY CENTER
+ ANNEX

260 KILOWATTS



FOOD DISTRIBUTION &
PANTRY

100 KILOWATTS

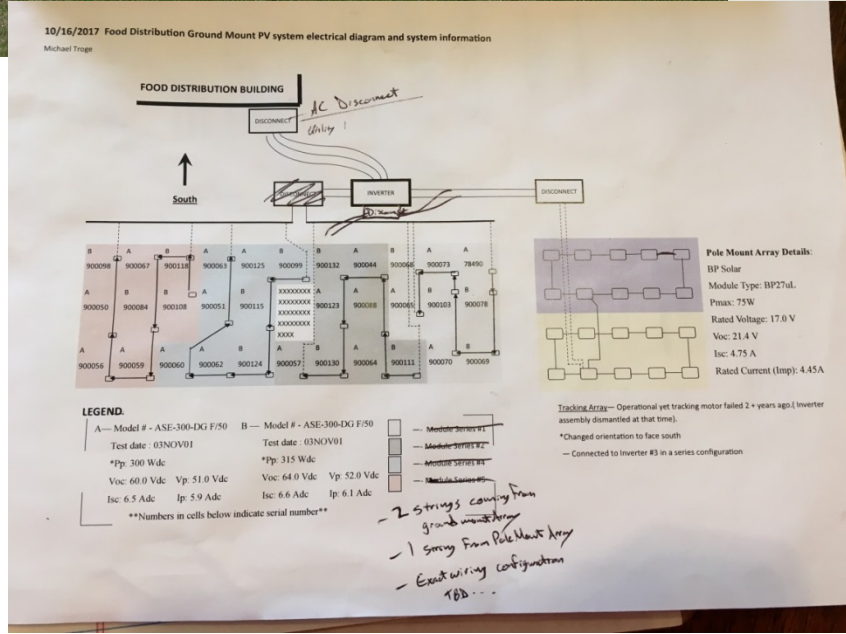
before

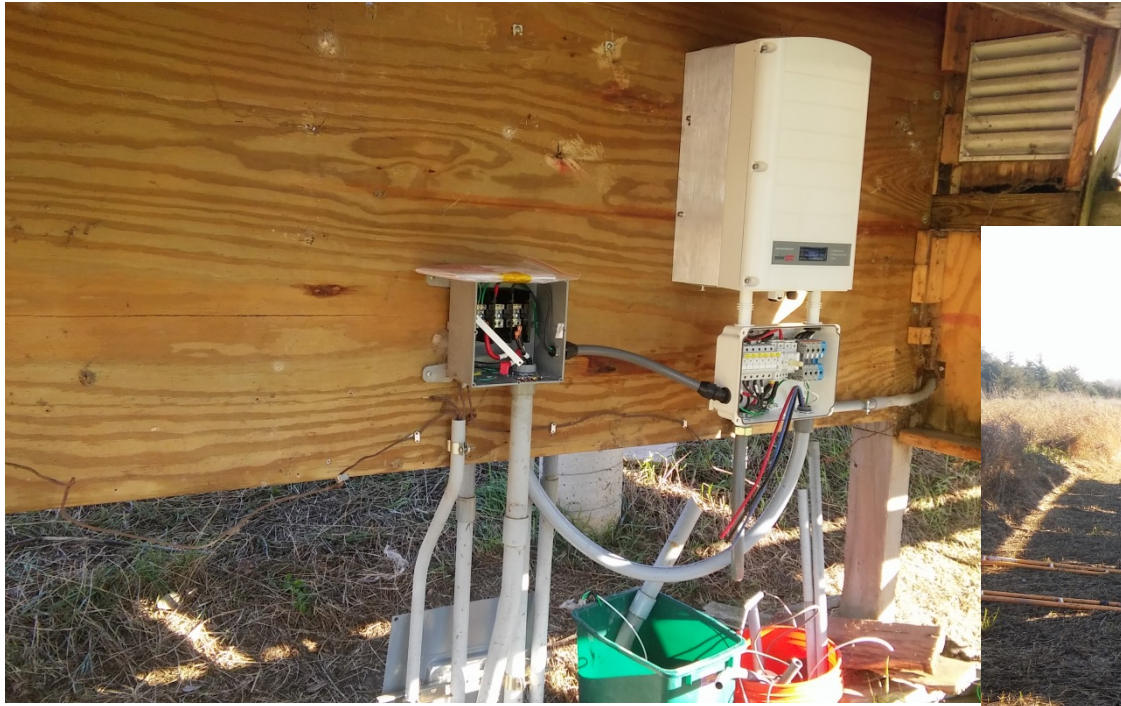


after



ELECTRICIAN TRAINING ON PV GROUND MOUNT





UPGRADING AN OLDER SYSTEM



CLASSROOM, SAFETY, STAGING,
SCAFFOLD, WIRING,
MC4 CONNECTORS,
OPTIMIZERS, INVERTERS,
DISCONNECTS, GROUNDING,
WIRE MGT, TESTING,
TROUBLESHOOTING,
DATA MONITORING



2017 CREWS

ONEIDA ELECTRICIANS,
ZONING, LABOR POOL,
CONTRACTORS,
TECHNICAL COLLEGE
STUDENTS





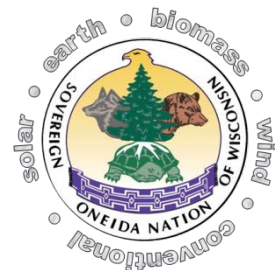
WEEKLY MEETINGS

ZONING, ELECTRICIANS
& CONTRACTORS WORK
SIDE BY SIDE



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



MTERA

- 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
- Executive Director on staff
- Looking for members

Yaw^ko!

Michael Troge
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Oneida Nation
PO Box 365
Oneida, WI 54155
mtroge@oneidanation.org
920-869-4572

