# Scaling up on Biomass:

# The Path to Zero Coal

November 2017

Facilities Management
The University of Iowa

- How much energy does UI use?
- What is District Energy / Combined Heat and Power?
- What are the sources of energy at UI's Main Campus?
- Wind and Solar Power
- Path to Zero Coal

# UI Utilities

## Focused on Reliability

University of Iowa Hospitals & Clinics
University of Iowa Health Care

## Focused on Clean Energy


## Objectives

**40% of campus energy from renewable sources by 2020**

**Zero coal by 2025**

# How much energy does the UI consume compared to my house?

- UI annual energy use is equal to:
  - 3,500 homes
  - 35,000 homes
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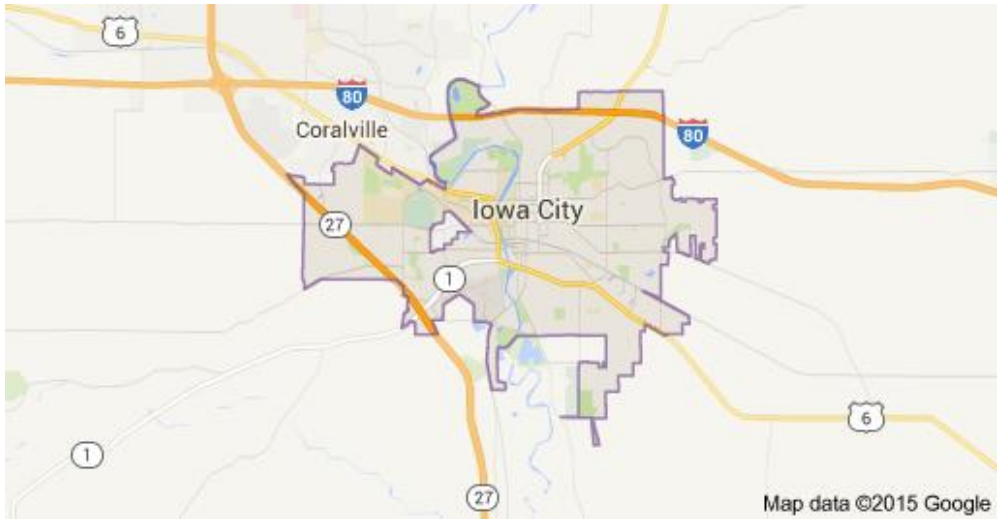
# Annual energy use at UI is …



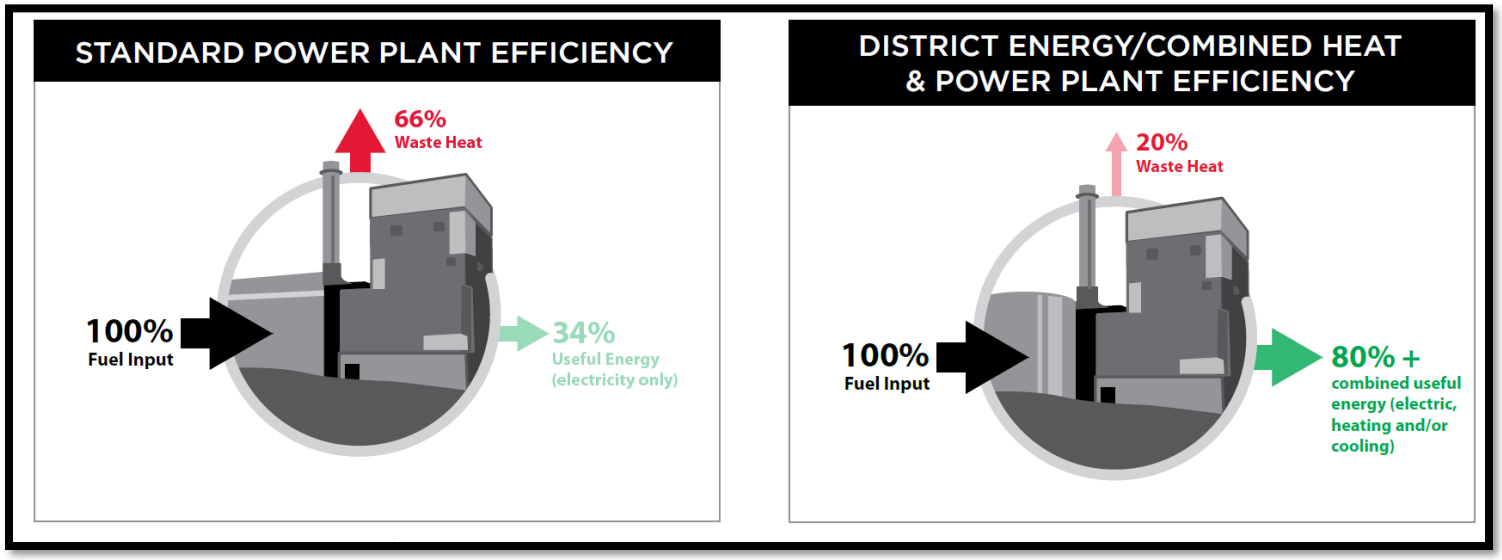

As much energy use as all of the homes in Iowa City

Unlike most homes, UI depends on steam to heat and cool its buildings, and for processes like sterilization

Steam is also used to generate some of our electricity. This system is called “Combined Heat and Power”

# Combined Heat & Power and District Energy Systems

- What is District Energy?




Source: IDEA Website/Smarttools

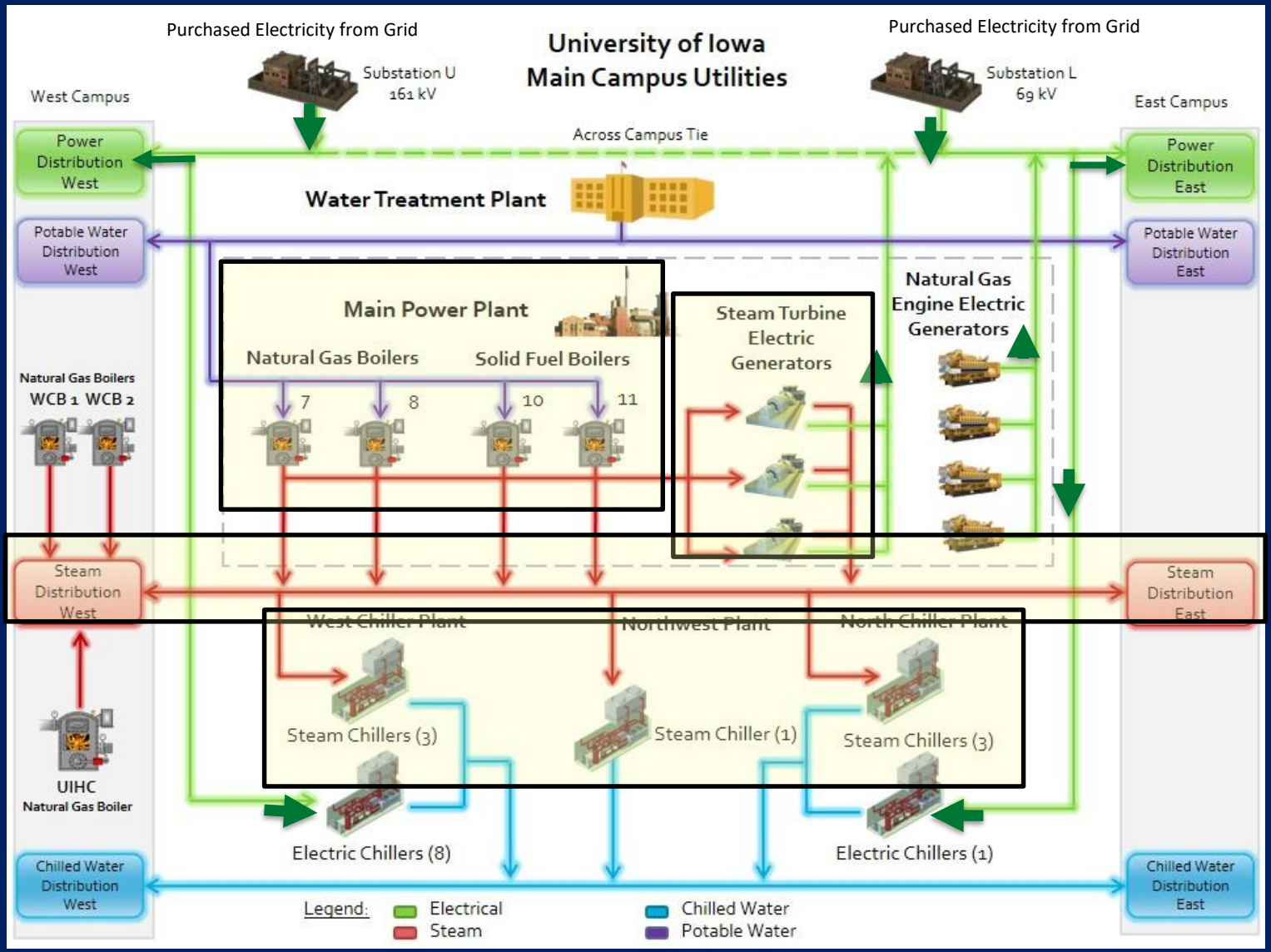
# UI Combined Heat & Power Overview

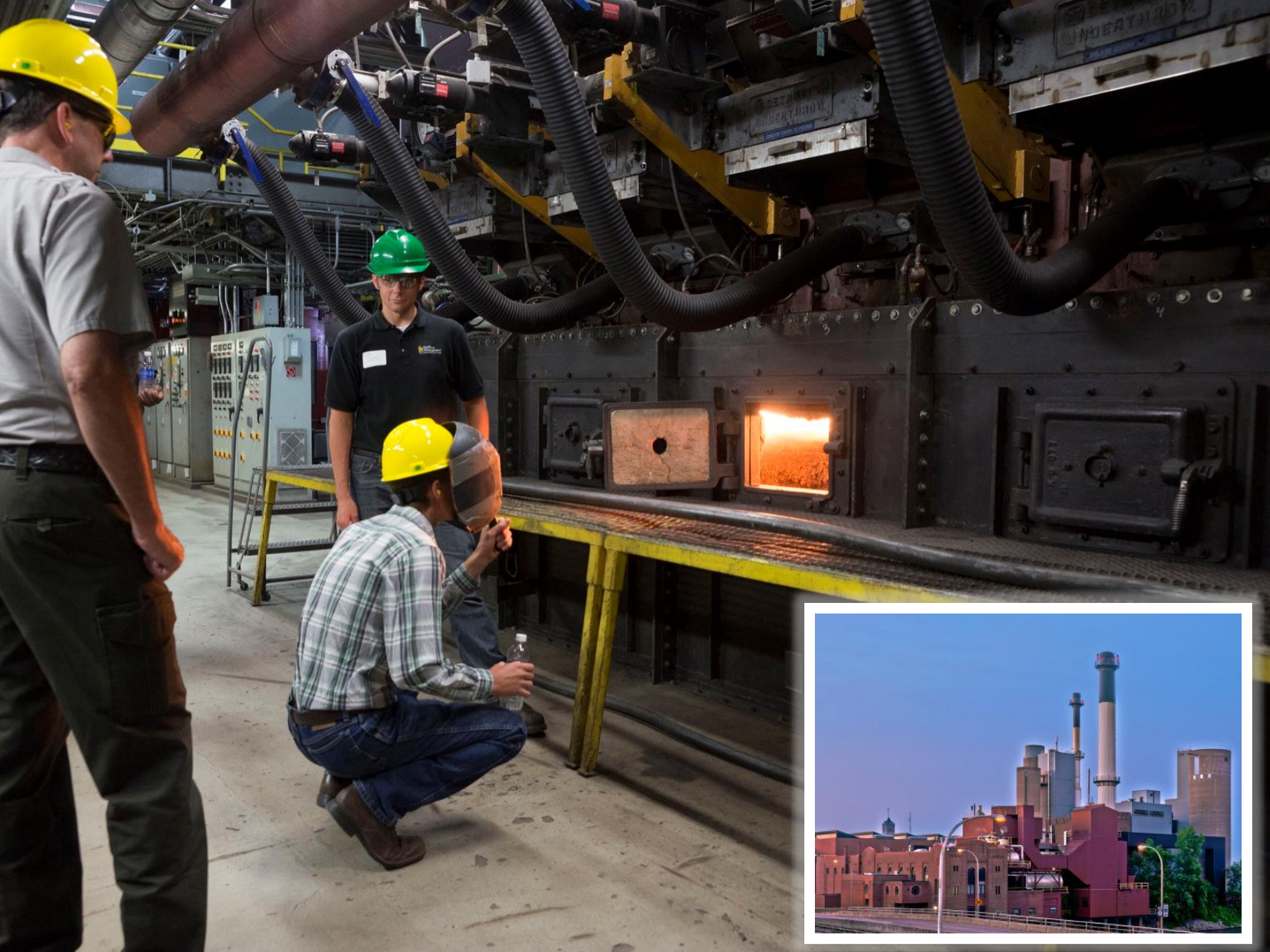
Boilers combust fuels to make steam

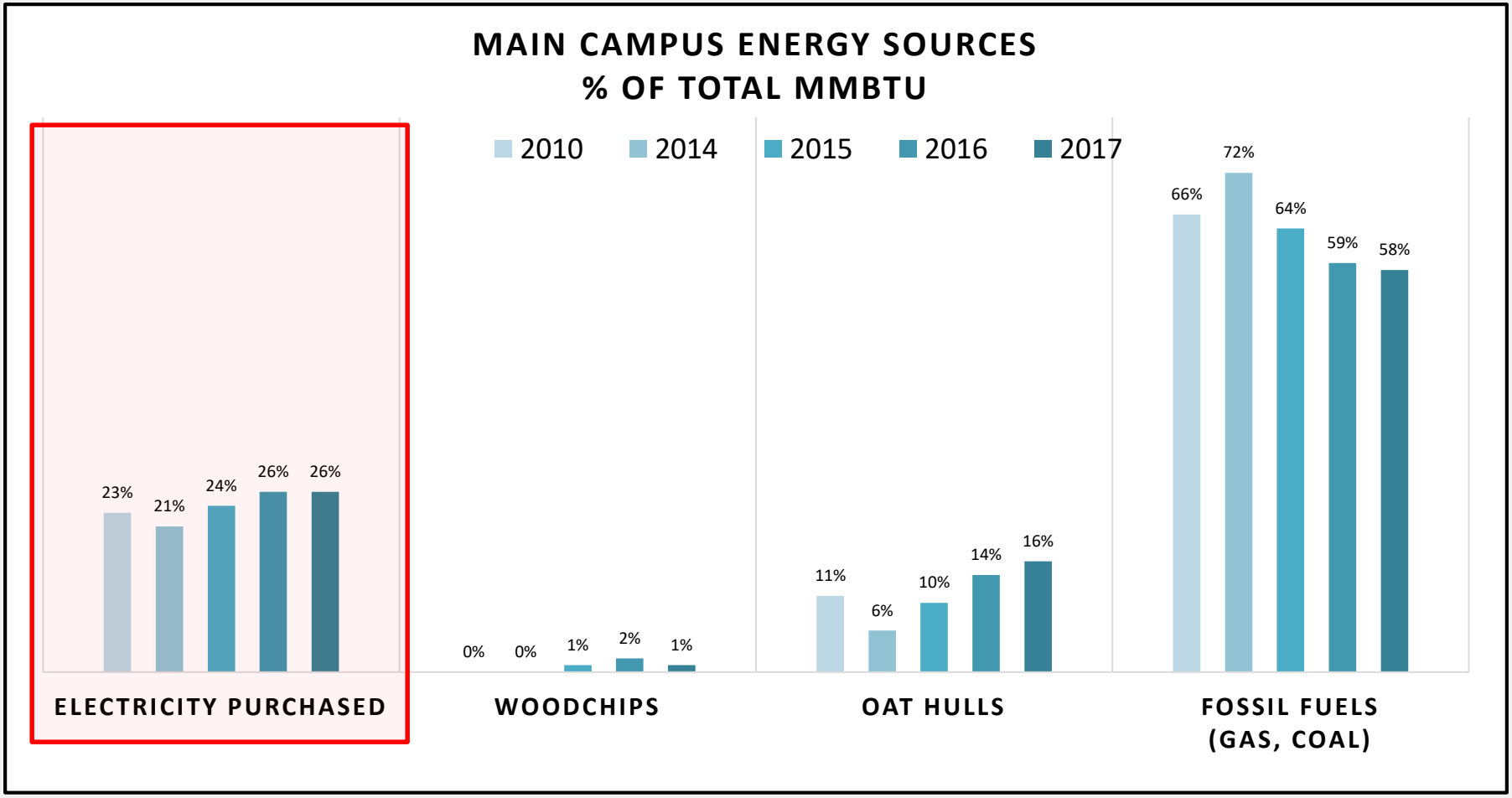
Steam passes thru turbines to make electricity

Steam delivered to campus, to heat buildings

Steam also goes to the chiller plants, to cool buildings







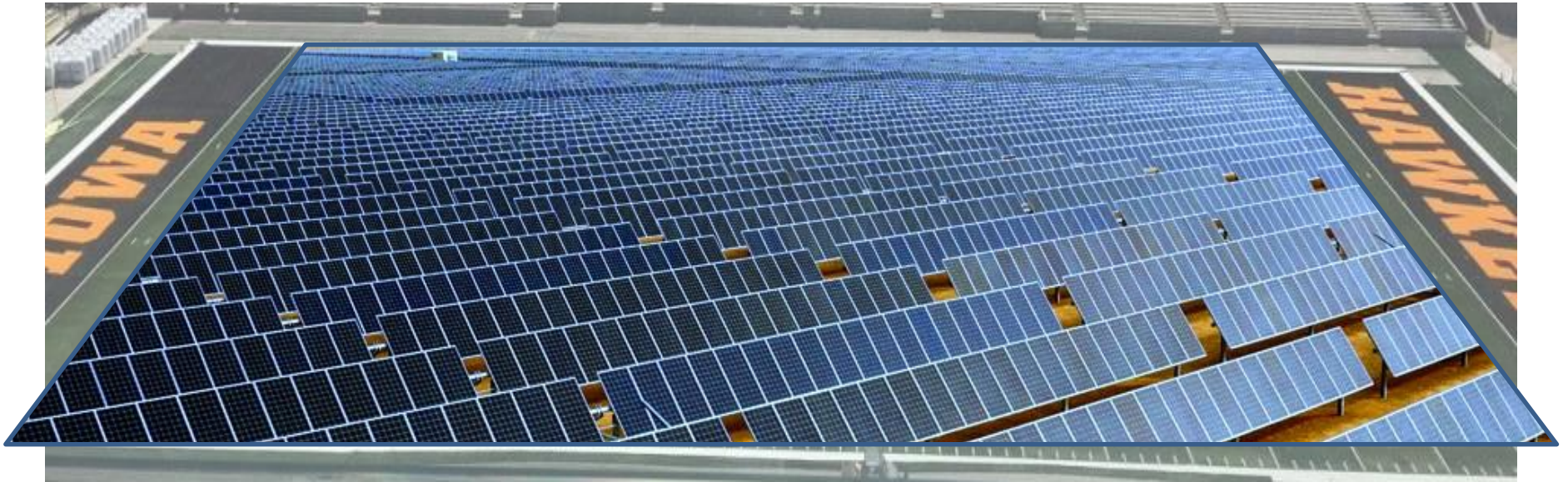

- On Main Campus, UI can generate about a third of its electricity, rest is purchased from MidAmerican Energy
- Purchased electricity accounts for about 25% of total energy use

# Electricity: why not convert to solar?

Purchased electricity demand at UI: ~29 megawatts (29 million watts)

Imagine the field at Kinnick Stadium completely covered with solar panels:

**To generate 29 megawatts of electricity how many stadiums would we need to fill?**

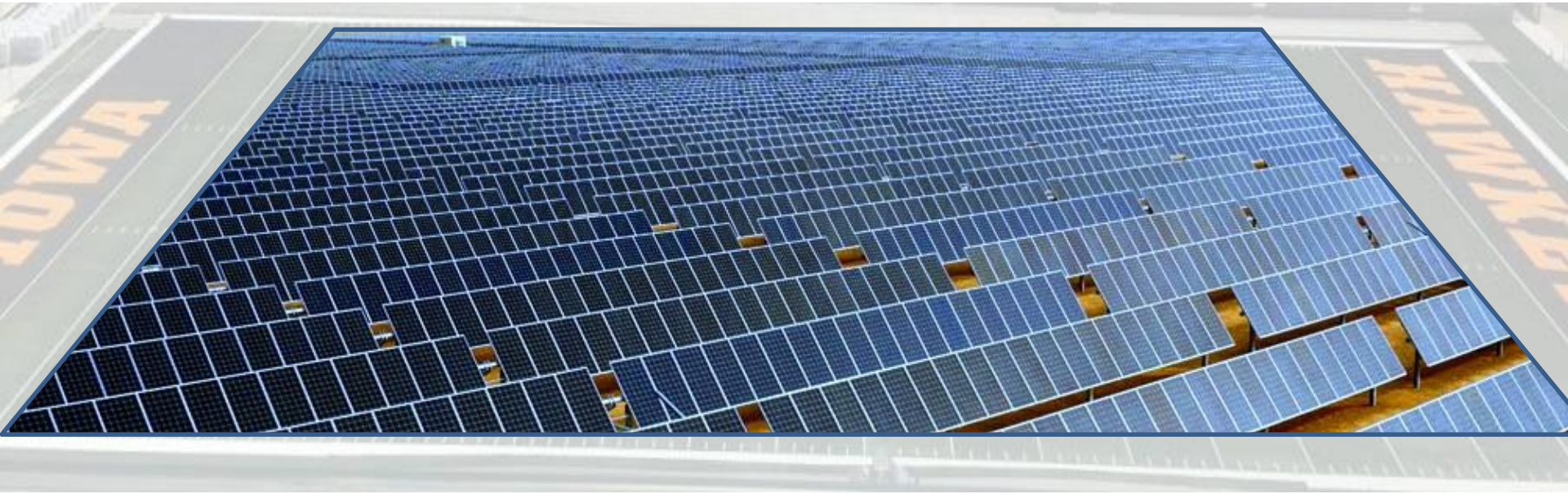


# Answer:

You'd need to fill the equivalent of 200 Kinnick Stadiums with solar panels to replace UI's purchased electricity.

Ground-mount solar projects require 6-8 acres per megawatt of generation

UI campus does not have enough open space to install a ground-mount solar project



# Rooftop Solar

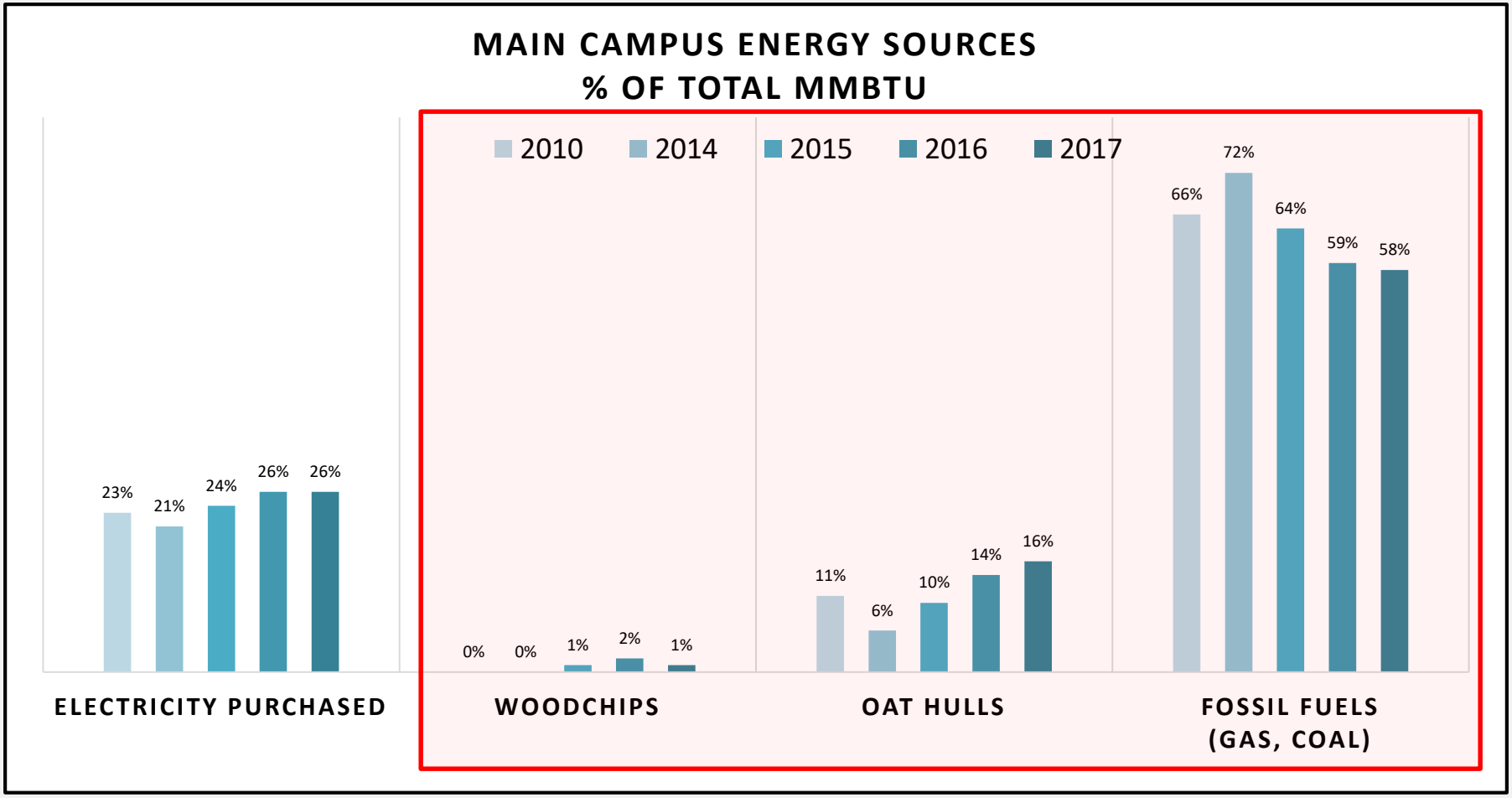
Generating 29 megawatts would require 3.6 million square feet of unshaded roof area

Solar panels on every campus rooftop would provide only 12.8% of the electricity needs for the UI campus

Solar power is intermittent, does not displace coal

# What about wind?

- To replace the purchased electricity, we'd need more than 30 large wind turbines and 7,000 acres of open land
- Housing density and zoning rules in Johnson County do not permit large wind turbines
- Windpower is intermittent, does not displace coal



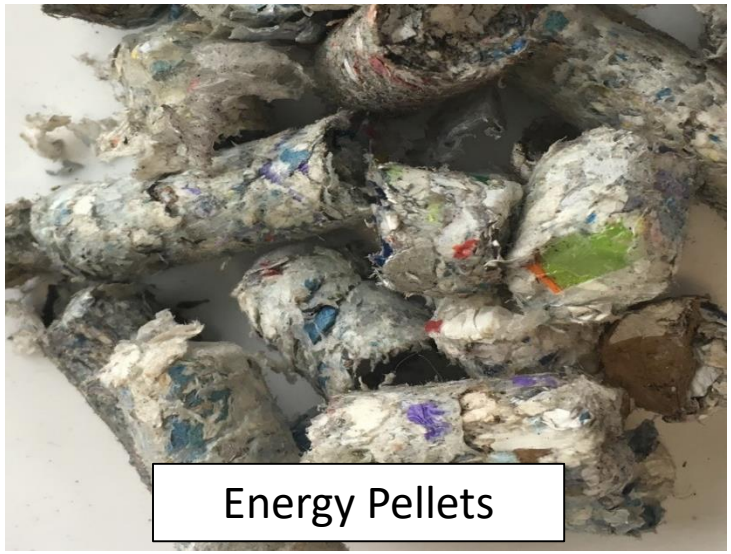

- Production of steam makes up the balance of campus energy use
- UI combusts coal, gas, biomass, and alternative fuels to make steam

# The Path to Zero Coal:

# Biomass and other Alternative Fuels

- Biomass = fuel developed from readily-replenished organic materials
- Biomass and alternative fuels can be used to supply steam to heat and cool our buildings
- Compatible with UI's existing facilities, does not require significant up-front capital
- Contributes to reliability and energy security

# Current Alternatives to Coal






# Miscanthus Grass

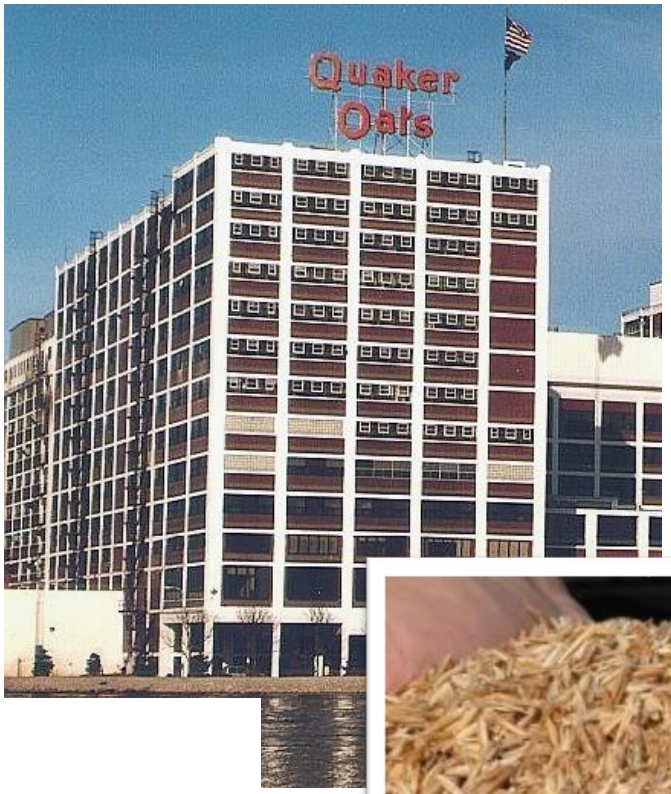
- Crop selected & managed in partnership with Iowa State University & AgGrow Tech
- Provides long-term, stable income to Iowa's growers
- Over 800 acres planted since 2013
- Each acre can displace ~4 tons of coal

**Looking ahead:**

- Increase bulk density to reduce cost of storage and trucking
- Trials to blend miscanthus into Energy Pellets
- Continue planting to reach target of 2,500 acres

# Oat Hulls

- Introduced ~2003
- Public-private collaboration created a new market for previously-discarded materials
- Displaces roughly 1,000 truckloads of coal per year




**Looking Ahead:**

Maintain collaborative relationship with Quaker Oats to secure stable supply

# Energy Pellets

- Cost-competitive and similar heat value as stoker coal.
- Significant improvement in CO2 emissions vs. coal
- Made from non-recyclable manufacturing by-products
- Diverts materials from landfills
- Job creation:  UI plans to attract pellet suppliers to locate in eastern Iowa

**Looking ahead:**
Expand usage of pellets to BLR 11

Develop a miscanthus-blend pellet

# Woody Biomass

- Consume ~ 2,200 tons annually from used pallets
- Evaluating urban wood waste (Emerald Ash Borer trees and ongoing routine timber management)
- In Iowa: 52 million woodland ash and 3.1 million community ash trees
- Our conveyor system not compatible with standard “mulch grind”. We need ¼” microchip format to capitalize on Iowa’s timber resources

**Looking ahead:**

Possible microchipper pilot project to process EAB trees

# We are Focused on Sustainability

Fossil Fuels usage down 12% (2010 to 2017, by MMBTU)

Coal usage down 61% (2010 to 2017, by MMBTU)

Greenhouse Gas emissions down 17% (2015 to 2016)

By 2020, coal is expected to be ~ 10% of our fuel mix

By 2025, our target is **zero coal** use on campus