

Red Light, Green Light

Obstacles and Successes of Recent District Energy Systems with CHP



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Henry Johnstone, GLHN Architect and
Engineers

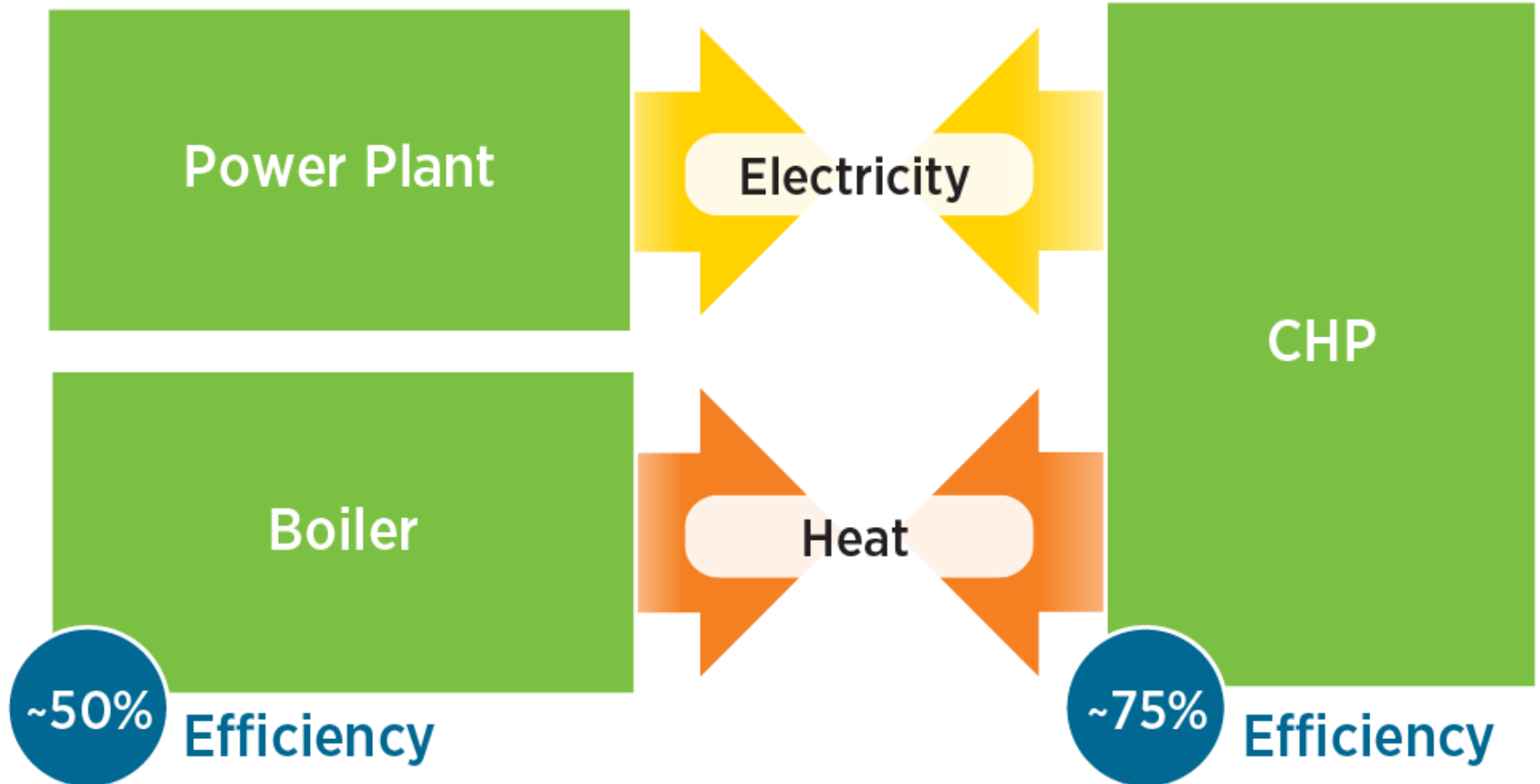
CHP at Universities

- **Benefits and obstacles to CHP implementation**
- **Key factors in evaluating CHP for campus districts**
- **Examples**

CHP Saves Energy

Traditional System

CHP System



CHP Benefits to Campuses

- **Energy efficiency**
- **Cost Savings**
- **Reliability**
- **Sustainability**

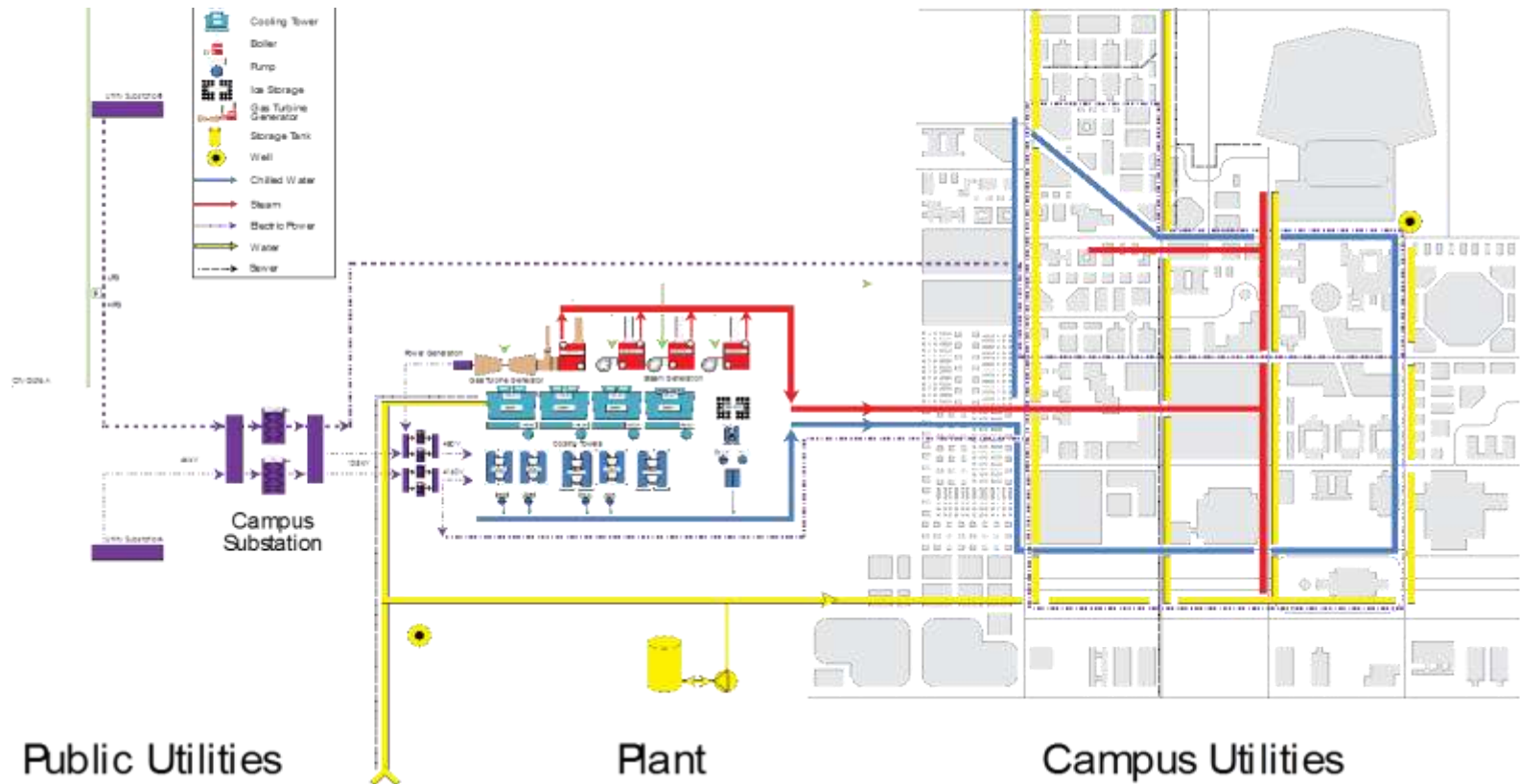
Potential Obstacles

- Commitment: long term capital investment
- High cost: equipment, infrastructure
- Change: operation, maintenance, management
- Resistance: utility and regulatory statutes
- Risk and instability: energy, availability
- Unclear benefits: projecting and articulating benefits

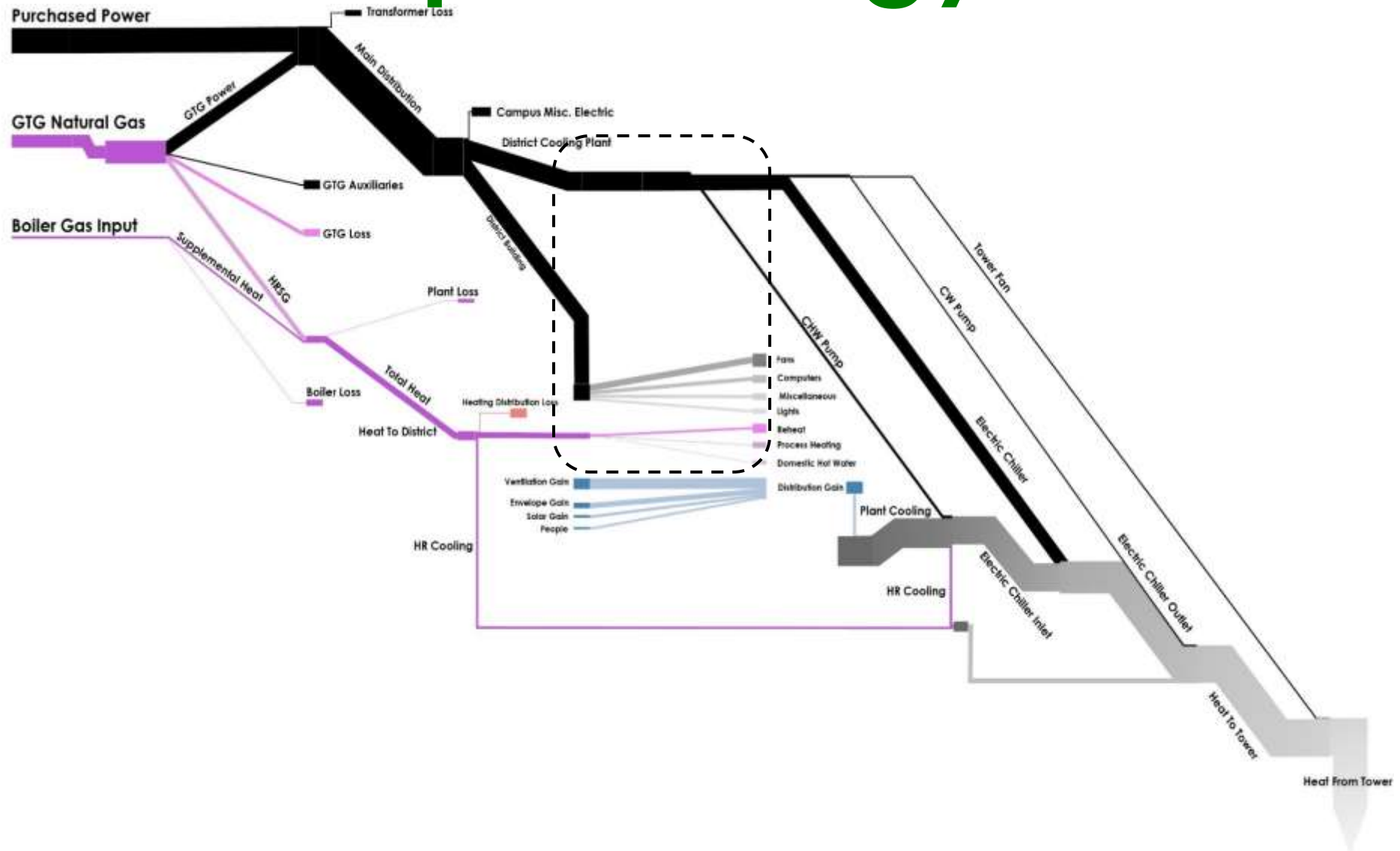


Campus Trends

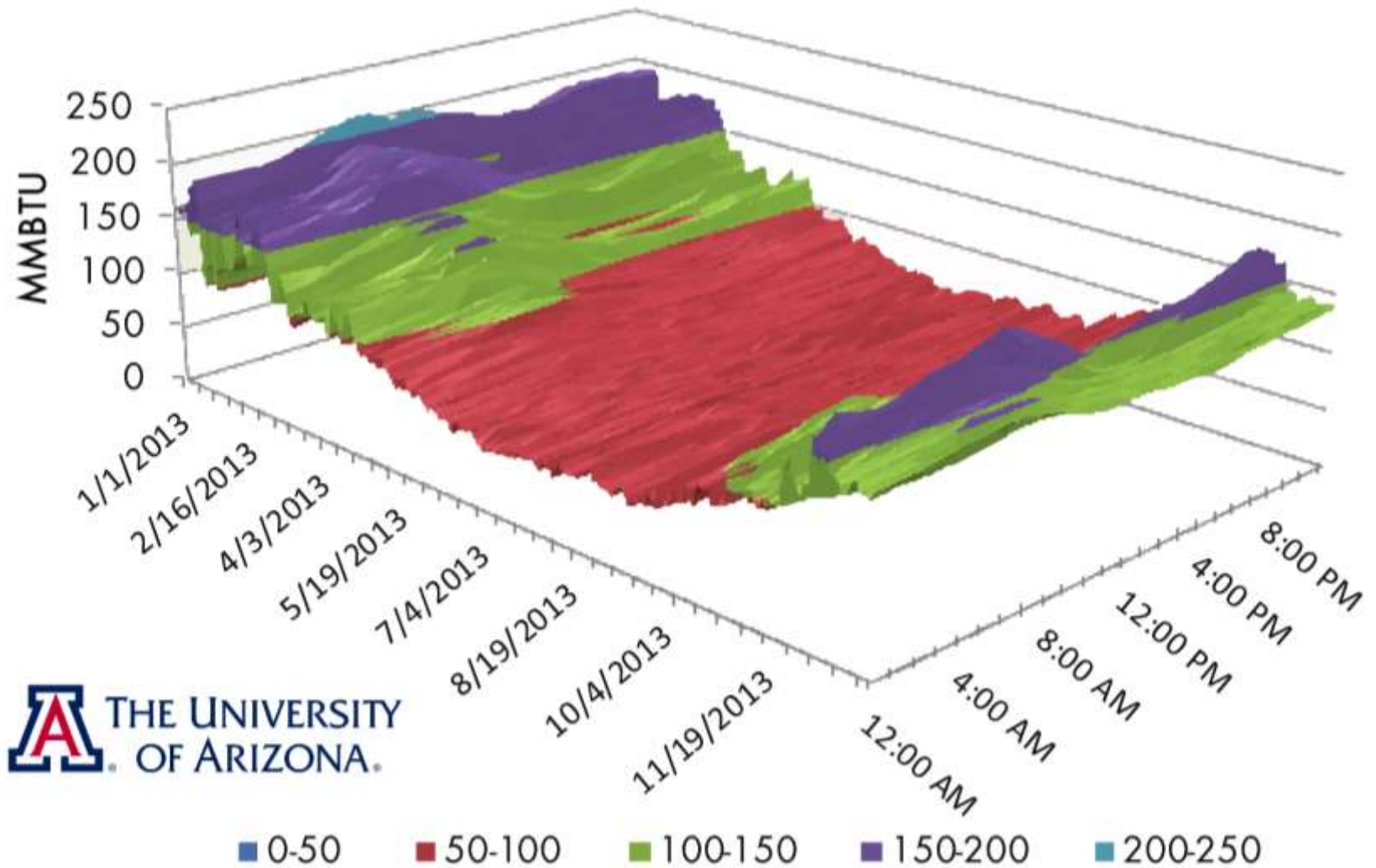
- Operating Budget Pressure
- Total Cost of Ownership



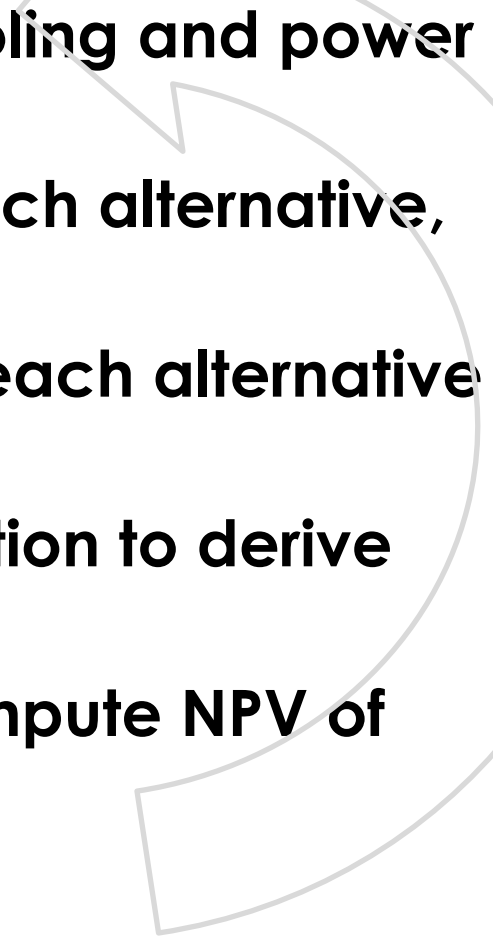
Campus Energy Flow



Campus Energy Consumption



Evaluation of DE with CHP

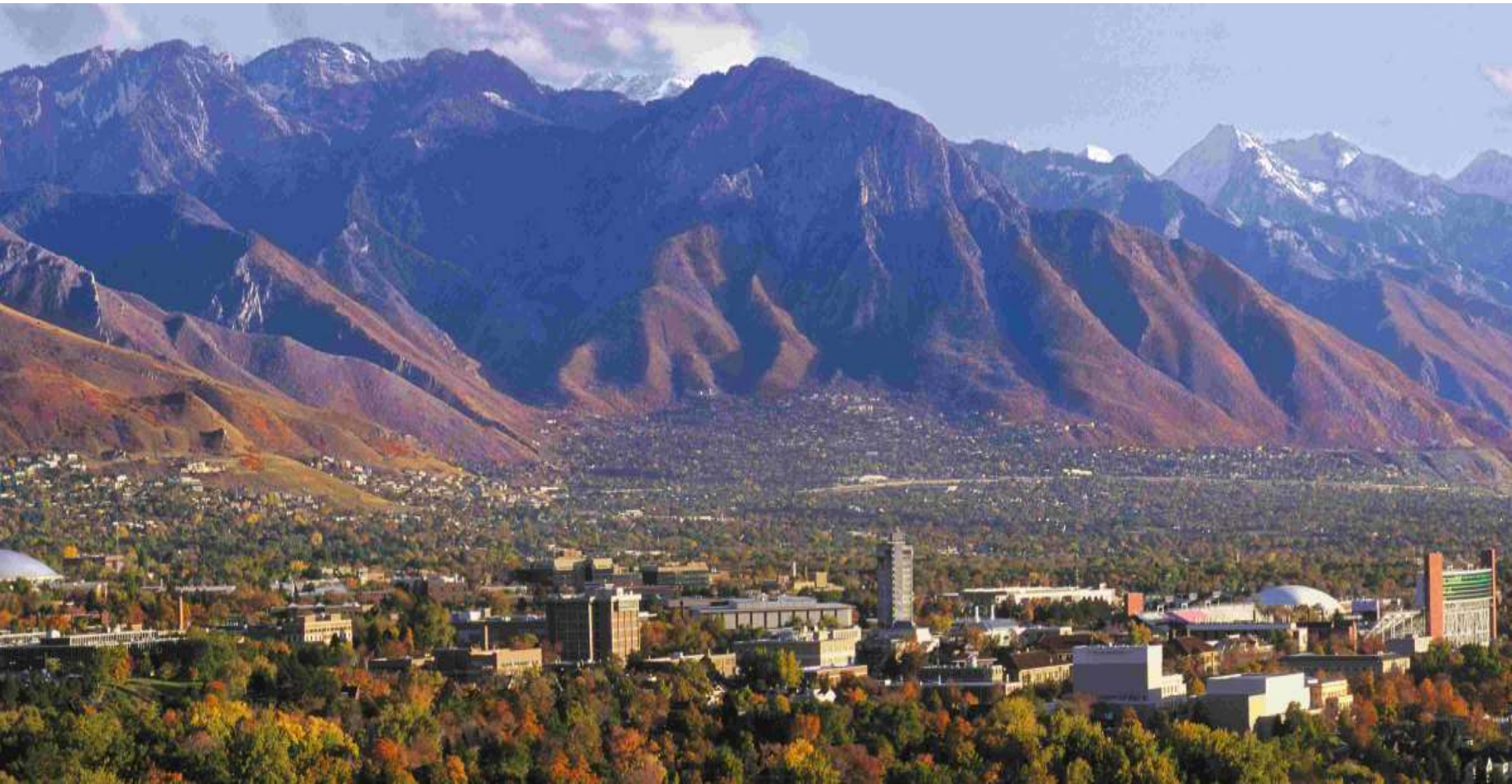
1. Estimate district hourly heating, cooling and power loads
 2. Compute hourly cost to operate each alternative, sum to annual operating expense
 3. Estimate yearly costs to construct each alternative based on build out schedule
 4. Compute debt service on construction to derive annual capital expense
 5. Tabulate annual cash flow and compute NPV of alternatives
 6. Identify lowest Net Present Value
 7. Test sensitivity of primary cost inputs
- 

University of Arizona - Tucson



- Operates continuously
- CHP output of 11 MW against campus peak of 40MW
- Meets baseload steam demand of 50,000 lb/hr in summer months

University of Utah



University of Utah CHP System: Quick Facts

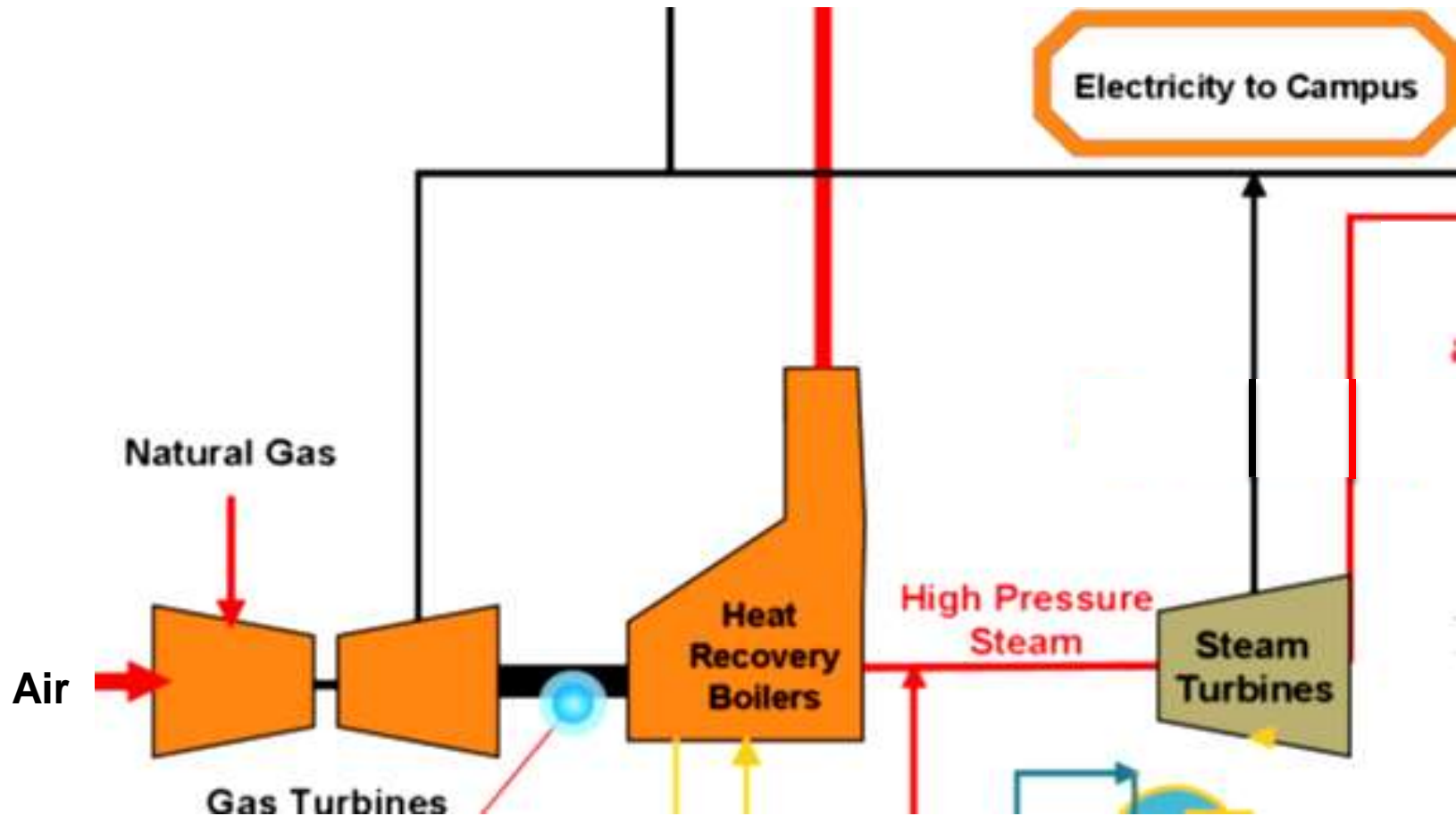
- CHP output of 6.5 MW; meets baseload hot water demand
- Reduces energy costs by ~\$1.2 million/yr
- Reduces campus CO₂ emissions by ~48,000 tons per



University of Texas - Austin



UT-Austin CHP System



UT-Austin CHP System



UT-Austin CHP System: Quick Facts

- **Functions as a microgrid**
- **50 MW campus peak demand**
- **Only 3 CHP system outages in 40 years, reliability of 99.9998%**
- **Energy cost savings of \$4.8 million/year**
- **CO₂ emissions cut by 140,000 tons/year**

Elements of Success

- **Timing of DE-CHP investment**
- **Align with campus goals**
- **Favorable energy prices**
- **Trained staff or use third-party**

Thank You

Henry Johnstone

GLHN A&E

hjohnsto@glhn.com

520-881-4546

www.glhn.com



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CHP Technical Assistance for College Campuses

Neil Kolwey

U.S. DOE Southwest CHP TAP

IDEA Campus Energy Conference 2015

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CHP Technical Assistance Partnerships

SOUTHWEST

DOE CHP Technical Assistance Partnerships (CHP TAPs)

NORTHWEST www.northwestCHPTAP.org

Dave Sjoding
Washington State University
360-956-2004
sjodingd@energy.wsu.edu

MIDWEST www.midwestCHPTAP.org

John Cuttica
University of Illinois at Chicago
312-996-4382
cuttica@uic.edu

Cliff Haefke
University of Illinois at Chicago
312-355-3476
chaefkl@uic.edu

NORTHEAST www.northeastCHPTAP.org

Tom Bourgeois
Pace University
914-422-4013
tbourgeois@law.pace.edu

Beka Kosanovic
University of Massachusetts Amherst
413-545-0684
kosanovi@ecs.umass.edu

PACIFIC www.pacificCHPTAP.org

Jack Clark
Center for Sustainable Energy
858-244-1187
jack.clark@energycenter.org

Gene Kogan
Center for Sustainable Energy
858-633-8561
gene.kogan@energycenter.org

MID-ATLANTIC www.midatlanticCHPTAP.org

Jim Freihaut
The Pennsylvania State University
814-863-0083
jdf11@psu.edu

SOUTHWEST www.southwestCHPTAP.org

Christine Brinker
Southwest Energy Efficiency Project
720-939-8333
cbrinker@swenergy.org

SOUTHEAST www.southeastCHPTAP.org

Isaac Panzarella
North Carolina State University
919-515-0354
ipanzarella@ncsu.edu

DOE CHP Technical Assistance Partnerships (TAPs): Program Contacts

Claudia Tighe
CHP Deployment Lead
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
Phone: 202-287-1899
E-mail: claudia.tighe@ee.doe.gov

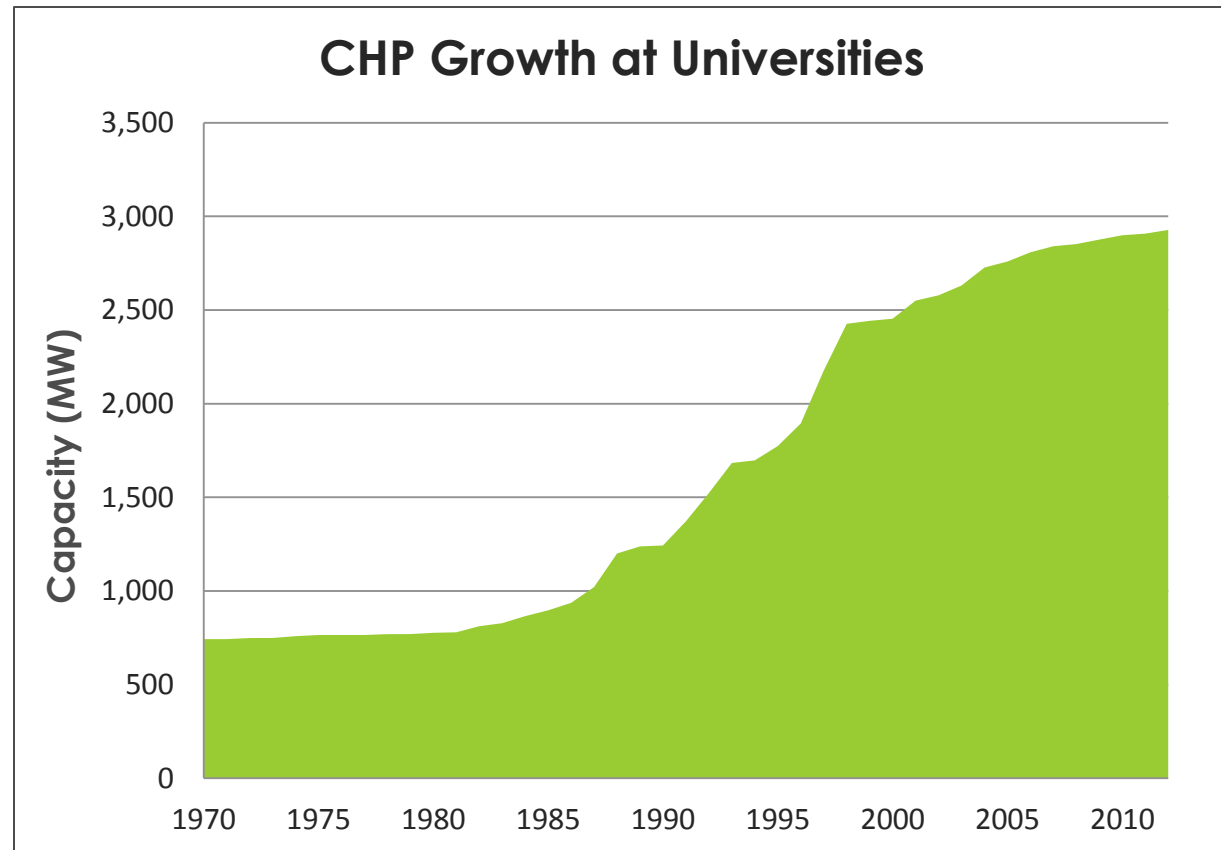
Jamey Evans
Project Officer, Golden Field Office
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
Phone: 720-356-1536
E-mail: jamey.evans@go.doe.gov

Patti Welesko Garland
CHP Technical Support Coordinator
Oak Ridge National Laboratory
Supporting, Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
Phone: 202-586-3753
E-mail: garlandpw@ornl.gov

Ted Bronson
DOE CHP TAPs Coordinator
Power Equipment Associates
Supporting, Office of Energy Efficiency and Renewable Energy
Phone: 630-248-8778
E-mail: tbronsonpea@aol.com

CHP at Universities

- **285 universities have CHP (2930 MW)**
- **Represents 3.6% of total installed CHP capacity in the U.S.**



CHP Benefits to Campuses

- Efficiency
- Cost Savings
- Reliability
- Sustainability

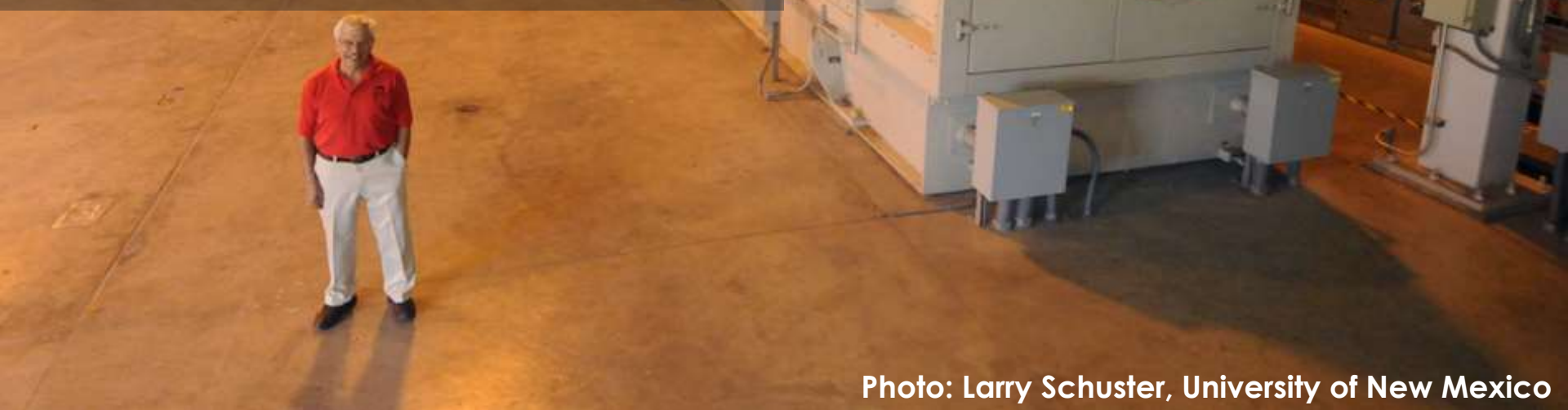


Photo: Larry Schuster, University of New Mexico



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CHP Energy and CO₂ Savings Potential

Category	10 MW CHP	10 MW PV	10 MW Wind
Annual Capacity Factor	85%	22%	34%
Annual Electricity	74,446 MWh	19,272 MWh	29,784 MWh
Annual Useful Heat	103,417 MWh _t	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft
Capital Cost	\$20 million	\$60.5 million	\$24.4 million
Annual Energy Savings	308,100 MMBtu	196,462 MMBtu	303,623 MMBtu
Annual CO ₂ Savings	42,751 Tons	17,887 Tons	27,644 Tons

Source: DOE, "Combined Heat and Power: A Clean Energy Solution," 2012

CHP Technical Assistance Partnerships

- **Market Opportunity Analysis**

Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors

- **Education and Outreach**

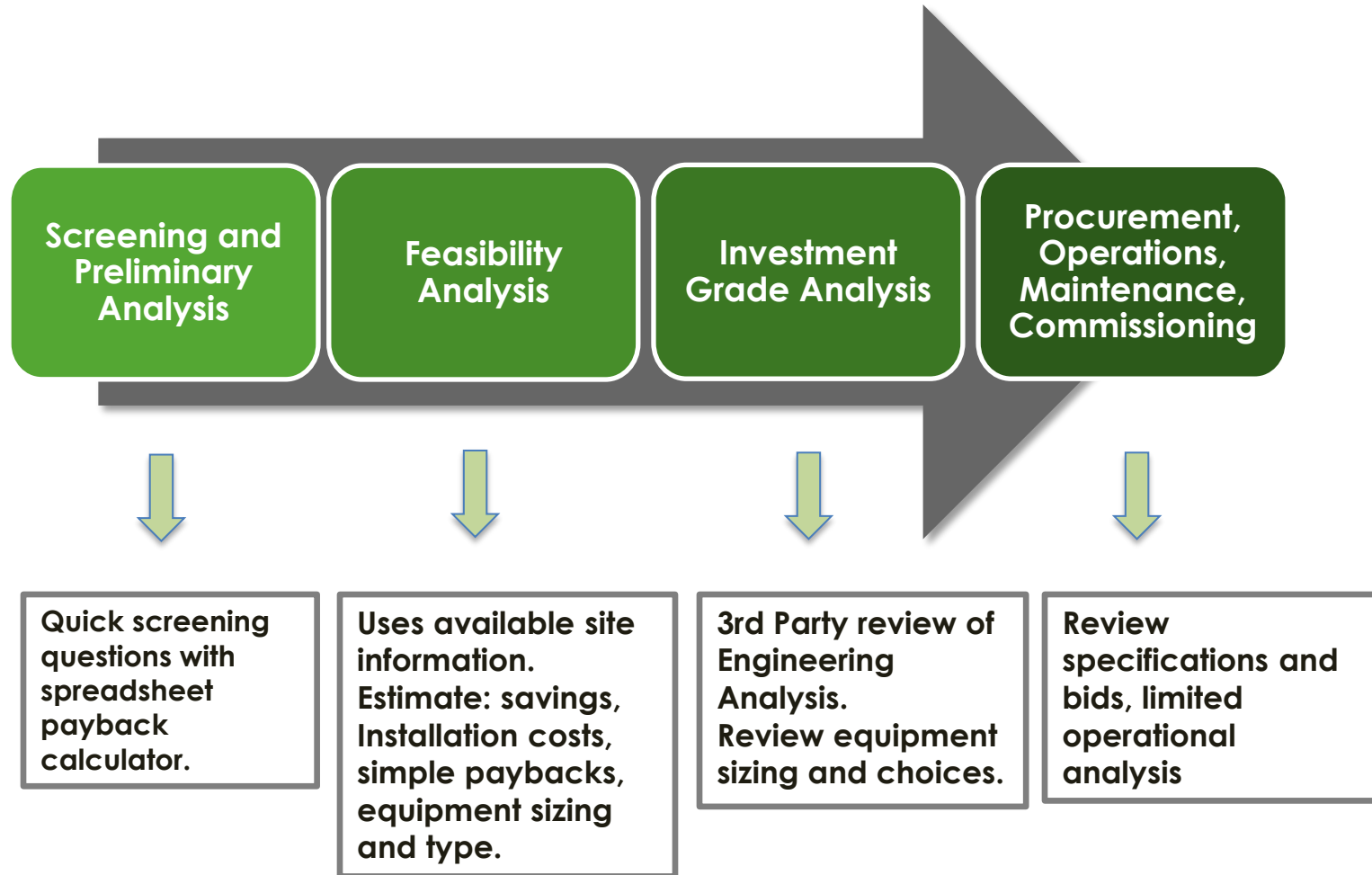
Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

- **Technical Assistance**

Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy with CHP in their facility and to help them through the development process from initial CHP screening to installation.



CHP TAP Technical Assistance



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CHP Technical Assistance Partnerships

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Thank You

Please Visit Our Booth

Neil Kolwey
U.S. DOE Southwest CHP TAP
nkolwey@swenergy.org
303-499-0213
www.southwestchptap.org

Christine Brinker, Director
U.S. DOE Southwest CHP TAP
cbrinker@swenergy.org
720-939-8333
www.southwestchptap.org



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