CHP Case Study: Columbus, GA

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Presented at

Workshop: CHP and Bioenergy for Landfills and Wastewater Treatment Plants

Salt Lake City – August 11, 2005

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Presentation Overview

- New Columbus Biosolids Flow-Through Thermophilic Treatment (CBFT^3) Class-A Digestion Process
- Use of Innovative ARES Engines for CHP
- Planned Gas Treatment

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Investigation Complete; Detailed Design Starting Soon

- 3-year sludge investigation finished in fall 2004
- Tour of ARES manufacturers and installations and Argonne National Laboratory in May 2005
- Class-A Letter from EPA and Patent received in July 2005
- Design planned to start this fall.

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CBFT^3 Process Overview

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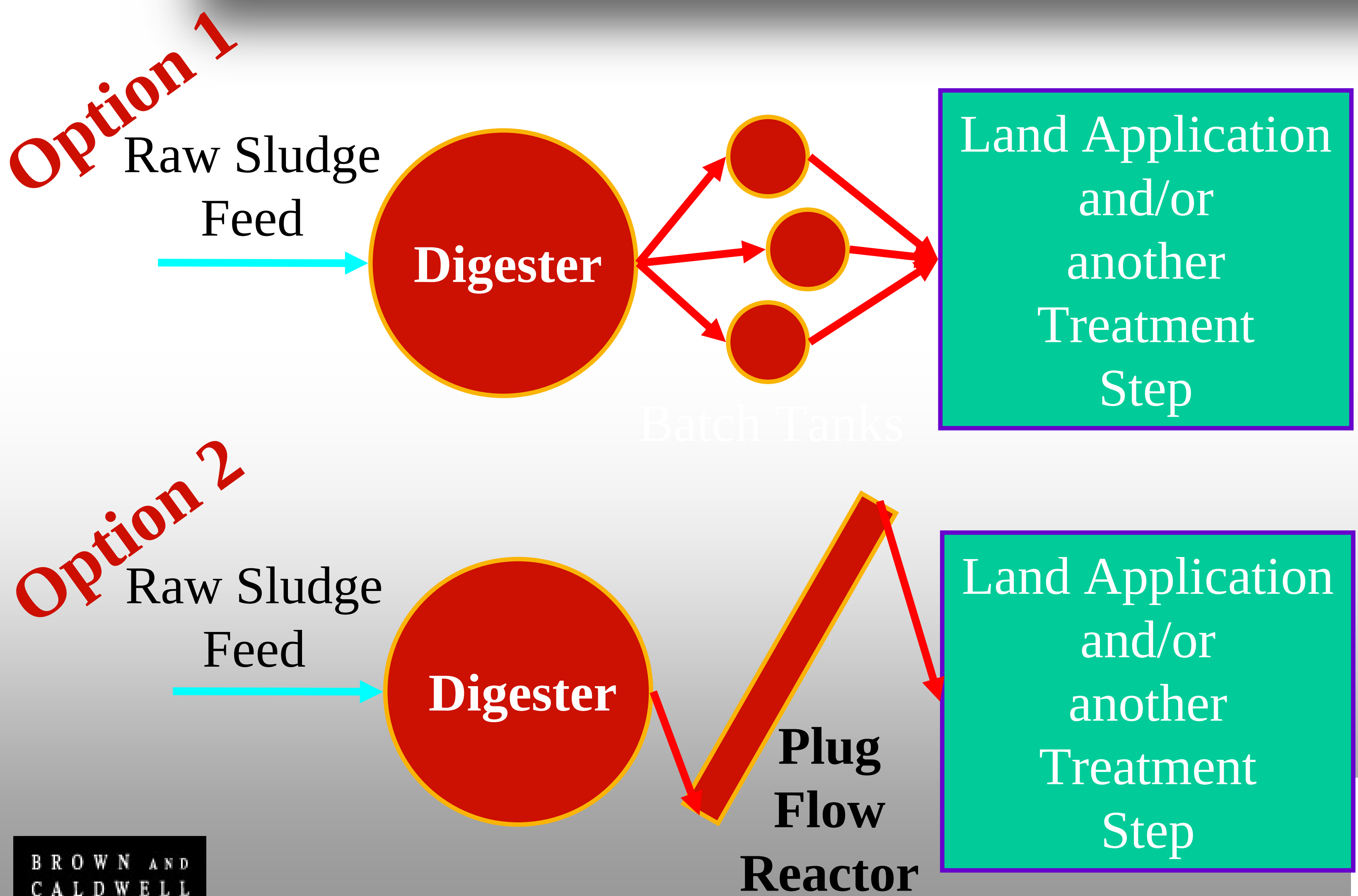
CBFT^3 is a CFMD Followed by a 30-Minute Contact Time



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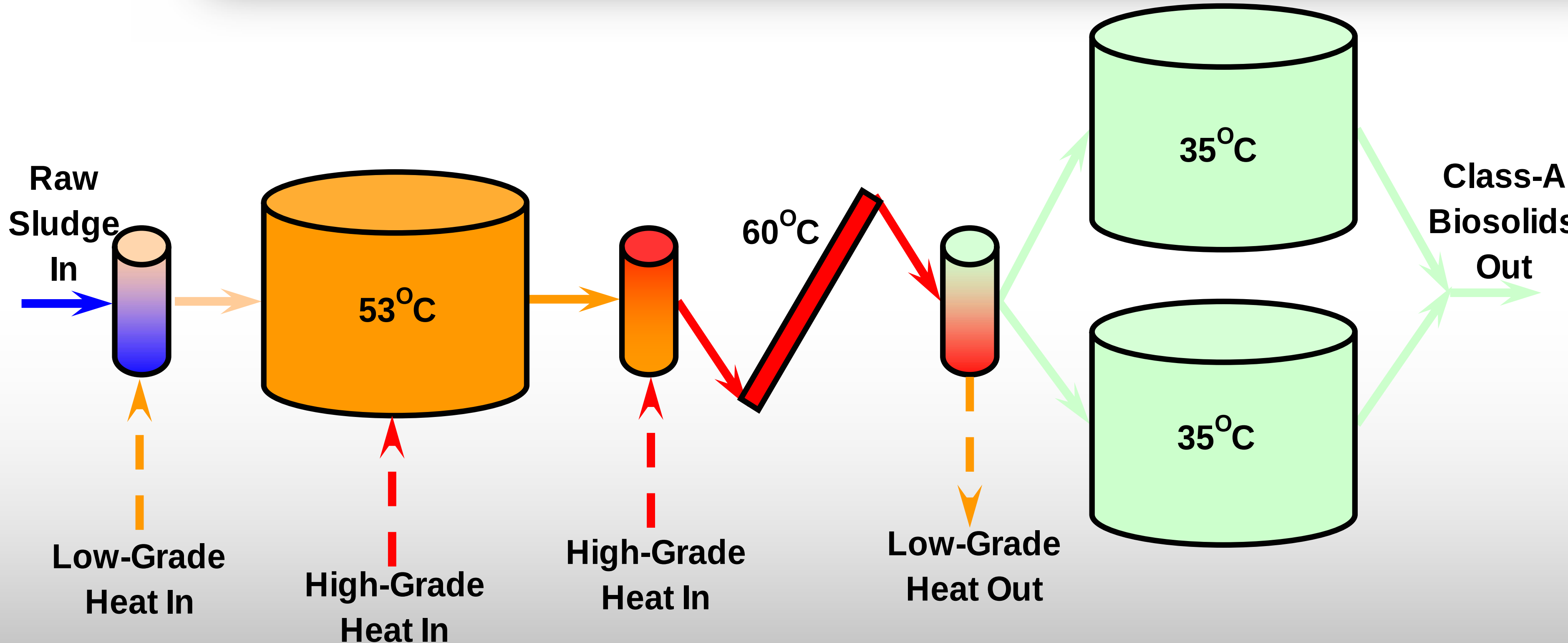
Heat Requirements for the Process



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Use of ARES for CHP

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ARES Program Overview

- Combined program sponsored by
  - US-DOE & National Labs
  - Caterpillar (2MW)
  - Cummins (1MW)
  - Waukesha (1MW)
- Goal of improved engine efficiencies and emissions as follows:
  - 44% BTE and <0.5 g/BHP NOx by 2004
  - 47% BTE and <0.1 g/BHP NOx by 2007
  - 50% BTE and <0.1 g/BHP NOx by 2010

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Columbus would be First Use of ARES on Digester Gas

- Planned addition of 2 new 1-MW engines
  - Planned engines are more electrically efficient (~41%) compared to other lean burn options (~34%) – 20% more power!!
- Thermal efficiency of ~44% raises overall efficiency to ~85%
- Pursuing green power credits to offset capital investment and enhance payback

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Engines have Multiple Heat Sources to "Harness"

***Intercooler* – Small source of low-grade heat**

***Exhaust* – Largest source of highest-grade heat**

***Jacket Cooling* – Large source of higher-grade heat**

***Lube Oil* – Small source of low-grade heat**

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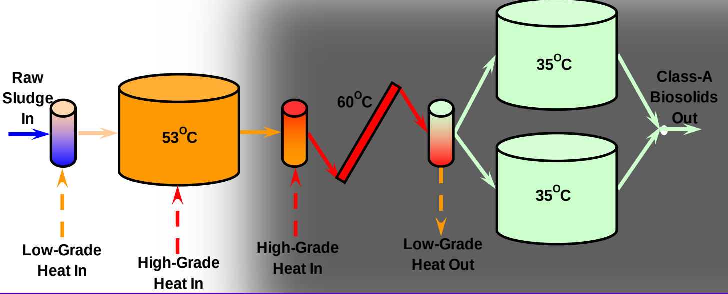
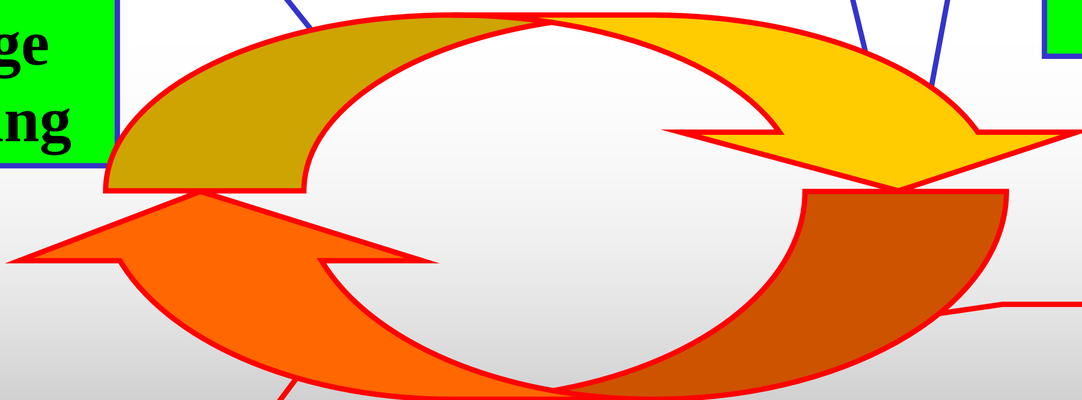
Low-Grade Heating Loop



Use heat for 35°C digestion if needed

Radiate excess heat for engine operation

Use heat for sludge pre-heating



Add heat from sludge cooling

Add lube oil cooling heat

Add intercooler heat

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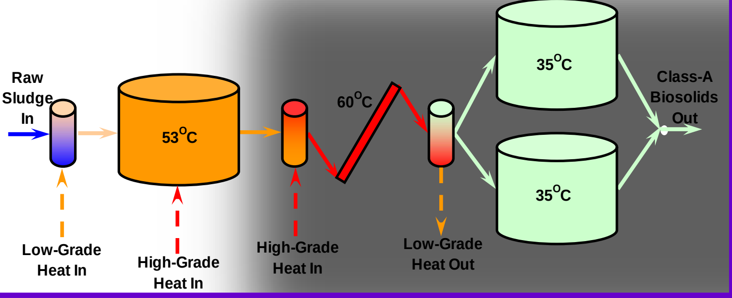
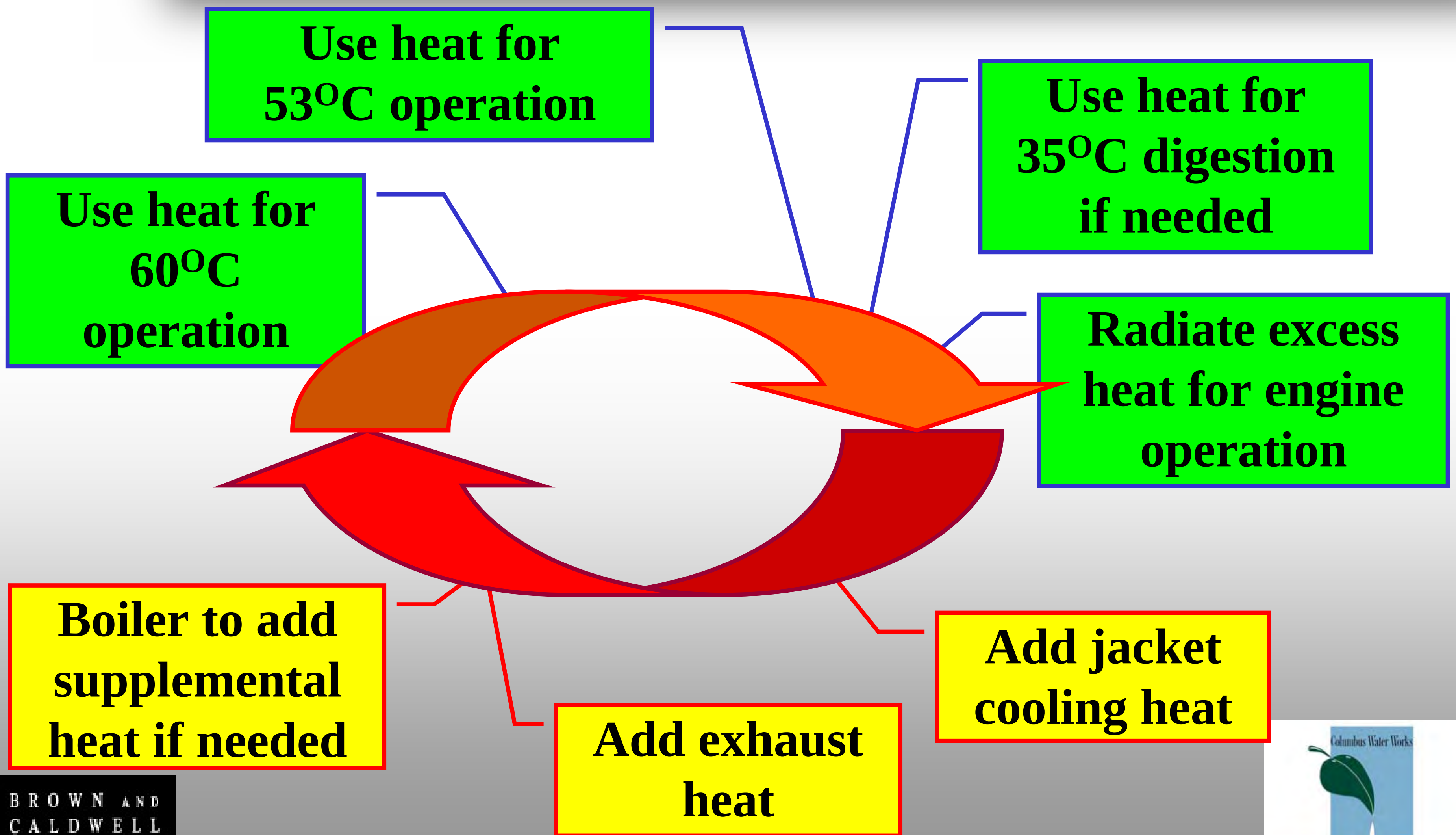


High-Grade Heating Loop



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Heat Balance is Complete without Supplemental Fuel

- At Columbus, heat recovered from engines and sludge cooling will fully heat process >99% of the time
- Variables include:
  - Ambient temperatures
  - Raw sewage/sludge temperatures
  - Thickening performance
  - Peak day loading

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Digester Gas Cleaning

Digester Gas is a Good Fuel

- More stable and higher BTU value that landfill gas
- Burns cooler with lower emissions (albeit with lower BTU value) than natural gas
- Contaminants must be addressed for reliable operation

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The Key to Success: Digester Gas Treatment

- Digester gas contains water, hydrogen sulfide (H_2S), and siloxanes
- Water is removed by cooling the gas
- H_2S can be removed by an iron sponge
- Siloxanes are a newer problem.
- Removing the water, H_2S, and siloxanes reduces maintenance

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Siloxane Build-up

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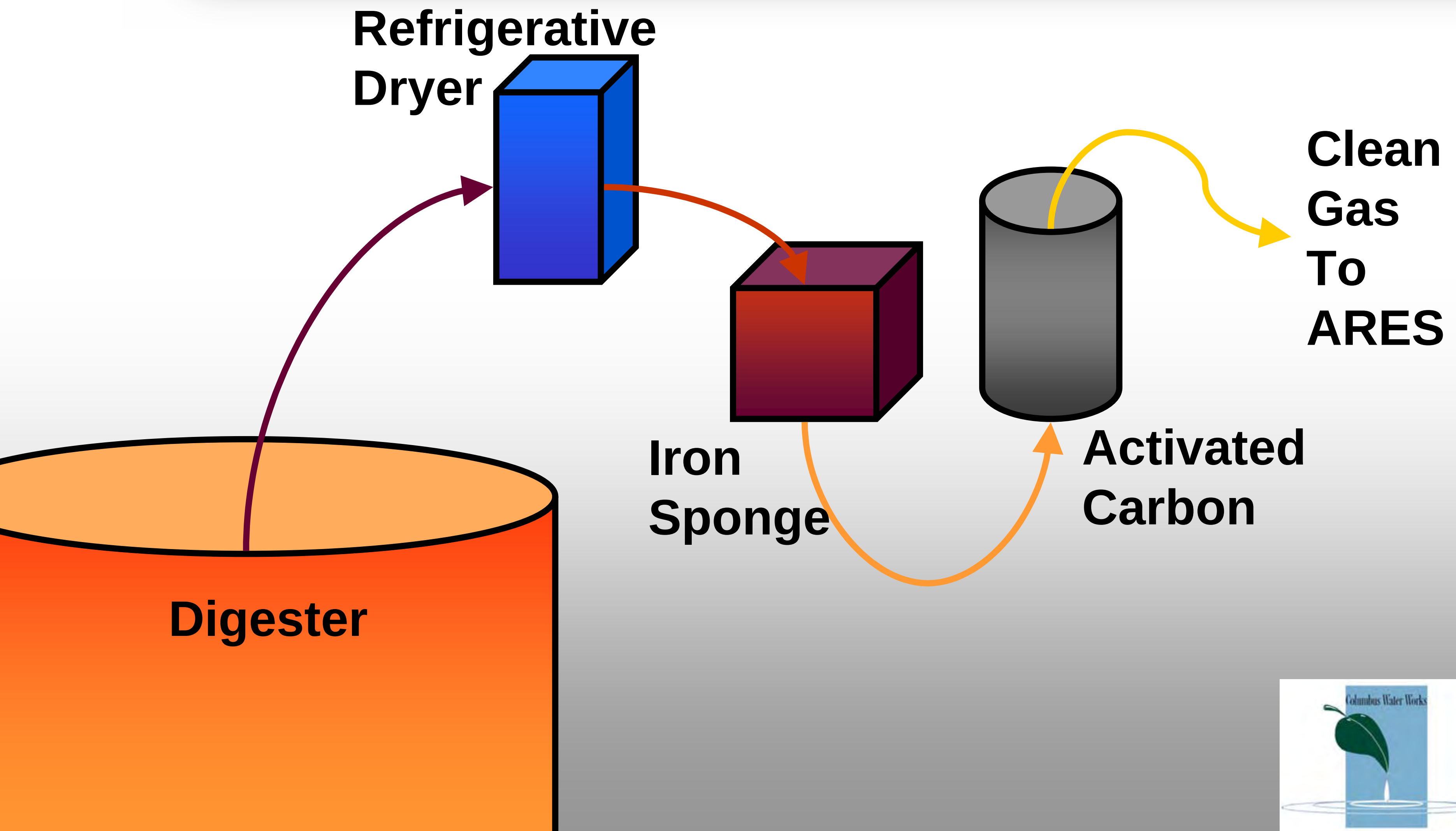
Planned Gas Treatment System for Lowest Life-Cycle Cost



Next Steps and Conclusions

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Next Steps…

- Pre-procure engine vendor
- Design improvements around that manufacturer's engine, heat recovery systems, and performance
- Construction in 2006 and 2007
- Start-up and testing in late 2007
- Reporting in early 2008

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Conclusions

- Engine co-generation can produce enough heat to operate class-A digestion at thermophilic temperatures
- New ARES engines will be demonstrated on digester gas in Columbus, GA, producing ~40% of the plant’s required elctricity
- Gas treatment can be done cost-effectively for high-tech CHP

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Questions?

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