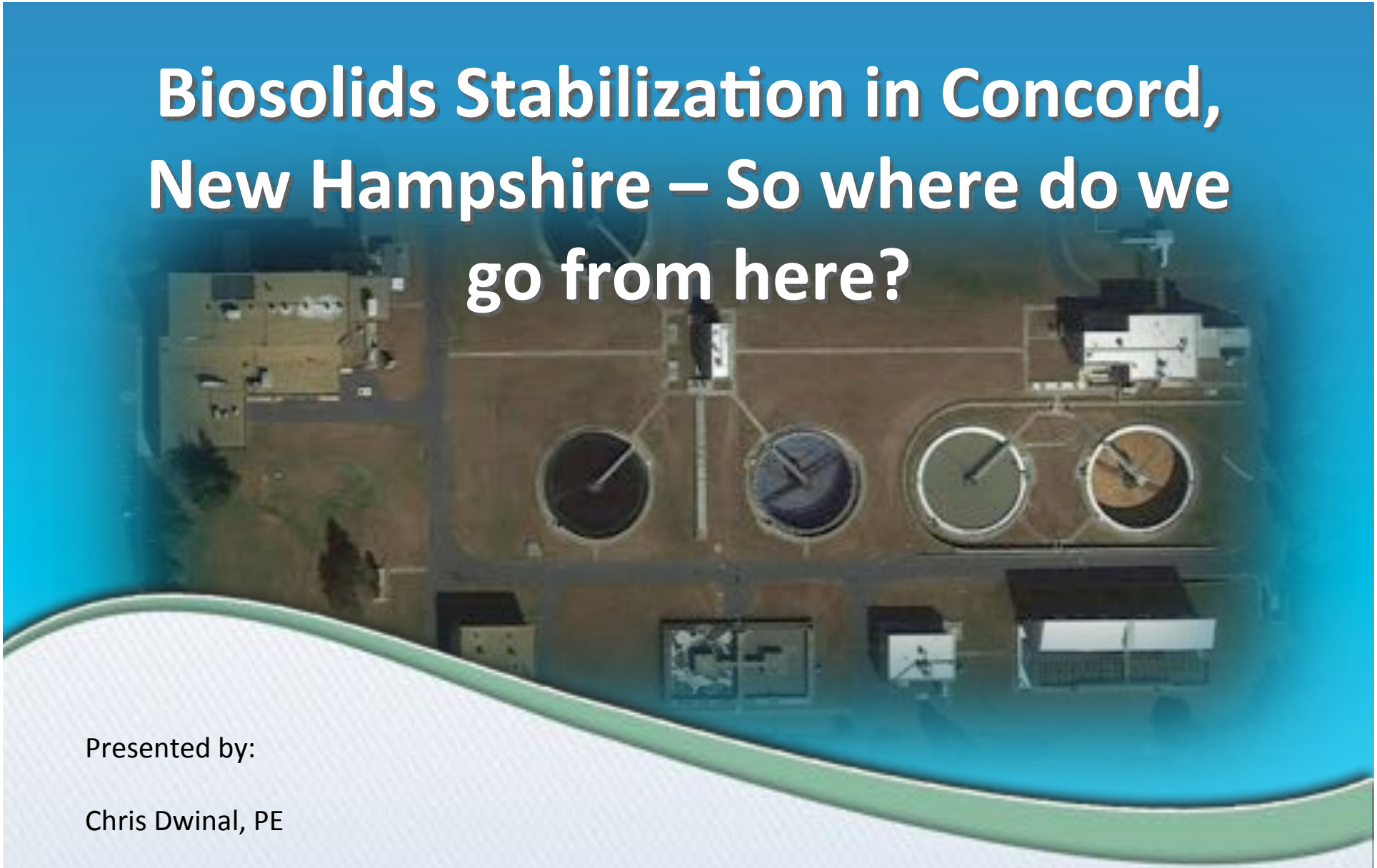
Biosolids Stabilization in Concord, New Hampshire – So where do we go from here?



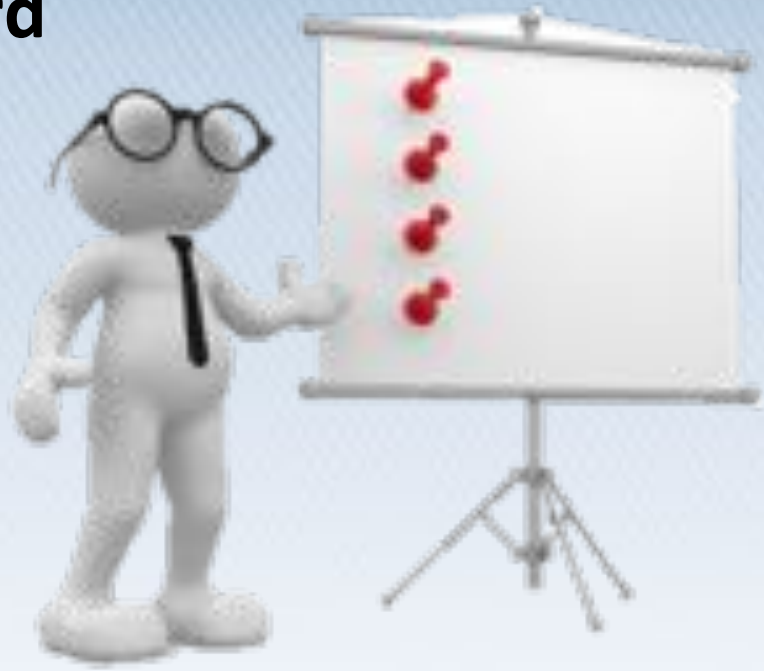
Presented by:

Chris Dwinal, PE

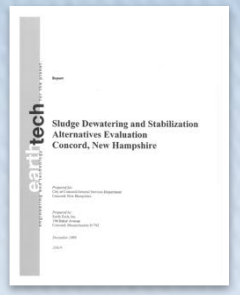
WRIGHT-PIERCE
Engineering a Better Environment

Presentation Overview

- History of biosolids in Concord
- Current RDP lime stabilization system
- 2015 Biosolids Stabilization Evaluation
- Short-term plan
- Long-term recommendations
- Key factors in ultimate path forward

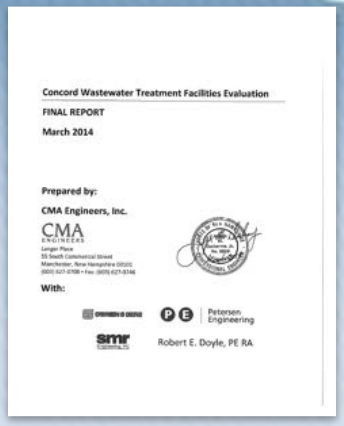


History of Biosolids


Sludge Dewatering and Stabilization Alternatives Evaluation
Concord, New Hampshire

First Biosolids Study recommends belt filter presses and RDP Class A lime stabilization

Dewatering and RDP Upgrade Complete


Concord Wastewater Treatment Facilities Evaluation
FINAL REPORT
March 2014
Prepared by:
CMA Engineers, Inc.
With:
Robert E. Doyle, PE RA

Comprehensive WWTF Evaluation recommends THAD and RDP evaluation

RDP Upgrade Underway

Pre-1999
- Plate and frame press
- Class B lime stabilization
- Land spreading through RMI

1999

2002

2003

2005

2010

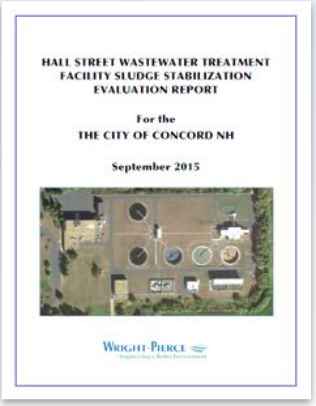
2014

2015

2016

Multiple studies/upgrades to address process issues and fugitive odors and lime dust

Biosolids Stabilization study recommends RDP short term, ATAD/TPAD long term


HALL STREET WASTEWATER TREATMENT FACILITY SLUDGE STABILIZATION EVALUATION REPORT
For the
THE CITY OF CONCORD NH
September 2015
WRIGHT-PIERCE

Issues with RDP Technology

- Difficulty meeting Class A with varying sludge
- Ineffective mixing of lime and biosolids
- Fugitive dust/odor emissions

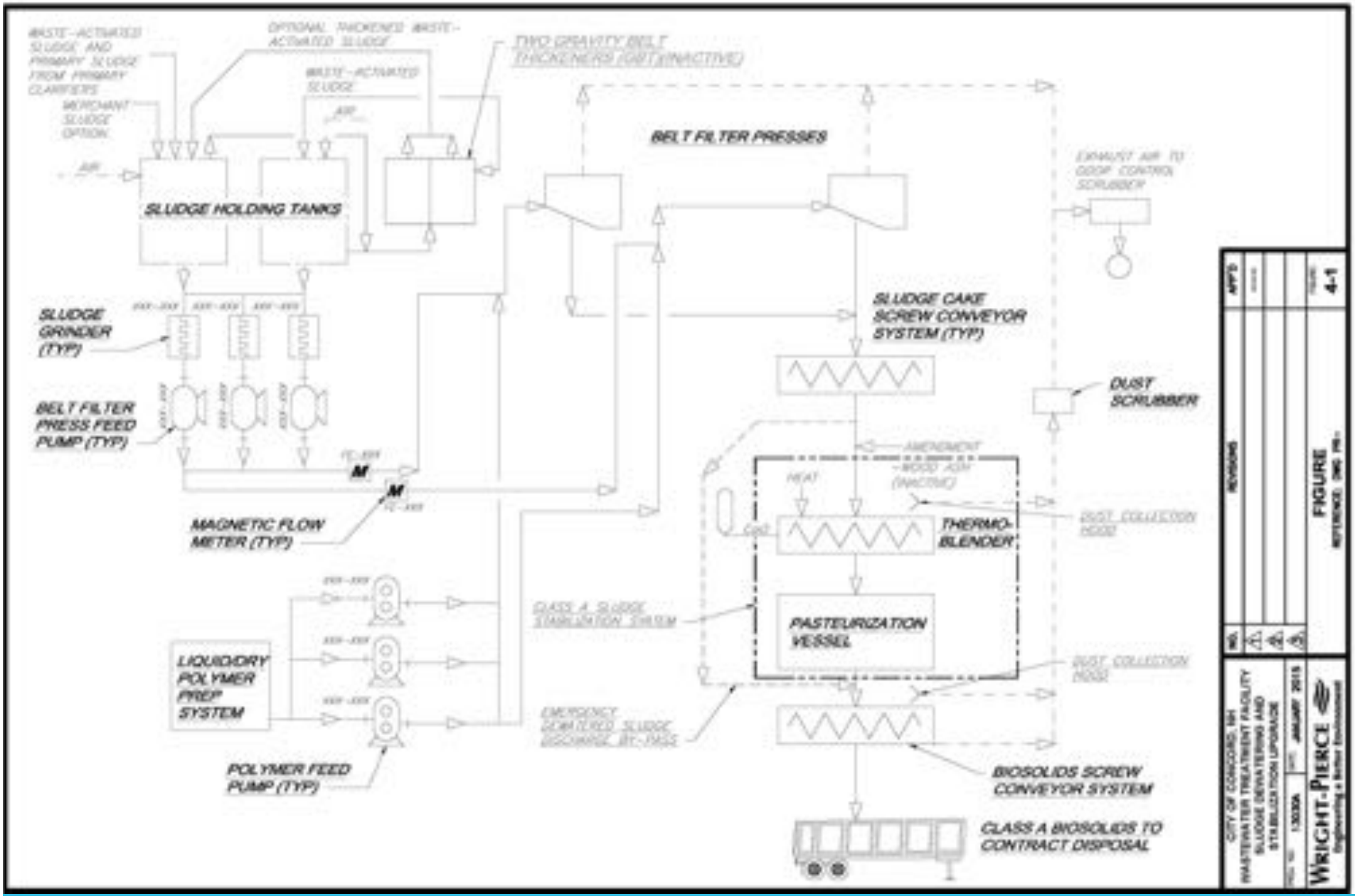
- Led to ventilation, odor control, and conveyor/ mixing upgrades 2008-2010
- System finally running well for past 5 years, but still not ideal…

Biosolids Processing Options Considered 1999-2014

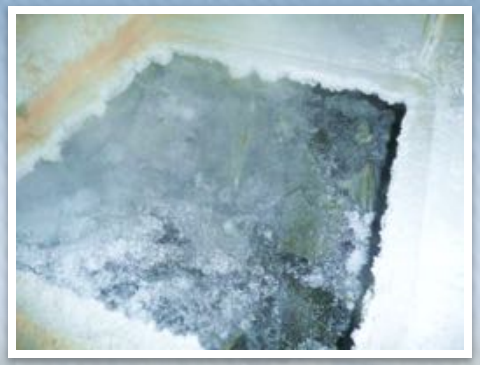
- Class A and B lime stabilization
- Composting
- Thermal drying
- ATAD
- Incineration
- Landfill
- Anaerobic digestion – mesophilic, thermophilic, thermal hydrolysis

2015 Biosolids Stabilization Evaluation

- One of several completed since 1999
- Goals
  - Conduct comprehensive evaluation of condition and life expectancy of RDP system
    - Recommended in 2014 Comprehensive Evaluation
    - City has contract with RMI through 2021 for trucking and reuse of Class A lime stabilized solids ($29.10/wet ton)
  - Conduct a comprehensive review of all biosolids processing and reuse options available to Concord
    - NH DES recommendation


WASTE-ACTIVATED SLUDGE AND PRIMARY SLUDGE FROM PRIMARY CLARIFIERS
MERCHANT SLUDGE OPTION
AIR
OPTIONAL THICKENED WASTE-ACTIVATED SLUDGE
WASTE-ACTIVATED SLUDGE
TWO GRAVITY BELT THICKENERS (ORIT) (INACTIVE)
BELT FILTER PRESSES
EXHAUST AIR TO ODOR CONTROL SCRUBBER
SLUDGE HOLDING TANKS
SLUDGE GRINDER (TYP)
SLUDGE CAKE SCREW CONVEYOR SYSTEM (TYP)
DUST SCRUBBER
BELT FILTER PRESS FEED PUMP (TYP)
AMENDMENT - WOOD ASH (INACTIVE)
HEAT
DUST COLLECTION HOOD
THERMO-BLENDER
MAGNETIC FLOW METER (TYP)
CLASS A SLUDGE STABILIZATION SYSTEM
PASTEURIZATION VESSEL
LIQUID/DRY POLYMER PREP SYSTEM
DUST COLLECTION HOOD
EMERGENCY SCAVENGED SLUDGE DISCHARGE BY-PASS
POLYMER FEED PUMP (TYP)
BIOSOLIDS SCREW CONVEYOR SYSTEM
CLASS A BIOSOLIDS TO CONTRACT DISPOSAL
NO.
REVISIONS
APP'D
FIGURE
4-1
CITY OF CONCORD, NH
WASTEWATER TREATMENT FACILITY
SLUDGE DEWATERING AND
STABILIZATION UPGRADE
JANUARY 2015
WRIGHT-PIERCE
Engineering a Better Environment

Findings of RDP Evaluation



- Great shape for 12 yrs. of service
- All equipment still functioning
- Auger heaters are weak point
- Some damage to Thermoblender
- Lime dust/ammonia emissions in processing room and garage not acceptable to City moving forward
- Several upgrade options considered

Long-Term Biosolids Stabilization

- Composting
- Class A lime stabilization
- Anaerobic and aerobic digestion
- Drying – mechanical and solar greenhouse
- Incineration
- Gasification
- Carbonization
- Dewatered Biosolids to off-site processing

Screening Criteria

- Demonstrated Technology
- Scalable to Concord's needs
- Potential for off-site odors
- End market for processed biosolids
- Possibility of public-private partnership

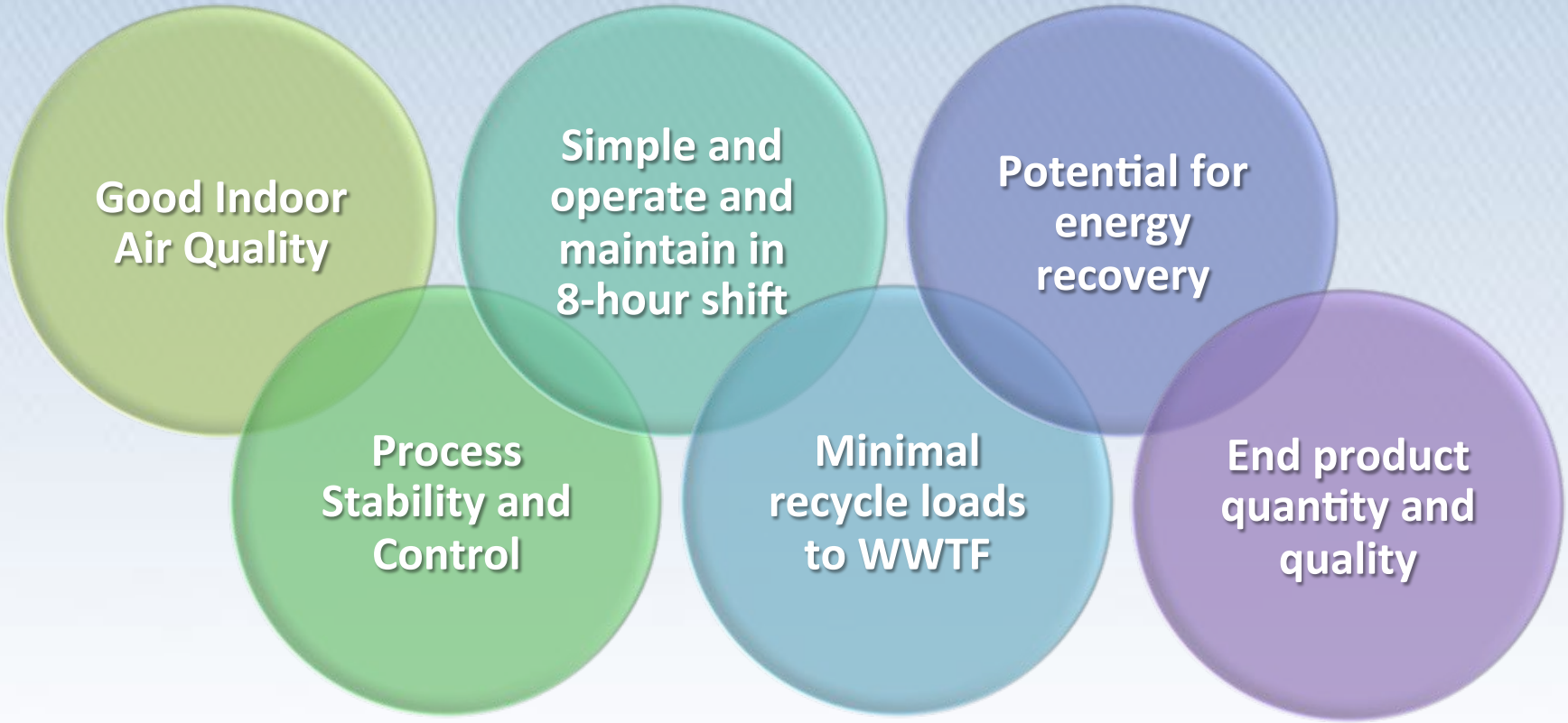
Technologies screened out

- Not demonstrated
  - Carbonization, gasification and thermal hydrolysis
- Not scalable
  - Incineration
- Odor potential too high
  - Composting and solar greenhouse drying
- Landfilling
- Public-private partnership
  - Stigma of being dumping ground for the region
  - Concerns with odors – historical issues in Concord

Six remained…

- 3 Class A Lime Stabilization
  - Retain RDP long-term
  - Schwing Bioset
  - FKC screw press
- 3 Digestion
  - Temperature or Two Phase Anaerobic Digestion
  - Mesophilic Anaerobic Digestion with Drying
  - Autothermal Thermophilic Aerobic Digestion

Evaluation Criteria



Class A Lime Stabilization

- RDP
- Schwing Bioset
- FKC Screw Press

RDP Class A Lime Stabilization

PROS

- Simple to operate
- Stackable, dry end product
- No post processing required
- Limited recycle loads impact
- Very cost effective - existing
- 50 U.S. installations

CONS

- Poor air quality
- Poor process control/ stability
- Full-time staffing required
- No energy recovery
- Odors when spreading
- Calcium saturation issues
- Highest biosolids quantity

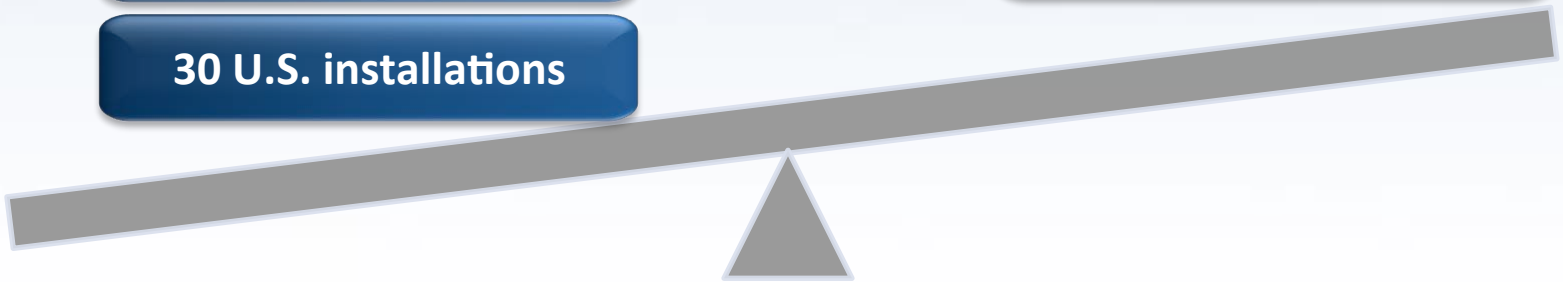
Schwing Class A Lime Stabilization

PROS

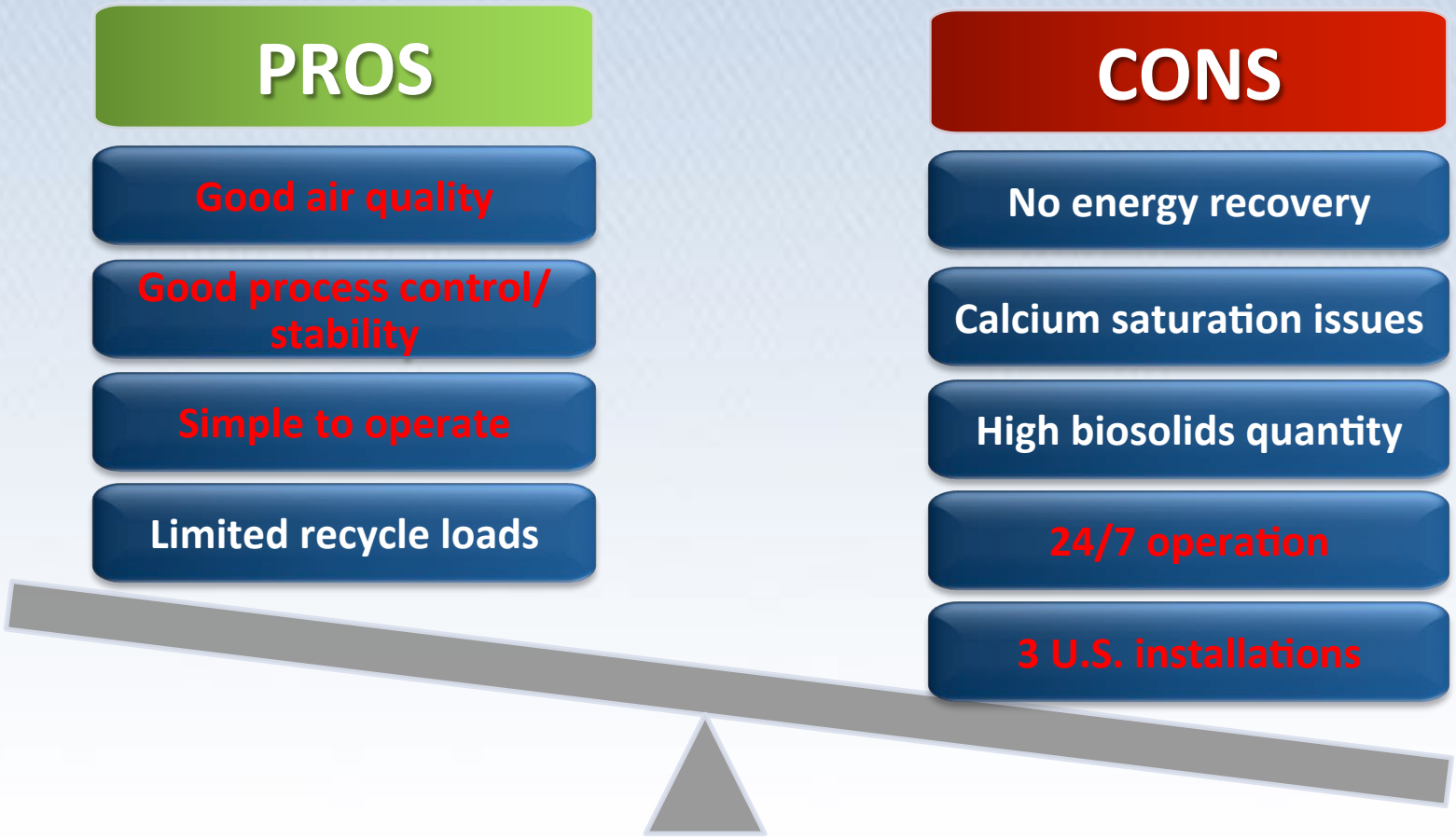
- Fully enclosed good air quality
- Good process control/ stability
- Limited staffing required
- Simple to operate
- Limited recycle loads
- 30 U.S. installations

CONS

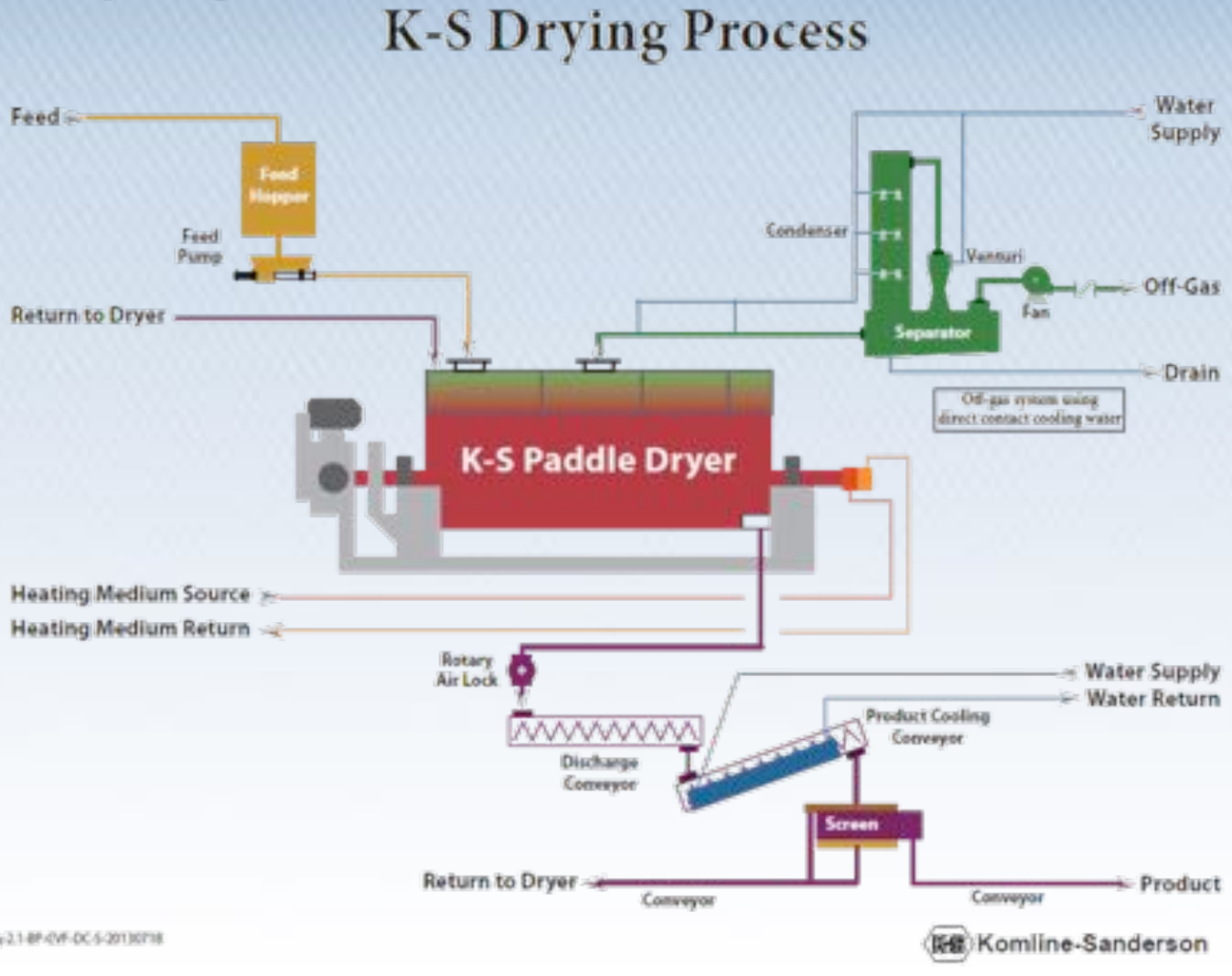
- No energy recovery
- Poor end product quality
- Requires post processing
- Calcium saturation issues
- High biosolids quantity



FKC Class A Lime Stabilization



Mesophilic Anaerobic Digestion w/ Drying



MAD with Drying

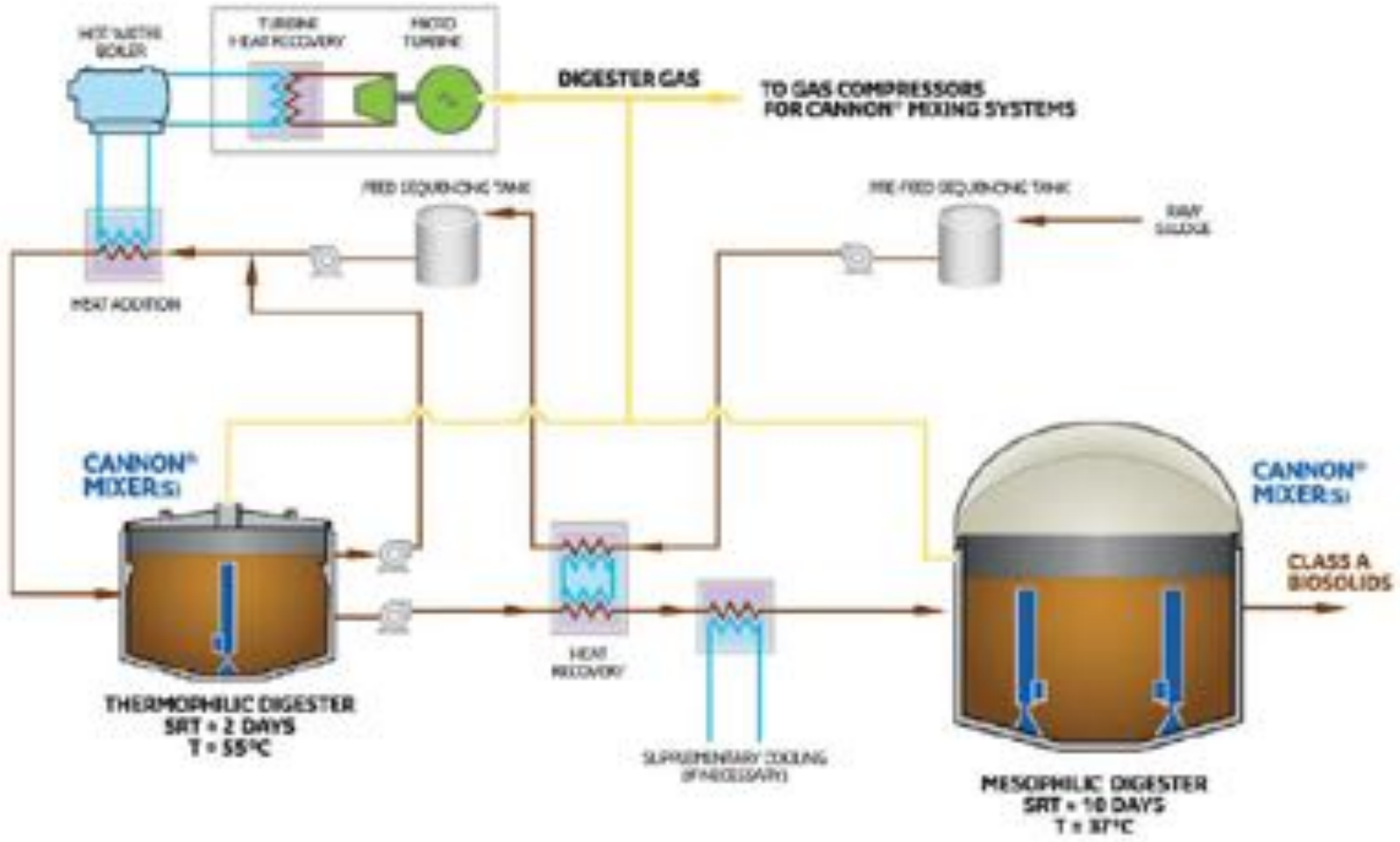
PROS

- Fully enclosed good quality air
- Good process control/ stability
- Good energy recovery
- Excellent biosolids quality
- Lowest biosolids quantity
- 30 U.S. installations

CONS

- 24/7 operation
- Complex process x 2
- High recycle loads

TPAD/2PAD Anaerobic Digestion



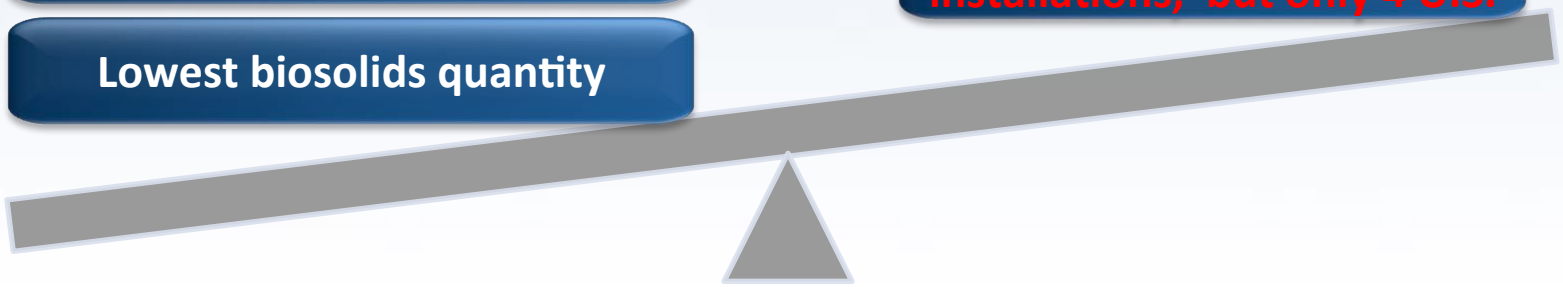
TPAD/2PAD

PROS

- Fully enclosed, good air quality
- Good process control/stability
- 8-hour staffing due to automation
- Highest energy recovery
- Excellent biosolids quality
- Lowest biosolids quantity

CONS

- Complex process
- Highest recycle loads to WWTF
- Numerous international installations, but only 4 U.S.



ATAD – 2nd Generation

ATAD

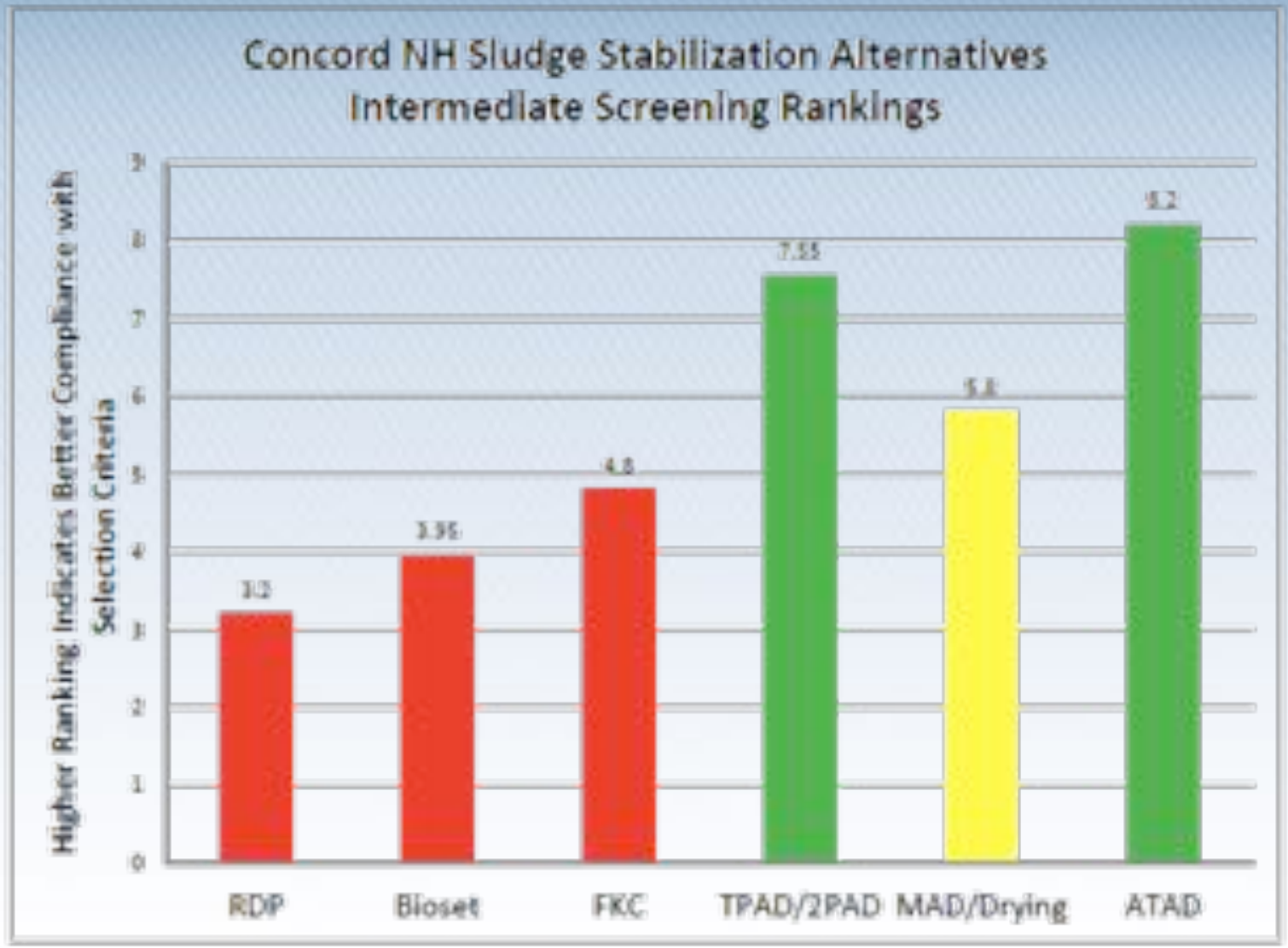
PROS

- Fully enclosed, good air quality
- Good process control/stability
- 8-hour staffing due to automation
- Excellent biosolids quality
- Low biosolids quantity
- Low recycle loads to WWTF
- 40 U.S. installations

CONS

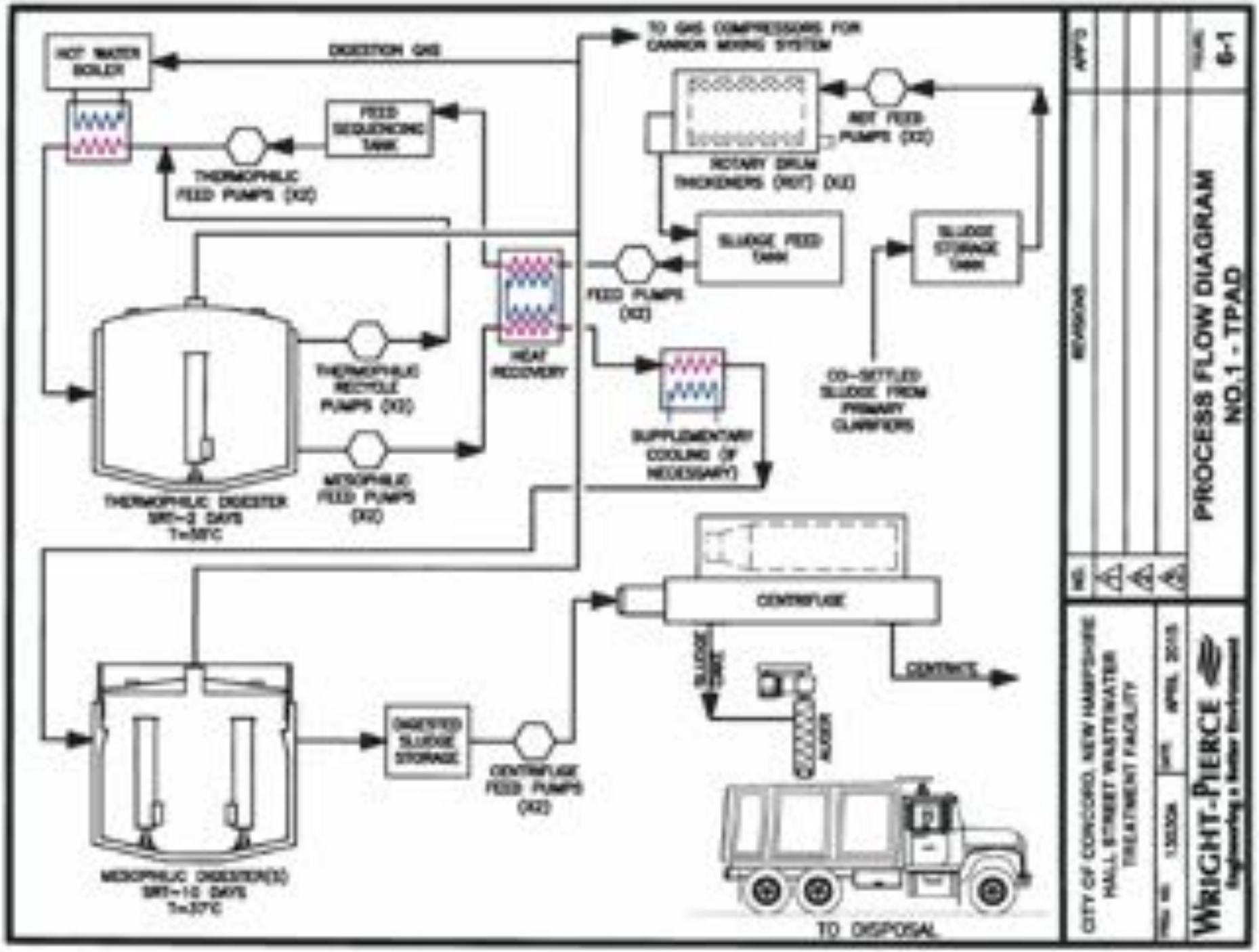
- Moderately complex process
- No energy recovery

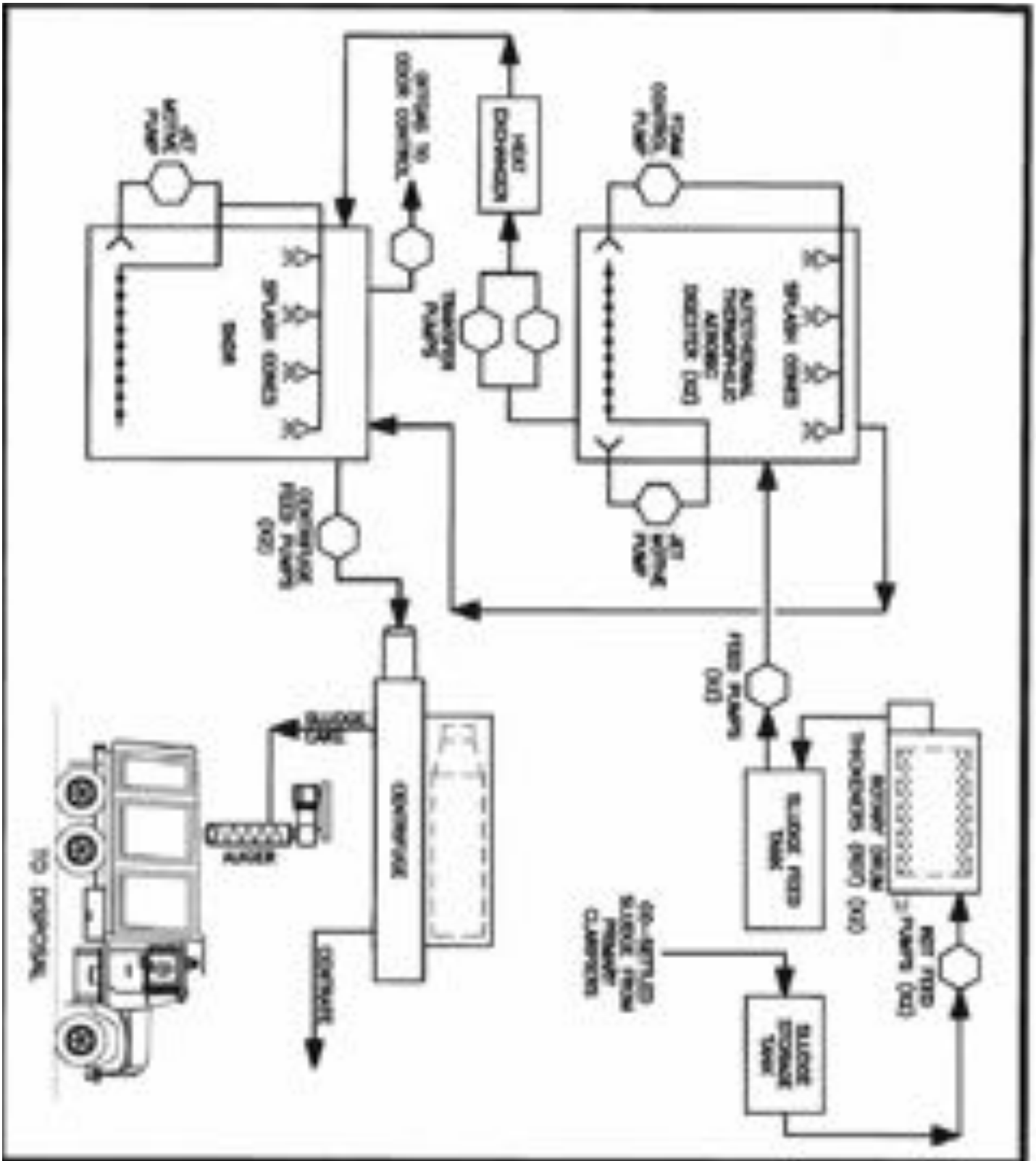
Evaluation Rankings



Final Analysis

- MAD dropped due to complexity and 24/7
- TPAD/2PAD and ATAD carried forth
- Both ~ $20 million capital cost
- TPAD lower life-cycle cost due to lower energy requirements
- Split decision
  - Staff more comfortable with ATAD and more installs
  - TPAD/2PAD lower life cycle cost (electric) but far less installs


HOT WATER BOILER
DIGESTION GAS
TO GAS COMPRESSORS FOR CANNON MIXING SYSTEM
FEED SEQUENCING TANK
THERMOPHILIC FEED PUMPS (X2)
ROTARY DRUM THICKENERS (ROT) (X2)
WAS FEED PUMPS (X2)
SLUDGE FEED TANK
SLUDGE STORAGE TANK
FEED PUMPS (X2)
HEAT RECOVERY
THERMOPHILIC RECYCLE PUMPS (X2)
SUPPLEMENTARY COOLING (IF NEEDED/MAY)
CO-SETTLED SLUDGE FROM PRIMARY CLARIFIERS
THERMOPHILIC DIGESTER SRT=2 DAYS T=55°C
MESOPHILIC FEED PUMPS (X2)
CENTRIFUGE
SLUDGE CAKE
AUGER
CENTRATE
DIGESTED SLUDGE STORAGE
CENTRIFUGE FEED PUMPS (X2)
MESOPHILIC DIGESTER(S) SRT=10 DAYS T=37°C
TO DISPOSAL
APP'D
BY/DATE
NO.
PROCESS FLOW DIAGRAM NO.1 - TPAD
FIGURE 6-1
CITY OF CONCORD, NEW HAMPSHIRE
HALL STREET WASTEWATER TREATMENT FACILITY
APRIL 2015
WRIGHT-PIERCE
Engineering a Better Environment



CITY OF CONCORD, NEW HAMPSHIRE HALL STREET WASTEWATER TREATMENT FACILITY	NO.	REVISIONS	APP'D
	1		
	2		
	3		
PROJ. NO: 13030A	DATE: APRIL 2013		
WRIGHT-PIERCE Engineering a Better Environment	PROCESS FLOW DIAGRAM NO.2 - ATAD		FIGURE 6-3

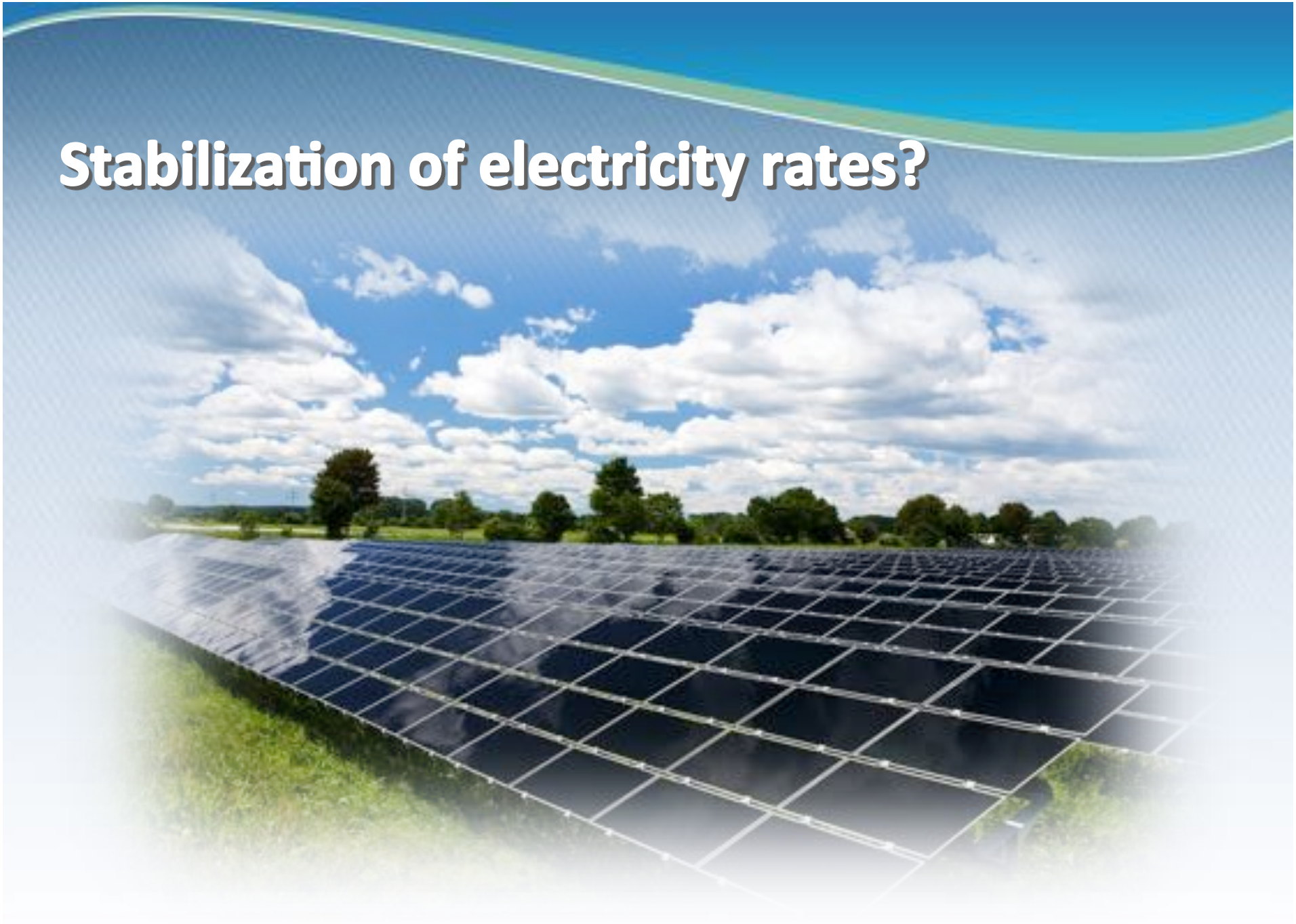
Final Recommendations – Lime Stabilization

- Very cost effective, 25% the cost of digestion
- But, not desirable long term
  - Highest biosolids quantity, lowest biosolids quality
  - No potential for energy recovery
  - Higher operator attention required
  - Concerns with air quality
- However, good short term option
  - Upgrade RDP and ventilation - ~$2 million
  - Low cost tipping fee in place through 2021

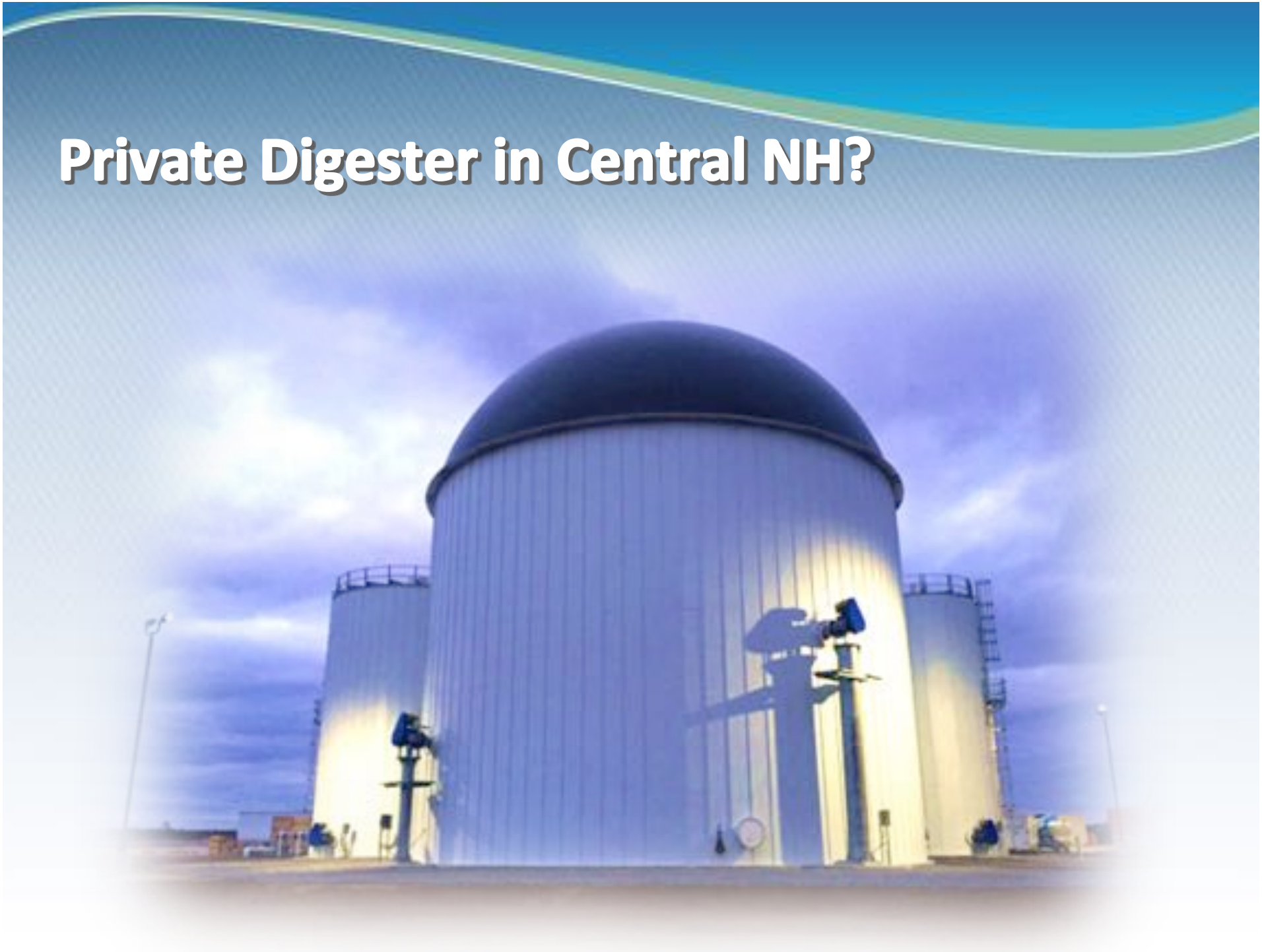
Final Recommendations – Long-Term

- Some form of digestion – consistent with 2006 and 2014 studies
- TPAD/2PAD lowest life cycle costs, but
- City staff prefer ATAD
  - Familiarity with equipment
  - Many more U.S. installs
  - Concord WWTF typical size of ATAD installs
- So, what's next?

Stabilization of electricity rates?



Private Digester in Central NH?



The Future

- **TPAD/2PAD life-cycle cost still cheaper with lower electricity cost**
  - **capital cost of TPAD/2PAD lower than ATAD**
- **Upgrading RDP allows time for…**
  - **further advancement of TPAD/2PAD technology**
  - **Allow for more U.S. installs**
  - **preliminary designs to nail costs**
  - **Possible development of alternative power sources to stabilize electricity rates?**
  - **Possible merchant facility for offsite processing?**

Variability in Electrical Rates

- **Over past two years**
  - **High of $0.147/kWh**
  - **Low of $0.112/kWh**
  - **Average of $0.132/kWh**

- **New solar PV in cornfield next to WWTF**
  - **20 year fixed price of $0.086/kWh <u>just for supply</u>**
  - **Essentially equal to current supply price for WWTF**
  - **Will offset other higher price electricity users in Concord**

Questions?

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