



Littleton/Englewood Wastewater Treatment Plant

BIOGAS USE APPLICATIONS





Project Goals

- Determine technical feasibility and economic viability to beneficially reuse digester gas
 - Develop renewable energy product
 - Create a revenue source using biogas
 - Highlight the L/E WWTP as a community resource
 - Evaluate partnering with neighboring industries

Resource Recovery Potential



	Digester gas production cfd	Gasoline gallon equivalent (GGE) per day
Current	468,600	2,060
2038 Projected	556,700	2,450

- Assumptions
 - 20-year analysis period
 - Projections based on Denver Regional Council of Governments (DRCOG) population forecast from 2013 Master Plan
 - Assume 1% annual increase in gas production over 20 years

Opportunities



1. Conversion of digester gas for onsite electrical power generation
2. Conversion of digester gas to compressed natural gas for vehicle fuel
3. Conversion of digester gas to pipeline quality natural gas and inject into a utility service line



Generation



CNG Fueling



Pipeline Injection

Analysis



1. Onsite co-generation:

- Not economically competitive against CNG and pipeline
 - Low electrical costs
 - Lack of federal funding opportunities
 - High equipment maintenance costs

2. Compressed natural gas (CNG):

- Higher initial capital costs (\$8.7 M)
- Higher operational costs associated with fuel station

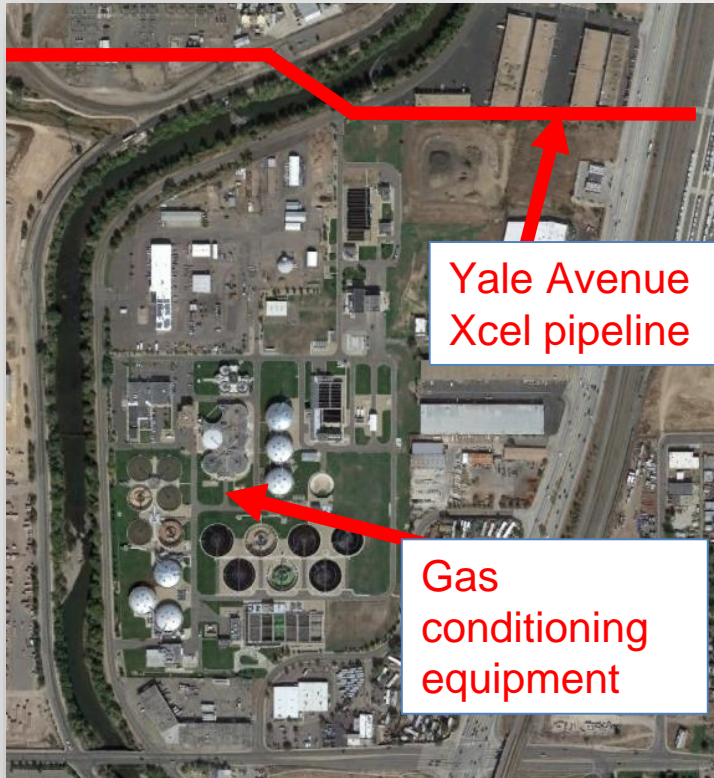
3. Pipeline natural gas re-injection

- Quicker payback period (~ 4 years)
- More revenue incentives

Pipeline Injection Recommendation



- Treat gas to pipeline quality for injection into Xcel Pipeline



Gas conditioning
equipment

- Simplified and lower risk construction
 - No major offsite pipeline construction
- Lower risk associated with negotiating with third parties
- Lower capital cost
- Lower payback period





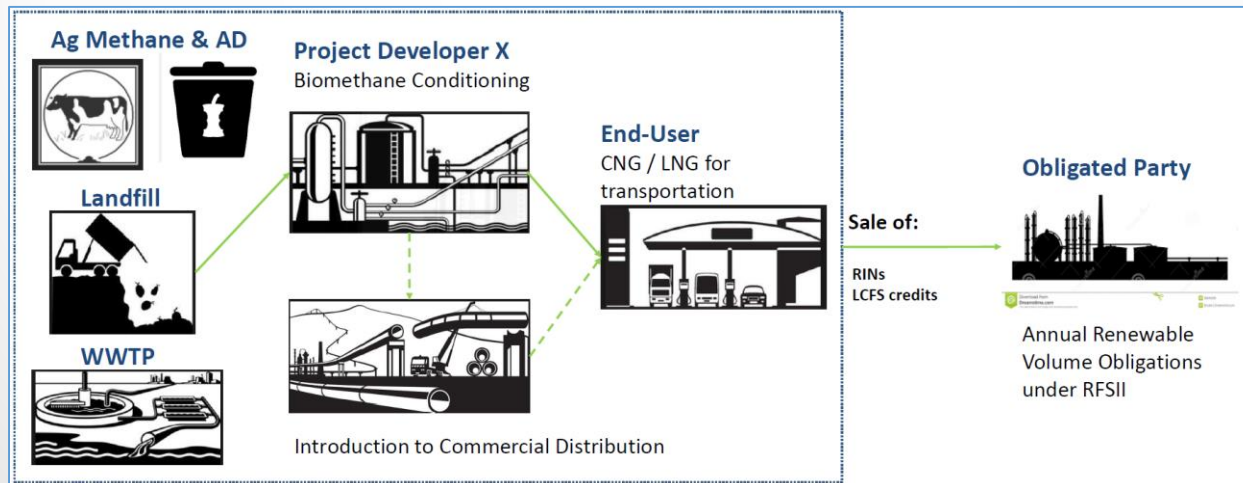
Pipeline Injection Installations

- Point Loma WWTP, San Diego, CA
 - 240 MGD
- Clean Water Services, OR
 - 65 MGD
- Under Construction:
 - South Bend, IN (2017)
 - Des Moines, IA (2017)
 - Raleigh, NC (2018)



Digester Gas – Revenue Source

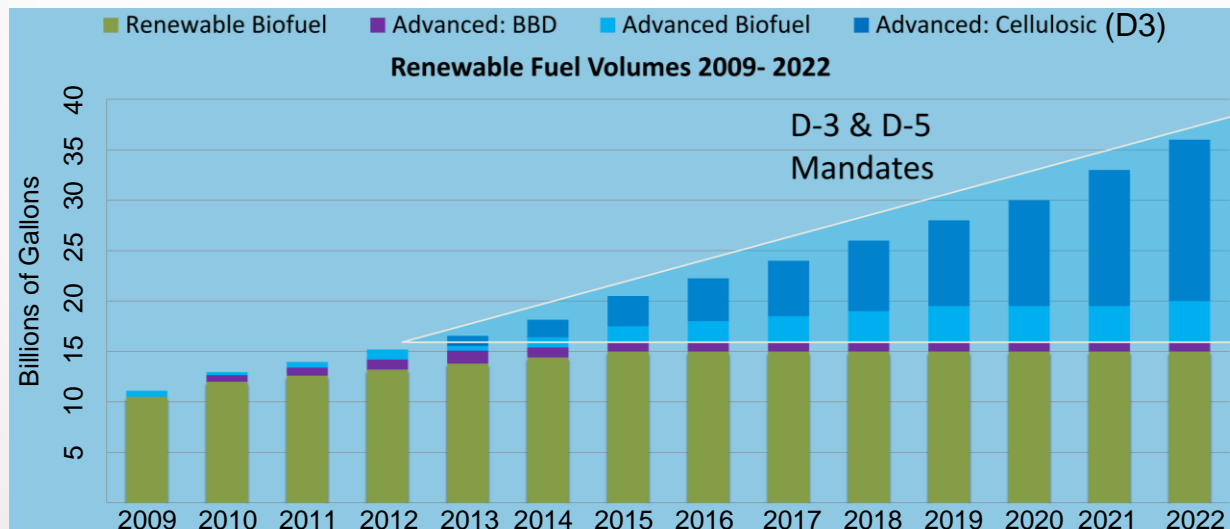
- Renewable Fuel Standard Program (RFS) developed to encourage use of renewable fuels
 - Four (4) categories: renewable biofuel, biomass based diesel, advanced biofuel, **cellulosic biofuel (WWTP biogas)**
 - Obligated parties (i.e. oil producers) are required to purchase renewable identification numbers (RINs) based on their levels of production





Digester Gas – Revenue Source

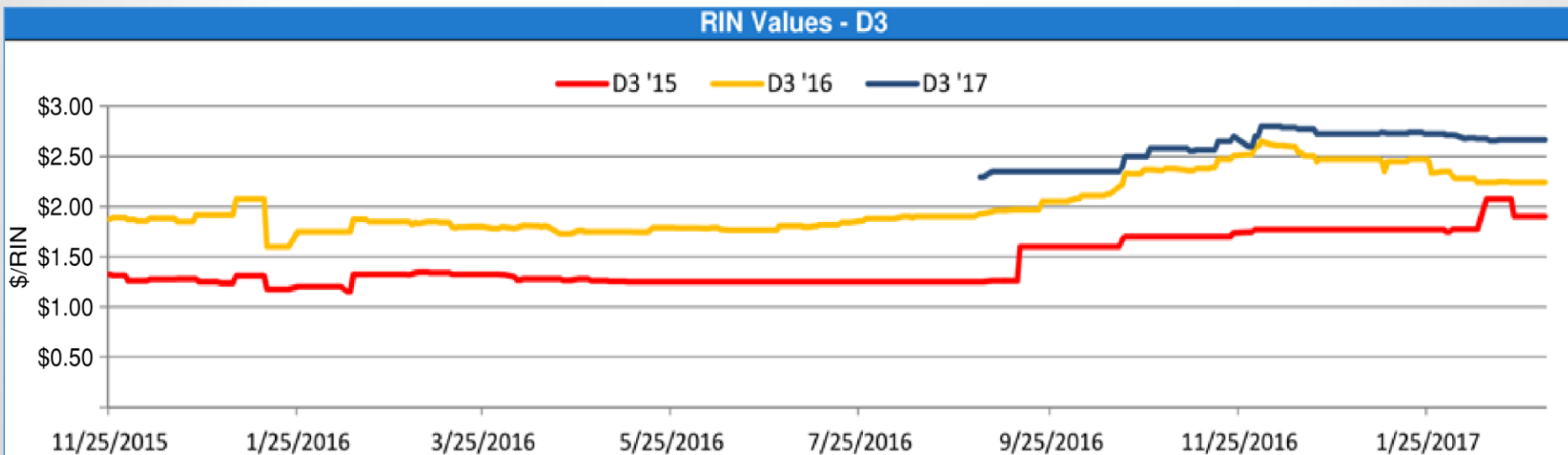
- Mandated quantities in effect through 2022, and will be specified by EPA administrator after that time





Digester Gas – Revenue Source

- RIN price has increased over time with increasing mandates
 - Currently: ~\$2.50/RIN
 - 3-year historical average: \$1.78/RIN





Results for Pipeline Injection

Description	Value
Digester Gas Revenue (yearly)	\$196,000
RIN Revenue (yearly)	\$2,301,000
Operating Cost (yearly)	(\$553,000)
Total Annual Revenue	\$1,944,000
Total Project Capital Cost	(\$7,800,000)
Payback Period (years)	~ 4 years

Baseline Assumptions:

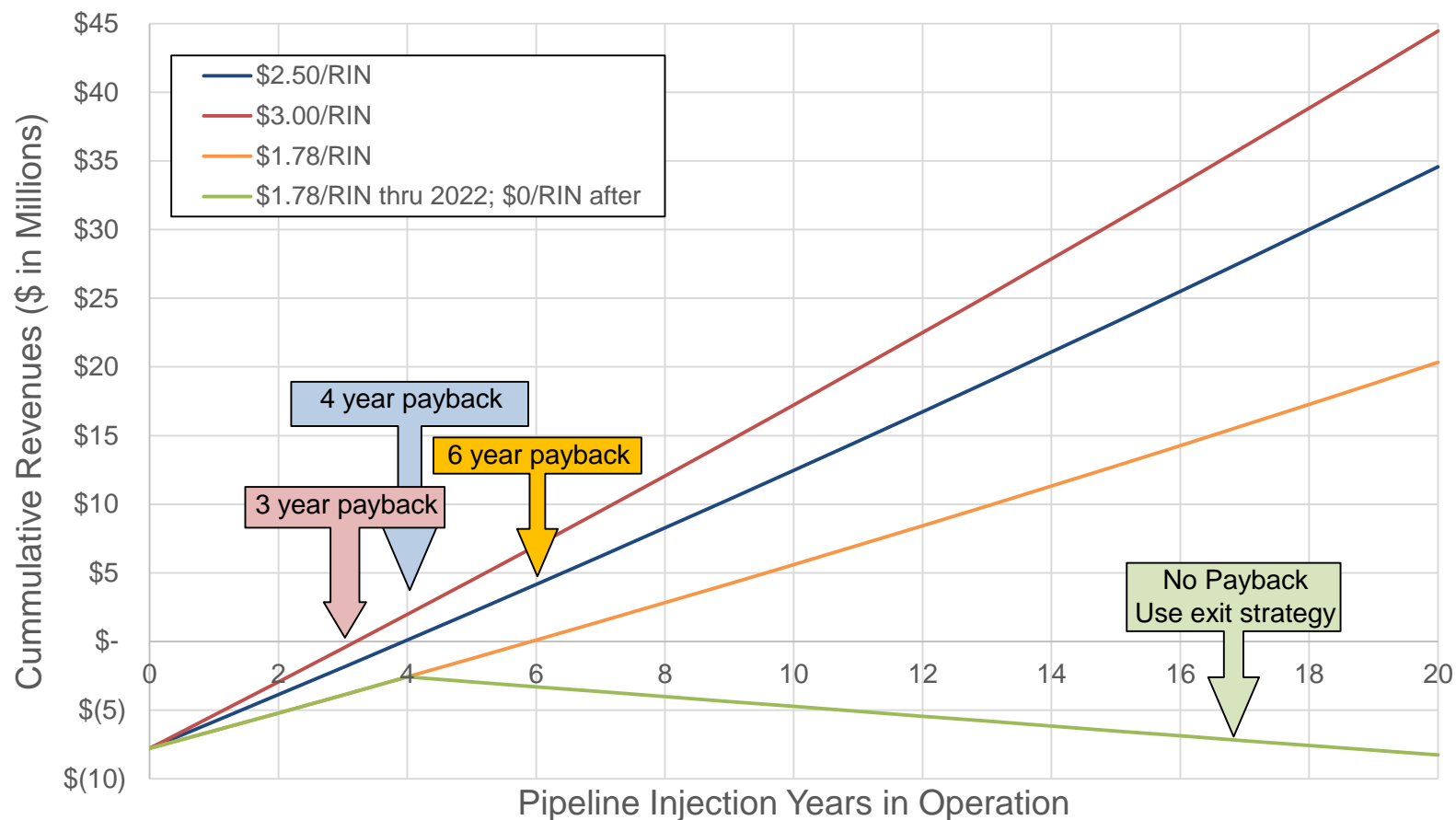
1. Assumed L/E WWTP pays initial capital costs
2. RIN value = \$2.50 / RIN

Pipeline Alternative: RIN Value Impacts



Payback Period Based on RIN Value Sensitivity

Assumes No Financing, Capital Investment = \$7.8M in 2018 (year 0)

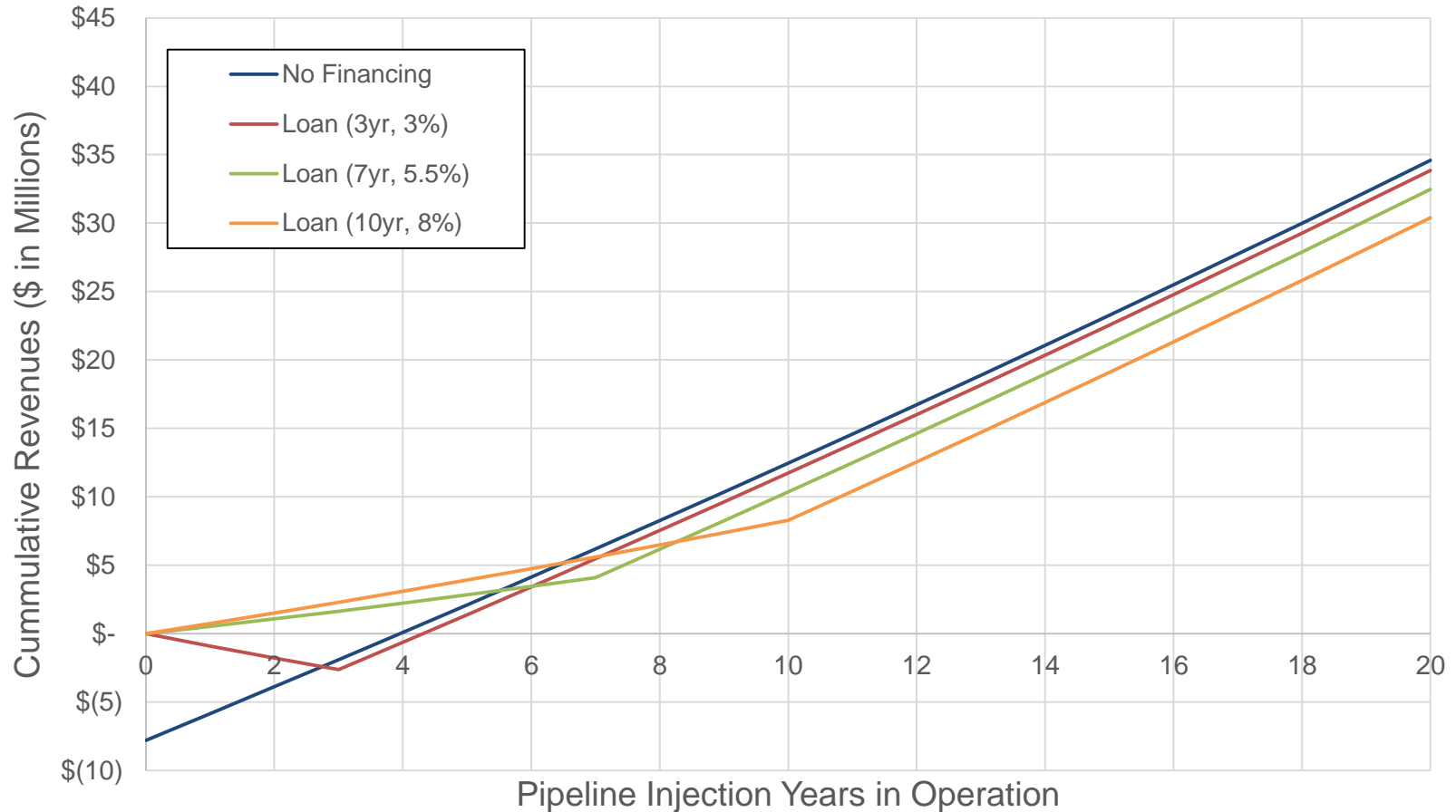


Sensitivity Analysis: Financing Options



Cash Flow Based on Financing Sensitivity

Assumes RIN = \$2.50; Capital Investment = \$7.8M in 2018 (year 0)





Time to Market is Critical

- Project supports triple bottom line
- Low risk
- RIN program beyond 2022:
 - *Set to go on indefinitely unless repealed by legislation*
 - *Renewable fuels support energy independence*
 - *Reduce imported petroleum*
 - *Agricultural industry relies on RINs for economics of ethanol production*
- Exit Strategy Opportunities:
 - *Return to co-generation*
 - *Convert to CNG fueling*
- *Estimated range of costs to off-ramp:*
 - *\$2M - \$3M*
 - *Additional equipment needed*
- *Exit strategy revenues*
 - *Electricity offset/sale*
 - *Sale of CNG fuel*

Implementation Schedule



Activity	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Develop Memorandum of Understanding with Xcel									
Develop Contract with Design Engineer for Design/Procurement Support									
Council Meeting (Design Engineer Contract Approval)				★ Council Meeting					
Secure Financing Options									
Develop RFP and Agreement with RIN Broker				★ Issue RFP		★ RIN Broker Agreement			
Develop contract with Xcel						★ Xcel Agreement			
Engineering Design					★ 30% Design		★ 60% Design	★ 90% Design	
Develop RFP for Digester Gas Cleaning Equipment						★ Issue RFP			
Develop RFP for Contractor							★ Issue RFP		
Construction									9 month duration →

- Anticipated Commissioning: Fall 2018
- Certification of RIN Credits: Early 2019



Project status update

- Xcel interconnection agreement initiated
- Request for proposal developed for renewable fuel credit management services
 - To manage the generation and monetization of fuel credits
 - Serve as a commercial advisor in the renewable fuel and natural gas markets
- Review of financing options with cities of Englewood and Littleton
- Scope of work for design services with Carollo Engineers



Alignment to City Goals



- Safe and Healthy Environment
- Sustainable Natural Environment
- Good Governance
- Effective Mobility and Reliable Infrastructure



- Assure a Financially-Sound City Government
- Develop and Maintain the Public Infrastructure
- Support Environmental Sustainability



Questions?