

Petra Nova successful demo

First three years typical of a first of a kind (“FOAK”) at full commercial scale

Petra Nova site



Absorber

CO₂ Pipeline

Compressor

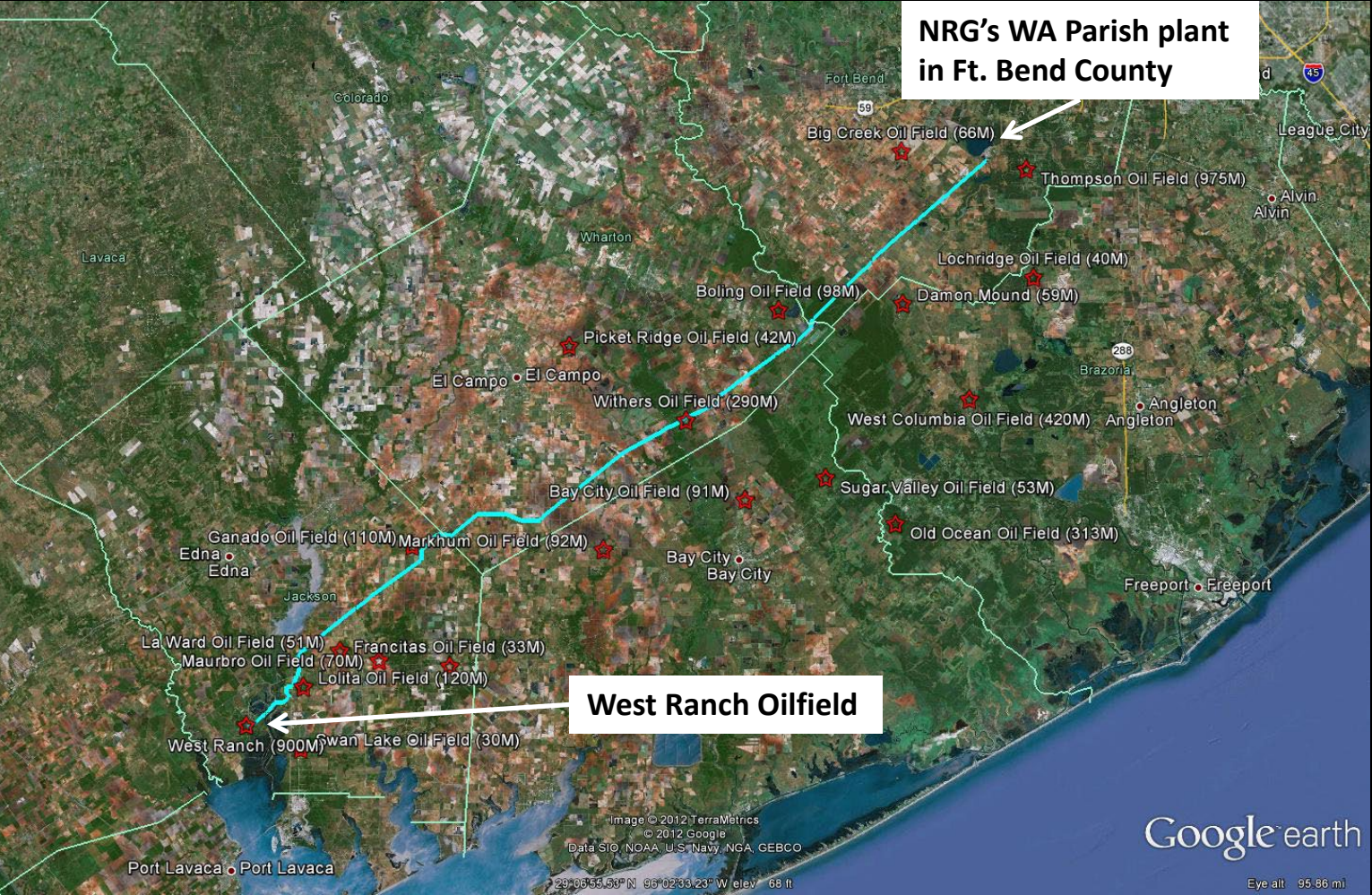
Quencher

Flue Duct

Cogeneration
(steam & power)

Regenerator

Petra Nova 81-mile CO₂ pipeline



West Ranch Oilfield

- ❑ 200+ new wells drilled
- ❑ 2 – central recycle stations
- ❑ 200+ miles of flow lines
- ❑ 4,000 acres areal extent
- ❑ 2 – 150K barrel tanks
- ❑ 300 – bbl/day prior to CO₂
- ❑ 6,350 – max bbl/day
- ❑ 800 – current bbl/day
- ❑ 6.4 million - incremental bbl total since EOR started



Commercially, What is Petra Nova?

Petra Nova	
Size	240 MWe
Flue gas fuel	Powder River Basin coal
Steam source	Stand-alone CCGT
Host plant owner	IPP – short term view
CO2 disposition	Project-owned oilfield
Exposure to oil price	Yes – high
Revenue sources	Crude oil sales
Host unit dispatch	Day-to-day decision
Capture technology	Mitsubishi

Petra Nova
is an
Oil Company
not a
CCUS project

Petra Nova did not have 45Q
Ongoing revenues solely tied to oil production

Petra Nova Operating Record

Outage by Component (Total Phase 3)									
	2017			2018			2019		
	Total	Full (Days)	Partial (FDEs)	Total	Full (Days)	Partial (FDEs)	Total	Full (Days)	Partial (FDEs)
CC Facility	41	23	18	34	19	15	29	17	12
Cogen Facility	67	57	10	1	1	0	20	14	6
WAP Unit 8	13	8	5	30	28	2	17	12	5
CO ₂ Pipeline	0	0	0	0	0	0	0	0	0
West Ranch	6	0	6	30	13	17	6	4	2
Weather	14	13	1	5	2	3	2	2	0
Planned Outage	0	0	0	52	52	0	0	0	0
Totals	141	101	40	152	115	37	74	49	25

By the 3rd year
Carbon Capture achieved
90+% online factor

Notes:

1. Except for the Cogen Facility, issues with BOP equipment is included in the CC Facility values.
2. Totals are shown for total day outages plus partial day outages (in full day equivalents, FDE). To calculate full day equivalents, daily de-rates were converted to hours (using a daily target of 5,265 tons per day), summed for the year, and divided by 24. For example, if CO₂ capture rate on a given day was 4,739 tons (or 90% of 5,265 tons) it would equate to 2.4 hours of outage time. If this occurred for 10 days, it would equal 24 hours or 1 full day equivalent.

Source:
W.A. Parish Post-Combustion CO₂ Capture and
Sequestration Demonstration Project
DOE Award Number DE-FE0003311
Final Scientific/Technical Report
March 31, 2020

Petra Nova Operating Record

CCS CO ₂ CAPTURE METRICS			
YEAR	PLANNED CO ₂ CAPTURE (SHORT TONS)	ACTUAL CO ₂ CAPTURE (SHORT TONS)	PERCENT OUTPUT VS. PLAN OF 85%
2017	1,635,919	1,180,594	72%
2018	1,392,300	1,122,050	81%
2019	1,613,300	1,529,174	95%

By the 3rd year
Carbon Capture facility
captured 95% of “Plan”
despite overall 80% capacity factor

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Petra Nova Operating Record

CCS PERFORMANCE METRICS (AT 100% LOAD)		
ITEM	AT COMMERCIAL OPERATION DATE	PHASE 3 RESULTS (3-YEAR AVG)
CO ₂ Capture Efficiency	93%	90.2%
CO ₂ Production (STON/HR)	222.6	222.5
CO ₂ Purity	99.24%	> 99%
Steam Consumption (STON/HR)	243	255
Power Consumption	34,851 kW	34,903 kW
Compressor Discharge Pressure	1,905 psig (MIN)	1,806 psig (NORM)
Compressor Discharge Temperature	96 DEG F	< 120 DEG F
Make-up Water to Cooling Tower	1,328 GPM	1,350 GPM

**Carbon Capture system
performed as planned
on Day 1 and for 3 years**

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Petra Nova Emissions

ABSORBER EMISSIONS METRICS (AT 100% LOAD)		
ITEM	PERMIT LIMITS	PHASE 3 RESULTS (3-YEAR AVG)
Volatile Organic Compounds (VOC)	24.53 TPY	2.84 TPY
Ammonia (NH ₃)	1.35 TPY	0.318 TPY

Emissions were much
better than expected

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Petra Nova Water Use

CCS/COGEN WATER USE (Acre-Feet)

ITEM	2017	2018	2019	3-Year Avg
Raw Water (primarily used for cooling)	1,303	1,312	1,681	1,432
Well Water (used to make demin water)	85	94	98	92

Water consumption was
half of estimated

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Petra Nova Capital & DOE Grant Funding

(Eligible for DOE cost share)

Petra Nova Eligible Capital Cost by Category	Cost (\$Millions)
CCS	225
CO ₂ Compressor/Dehydration	60
Cogen	150
Water Treatment	35
Cooling Tower	20
Flue Gas Tie-in	15
Owner's Costs	100
Total	636

DOE CCPI Grant	(\$Millions)
Initial Grant	167
Pro rata share of additional authorization	23
Total	190