Citation OIL & GAS CORP.

Salem Unit
Casinghead Gas Project

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Hy-Bon Engineering

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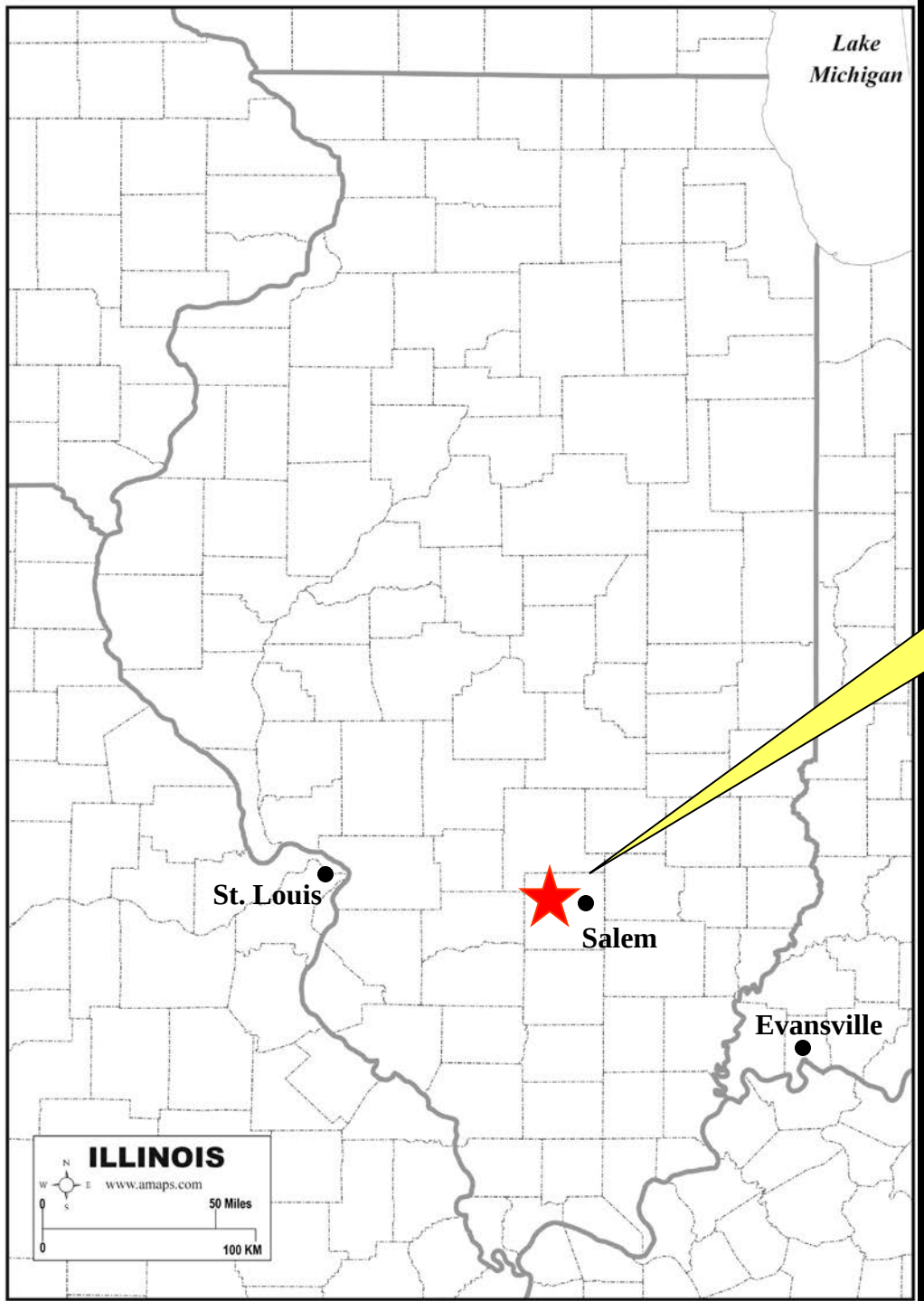
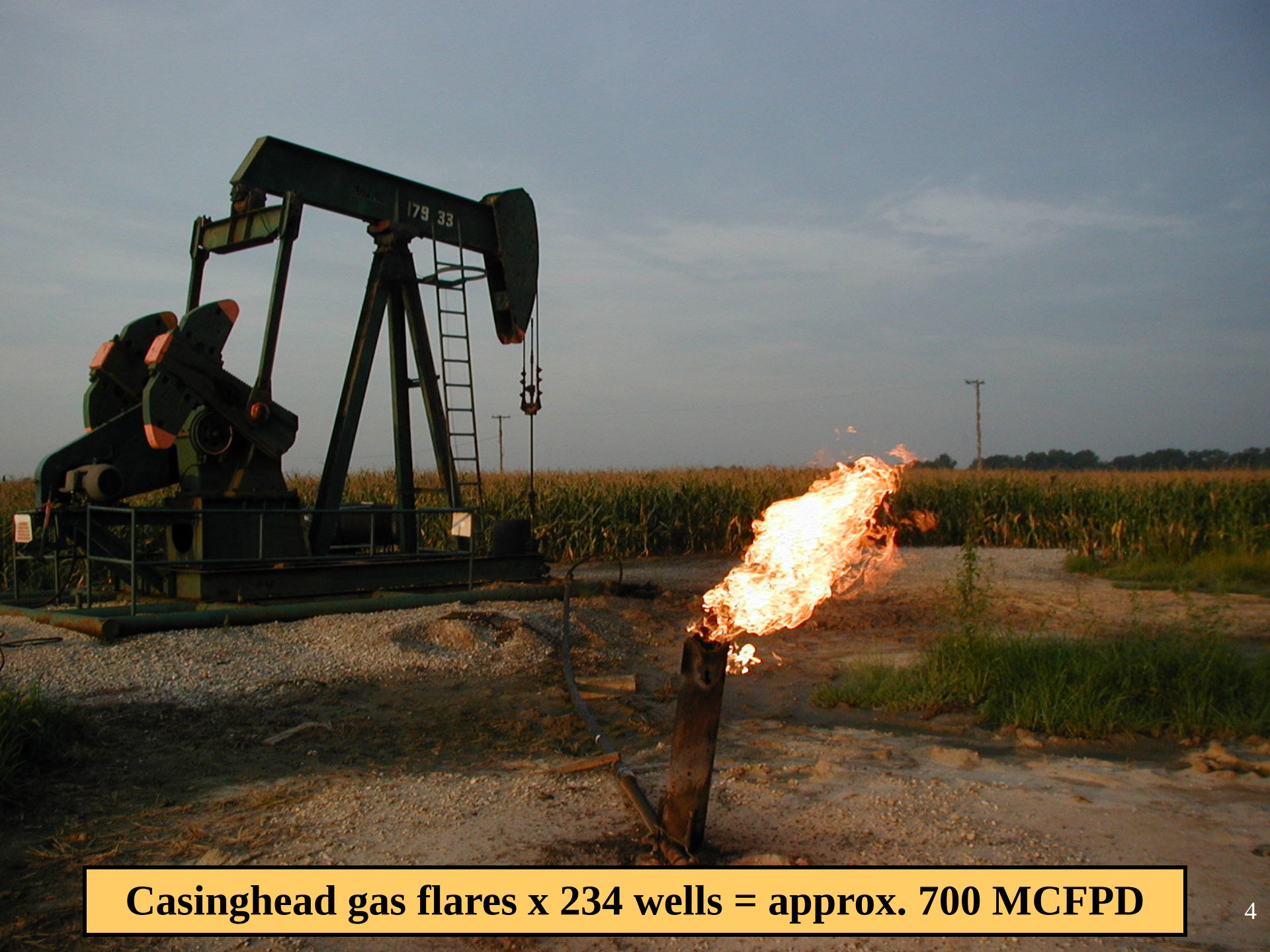
Citation Oil & Gas Corp.


Lake
Michigan
St. Louis
Salem
Evansville
ILLINOIS
www.amaps.com
50 Miles
100 KM

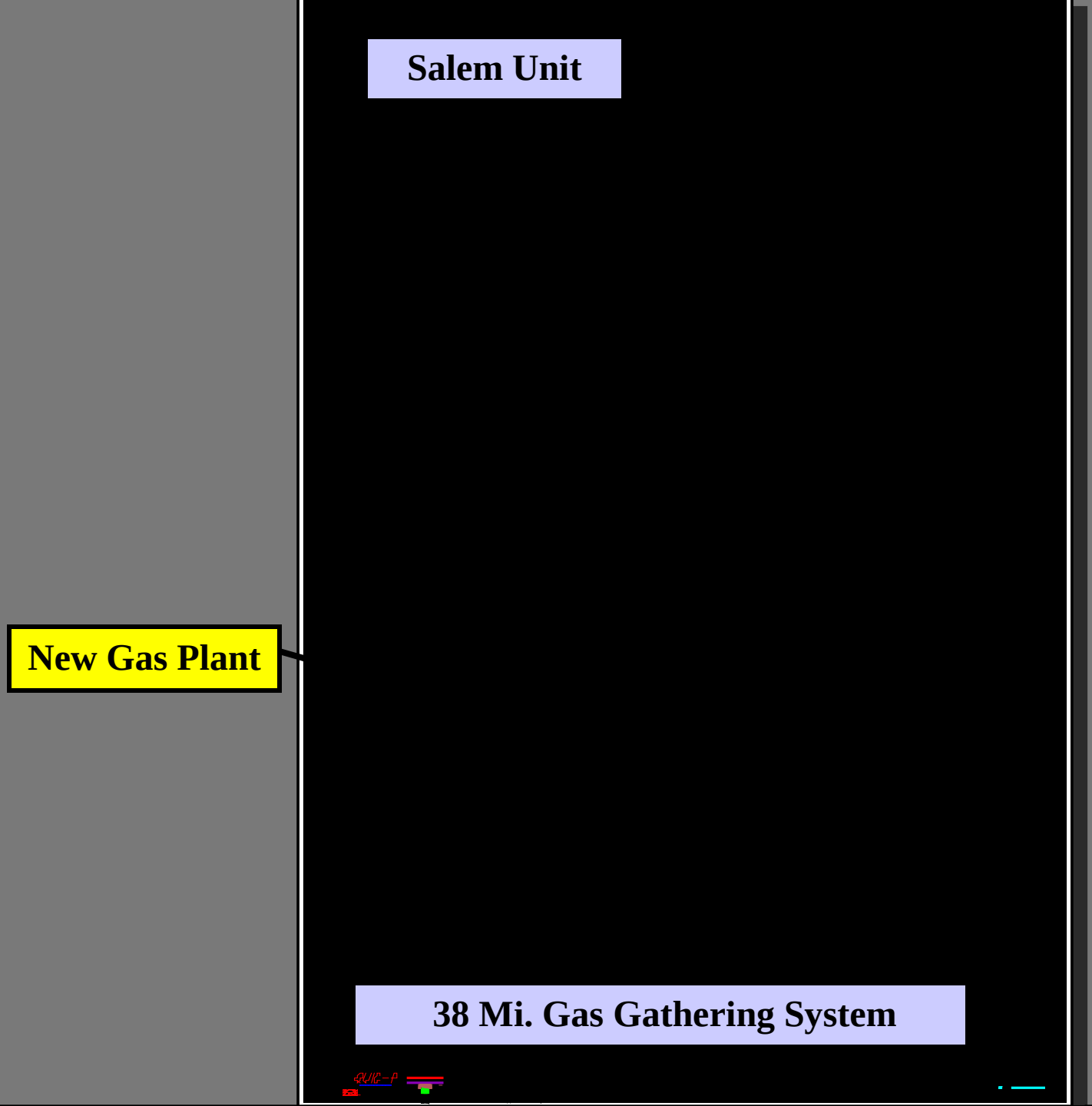
Salem Unit

Salem Unit History

- Field discovered 1938
- Unitized in 1950s
- Earliest large waterflood in USA
- Operated by Texaco until 1998
- Produces from 5 zones
- 1,725 BOPD & 110,000 BWPD
- All gas previously flared



Casinghead gas flares x 234 wells = approx. 700 MCFPD


Salem Unit
New Gas Plant
38 Mi. Gas Gathering System

Field Compressor Site

Electric drive used to minimize downtime.

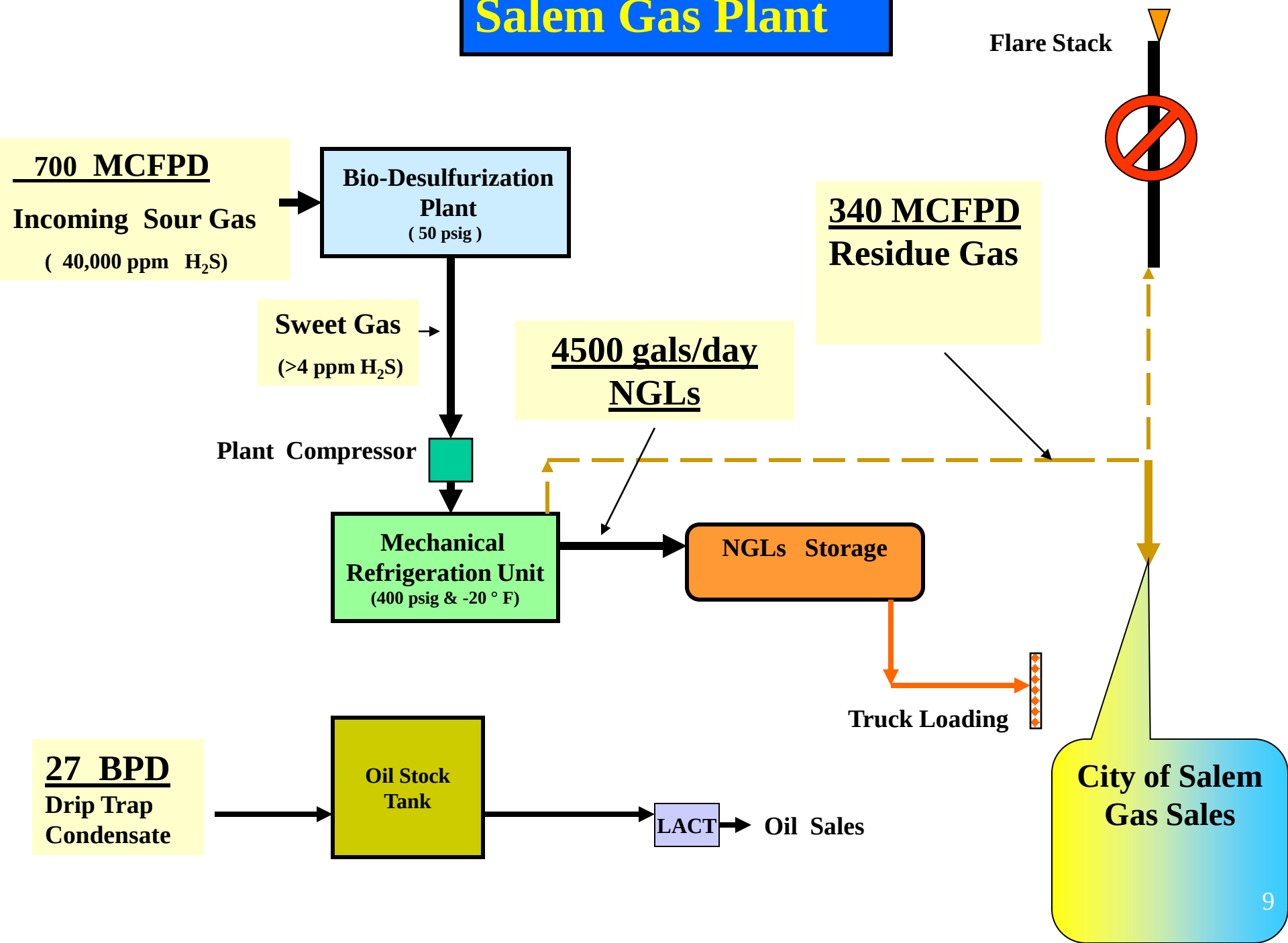
PLC monitoring used to maintain a constant vacuum on the wells..

Picture Courtesy of Hy-Bon Engineering

Rotary Screw compressors were used due to the wet nature of this gas stream. Filters are used before the skid to remove iron sulfide, then a scrubber vessel and automated liquid transfer system on skid to handle the liquids which are common in this application.

Picture Courtesy of Hy-Bon Engineering

Salem Gas Plant




1,533 MMCF Sour Gas Processed
98% Uptime since 2006 Startup
Bio-Plant

Picture Courtesy of Hy-Bon Engineering

Plant Compressor

Mechanical Refrigeration Unit

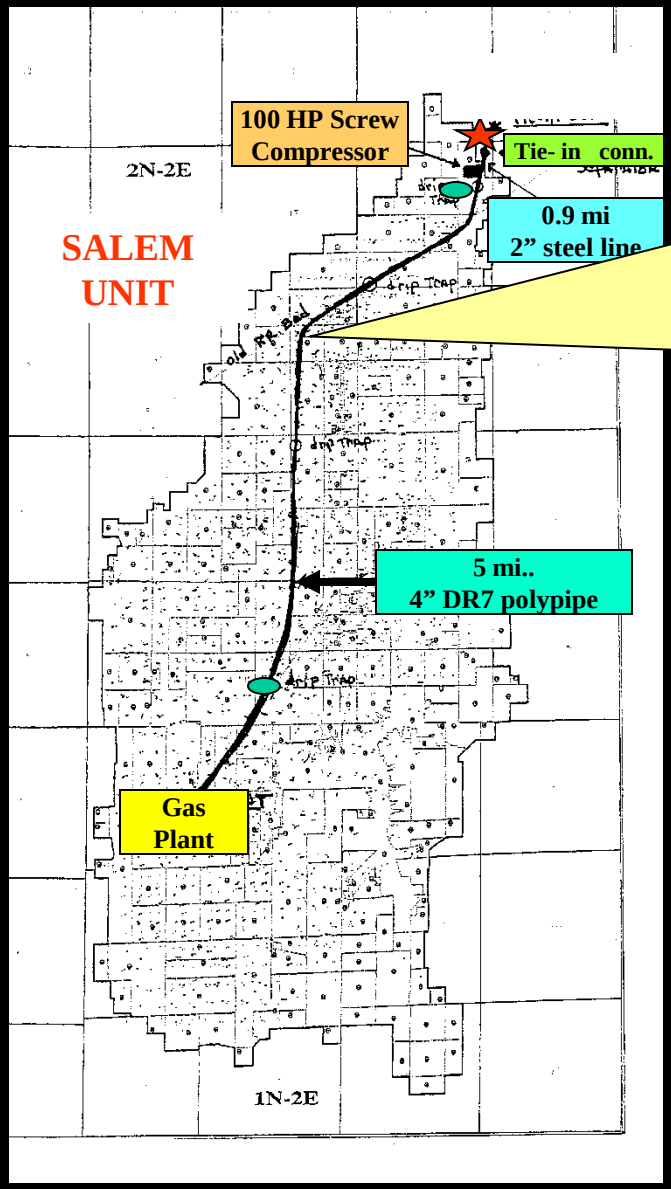
To Date

879 Truck Loads

Or

7.9 million gals

(188,000 bbls)



Pipeline provides 25% of Salem's Annual Gas Use

Gas Sales = 468 MMCF since 2007 startup

SALES GAS PIPELINE to CITY of SALEM

Conclusions

- **Capturing this stranded gas is good business.**
- **No Flaring = 125 MMCF methane reduction per year**
- **Revenue: $34,000 (gas) + $158,000 (ngl) = $192,000/mo.**
- **Bio-desulfurization works very well (< 4ppm H2S).**
- **Sales gas deal is win/win for Citation & Salem.**

Libya VRU Pilot Program

Hy-Bon Engineering

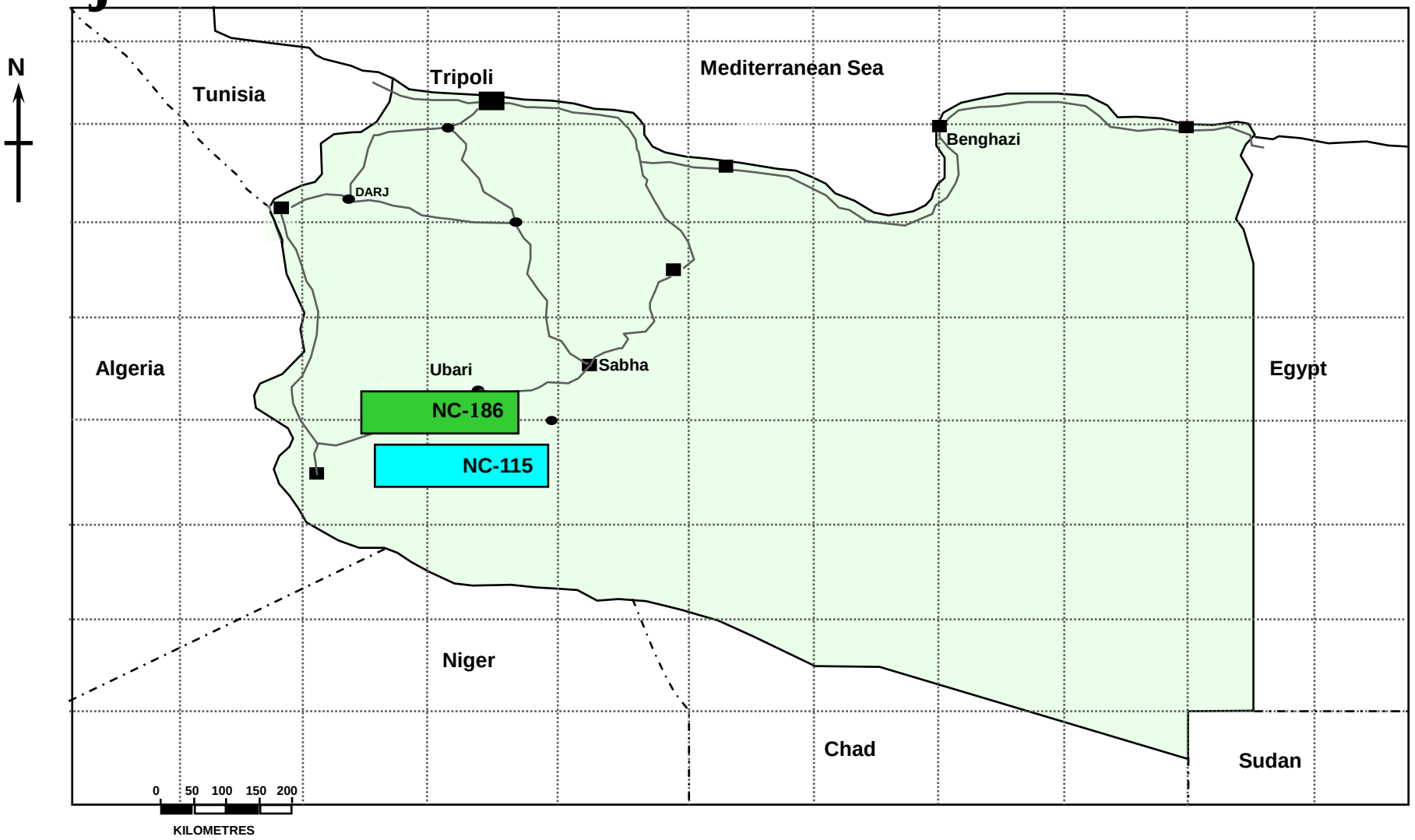
AKAKUS OIL OPERATIONS- LIBYA
Gas Utilization& Flare Emission Reduction Project

As presented at the Technology of Oil and Gas Forum; Tripoli, Libya
Mr. Mohamed Amari

Libya VRU Pilot Program

Hy-Bon Engineering

Project Location



Libya VRU Pilot Program

Hy-Bon Engineering

This is a picture of the flares at NC-115 before the VRU's were installed

Libya VRU Pilot Program

Hy-Bon Engineering

GAS UTILISATION PROJECT STRATERGY

INITIATIVE FOR REDUCTION IN GAS FLARING

- In Jan 2005 AOO achieved ISO 14001 certification with the requirement to gradually minimize the gas flaring. Accordingly several options were explored to achieve the optimum process scenario in terms of utilizing the produced gases for power generation and hydrocarbon recovery.

- In 2006 the Gas Utilization feasibly study was finalized with a recommendation to implement the project in to two phase:

- **Phase I**:
  - In this phase the VRU packages were introduced to treat the low pressure tank gas. This was the first installation in Libya, which was focused on flare reduction of Tank vapor/ gas by recovering the condensate and diverting the remaining gas to the main plant compression system. The Project was completed in late 2008 .
  - By installing the VRU and splitting the existing compression systems in to two independent trains the fuel gas had increased to allow four power generation units to operate on Gas and maximizing the condensate recovery thereby reduce flaring.
  - **Awarded Vapor Recovery Units design and Fabrication to Hy-Bon Engineering, a company with 55 years experience in this field.**

Libya VRU Pilot Program

Tank Gas- Vapor Recovery Units

Hy-Bon Engineering

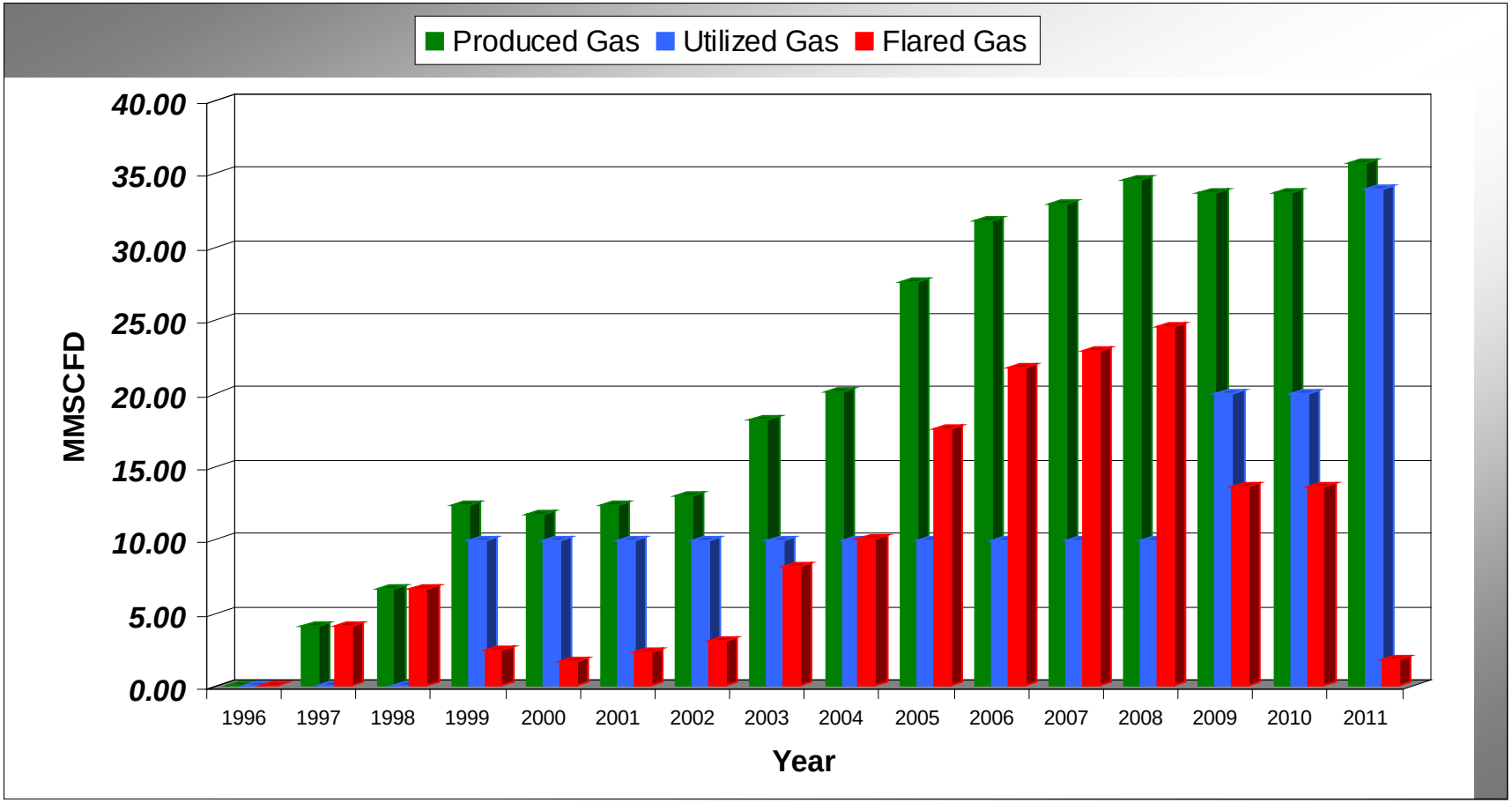
Location	Processed Tank Gas MMSCFD	VRU Recovered Condensate	Additional recovered condensate
NC-115	4	1200 blls/day@ 60 psig	1750 blls /day @ 150 psig
NC-186	2	275 blls/day@ 60 psig	1121 blls/day @ 250 psig

Location	No of VRU	Pay back time	Co2 emission reduction
NC-115	3	3 months	866 tons/day
NC-186	2	8 months	406 tons/day

Libya VRU Pilot Program

Hy-Bon Engineering

Gas Production & Utilization



Libya VRU Pilot Program

Hy-Bon Engineering

Benefits:

Gas: The gas captured by the VRUs is directed to the suction of booster compressors that go to the turbines that generate electricity.

Condensate: Along with the gas being utilized the condensate is sent to the flash drum at the front of the system to be blended back into the crude oil.

Pollution: Less pollution to the atmosphere is always a benefit to any application. It is truly a waste to just burn these resources and pollute the planet in which we live.

Goal: The goal is to eliminate these flares completely. They would only be used in an upset situation. At that time all gas and condensate would be used for the purpose of making Akakus Oil more money and help clean up the environment at the same time.

Libya VRU Pilot Program

Hy-Bon Engineering

5. ECONOMICS

Recovered Vapors

Heating Value - 3080 Btu/ft^3
Wobbe Number - 2289 Btu/ft^3
Volume - 6.0 MMSCFD

Condensate Production

Volume - 1475 bbl/d

Valuation

Savings per Month (gas at a conservative worldwide rate of $3 mscfd) - $1,600,000

Savings per year - $18,630,000

While not as easily estimable (due to spiking the condensate into the crude oil) it can be determined that the produced volume of condensate adds another $2,655,000 per month (based on a conservative $60/bbl rate) or $31,860,000 per year to the Akakus bottom line.

Libya VRU Pilot Program

This is a picture of the flares at NC-115 after the VRU's were installed

Libya VRU Pilot Program

CASINGHEAD GAS CAPTURE

STRATEGIES AND CASE STUDIES

CASINGHEAD GAS

- Approximately 18 Bcf/yr of Methane is estimated to be lost from well venting and flaring in the U.S. In many oil producing countries these numbers could be measured in the Bcf per DAY.
- 2 Primary Sources Include:
  - Separator gas vented or flared during oil processing
    - Occurs at each stage of separation process (typically 3) as water and gas are separated from the oil for collection
  - Casinghead gas
    - Most mature formations produce more oil if the gas pressure on the casing (or annulus) is reduced.
    - This is often accomplished by venting this casinghead gas at or near the wellhead

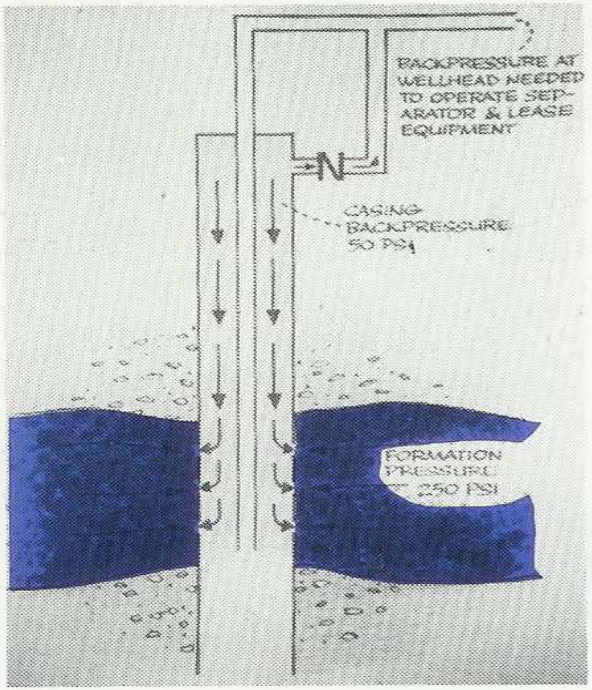
CASINGHEAD GAS REDUCTION
The Concept

- Casinghead gas relatively wet (.85 spec gravity / 16gpm)
- Weight of this column of wet gas sitting on the formation has an incremental effect on bottom hole pressure
  - Dictated by oil specific gravity and the well depth
- When you add wellhead pressure (i.e., flowline or 1st stage separator), this pressure on the formation is significantly impacted
  - Further complicated by fluctuating wellhead pressure from the pipeline
- Concept is simple – relieving this pressure in the casinghead reduces the weight (pressure) on the formation, allowing oil or gas to more easily flow from the formation into the well bore.

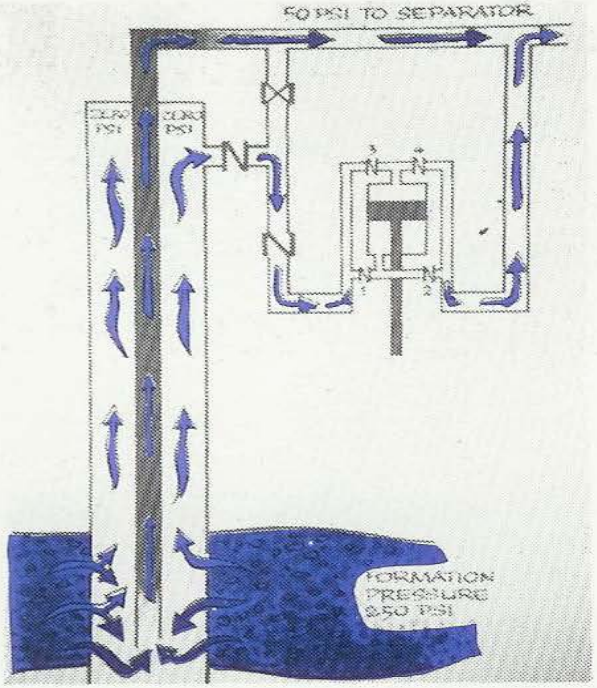
Relieving Back Pressure

BEFORE COMPRESSION

Restricting Back pressure holds back the flow of Hydrocarbons into the well bore.



AFTER COMPRESSION



Back pressure is relieved from the face of the formation allowing more hydrocarbons to flow into the well bore.

Diagram courtesy of Permian Production Equipment

CASINGHEAD GAS REDUCTION How It Works

- Goal is to maintain a casinghead pressure as close to zero as possible without pulling a vacuum
- Low horsepower compressor units utilized
  - Can be rotary vane, rotary screw or small recip based on gas stream
- Pressures as low as ½" water column are maintained using a bypass system with a recycle/ throttling valve
  - Bypass pilot control maintains this pressure / gas recycled below set point
- Steady pressure is maintained on the well bore, and produced gas is sent down the flowline or gas line

CASINGHEAD GAS REDUCTION Benefits

- The majority of wells tested in older, mature basins tend to respond favorably to a reduction in casinghead pressure
- Many wells respond with dramatic increases in oil and or gas production – particularly in water flood or CO2 flood projects
- Often allows subsurface pumps to operate more efficiently, and often eliminates “gas locking” problems
- Eliminates the impact of fluctuating or rising pipeline pressures on your production
- On wells that respond favorably, the payback economics are extremely compelling

CASINGHEAD GAS REDUCTION Weaknesses

- Not all formations respond favorably; even individual, adjacent wells in the same formation often respond differently
- While we know some entire formations that do not respond, within areas that do respond it requires well-by-well testing
- Some formations respond with increased produced water
- In some cases, wells respond incredibly for 7 to 10 days, and then drop to previous levels
- While oil production gains after 30 days generally remain constant, gains in gas production may drop to previous levels

CASINGHEAD GAS REDUCTION Lessons Learned

- Ask the questions – you may be venting this gas and not know it
  - Especially when contract pumpers are being used
- Make your decisions based on fact
  - Like tank testing, the key is accurately quantifying the gas stream, so true payback economics can be evaluated
- Look at the opportunities across the entire field, not simply well by well
  - Linking multiple wellsites can dramatically improve the economics of gas capture
- Align field incentives to your gas capture goals
  - If field personnel incentives are strictly tied to increased oil production and cost containment, the field solution will always be to vent this gas (i.e., a ball valve is much cheaper than a compressor package)

Additional Info

CASE STUDY - LEA CO., N.M. Hobbs Area

	BEFORE COMPRESSION	AFTER COMPRESSION	GROSS MONTHLY INCOME INCREASE
CASINGHEAD PRESSURE	50 PSIG	2 PSIG	
GAS PRODUCTION	200 MSCFD	250 MSCFD	50 X $3.00 X 30 = $4500.00
OIL PRODUCTION	30 BBLD	35 BBLD	5 X $20.00 X 30 = $3000.00
DISCHARGE PRESSURE	-	50 PSIG	**Total = $7,500 per Month**

Case Study – Ector County
4 Separate Compressors / Multiple Wells
Cowden Area

	BEFORE COMPRESSION	AFTER COMPRESSION	GROSS MONTHLY INCOME INCREASE
CASINGHEAD PRESSURE	45 PSIG	2 PSIG	
GAS PRODUCTION	Incremental Gas Produced	18 MSCFD 12 MSCFD 7 MSCFD 8 MSCFD	45 X $3 X 30 = $4,050
OIL PRODUCTION	160 BBLD 50 BBLD 46 BBLD 17 BBLD	180 BBLD 115 BBLD 58 BBLD 27 BBLD	107 X $20.00 X 30 = $64,200.00
DISCHARGE PRESSURE	-	45 PSIG	**$68,250 per Month**

RECOMMENDED PROCESS

1) Determine which fields may respond most favorably, and then prioritize well locations.

Picture Courtesy of Hy-Bon Engineering

RECOMMENDED PROCESS

2) Following well selection, a mobile, trailer mounted unit (natural gas engine driven) is moved to location for a 45 day test.

Picture Courtesy of Hy-Bon Engineering

RECOMMENDED PROCESS

3) Following 30 days of sustained production increase, an electric drive, skid mounted unit is moved to location, and the trailer is released to test the next candidate well.

Picture Courtesy of Hy-Bon Engineering

RECOMMENDED PROCESS

4) Based on the proximity of the wells and line pressure, evaluate linking opportunities for multiple well gathering systems.

Picture Courtesy of Hy-Bon Engineering