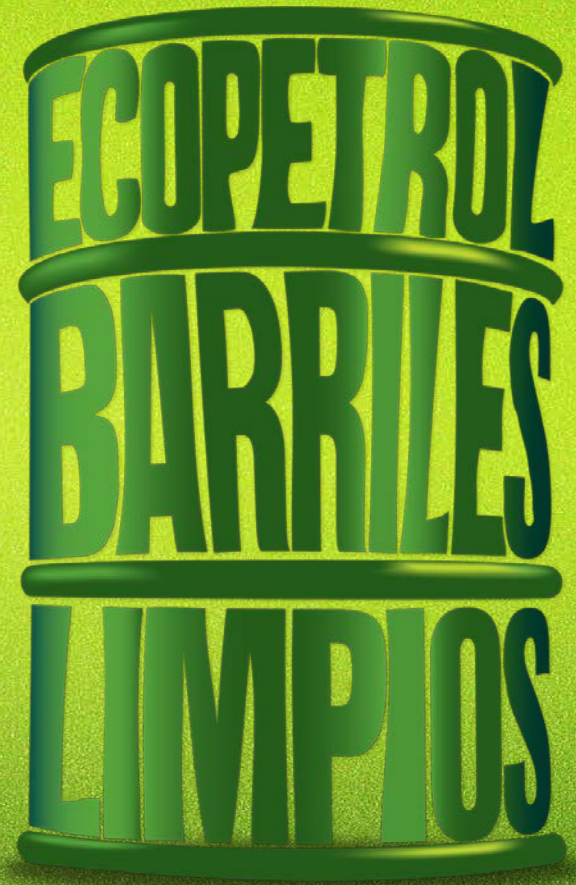


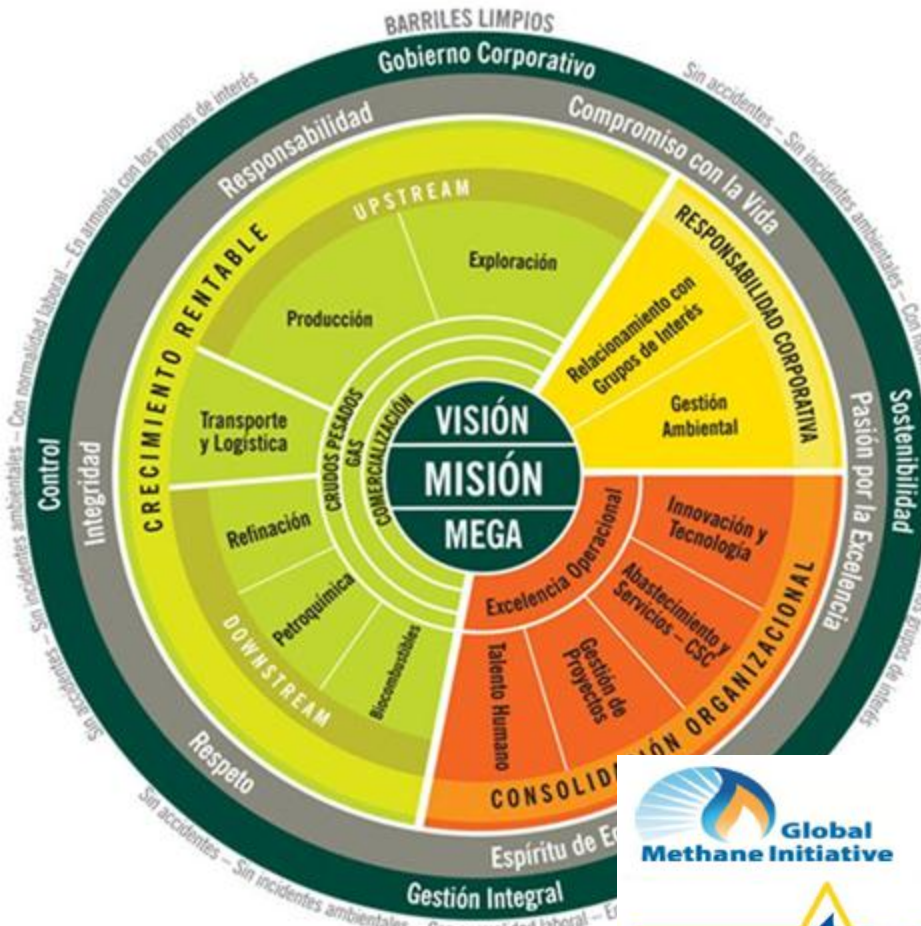
# *METHANE EMISSIONS*

## *ECOPETROL-EPA COLLABORATION Global Methane Initiative*

*SUPERINTENDENCIA DE OPERACIONES DE MARES  
INSTITUTO COLOMBIANO DEL PETRÓLEO  
ENVIRONMENTAL PROTECTION AGENCY (EPA)  
MARCH 2013*



# COMPANY STRATEGIC ALIGNMENT



## Organizational Culture:

- ✓ *Commitment to Life*
- ✓ *Responsibility*

## Strategic Guidelines:

- ✓ Profitable Growth
- ✓ Corporate Responsibility
- ✓ Organizational consolidation

## Strategic Advisers:

- ✓ Production
- ✓ *Environmental management and relationship with stakeholders*
- ✓ *Innovation and Technology*

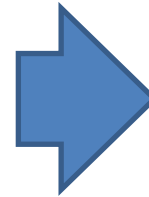


# REASONS FOR DOING IT

## GREENHOUSE GAS

¿What we do?, ¿Implement Investment Projects? ¿Legislative changes?

Environmental Legal Breaches  
Claims  
Losses  
Climate change



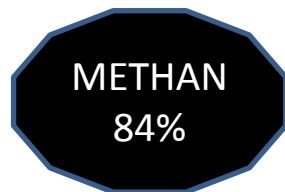
*Opportunities*



*Overall Project Goal*

Generate, evaluate and implement alternatives to the use of this non-renewable resource, to continue operating the oil fields in compliance with legal and environmental regulations, creating wealth for the company

To mitigate or eliminate emissions of methane, also mitigate or eliminate other compounds:



ethane, propane, butane, pentane, hexane,  
carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO),  
hydrogen sulfide (H<sub>2</sub>S)

# FIELD APPLICATION

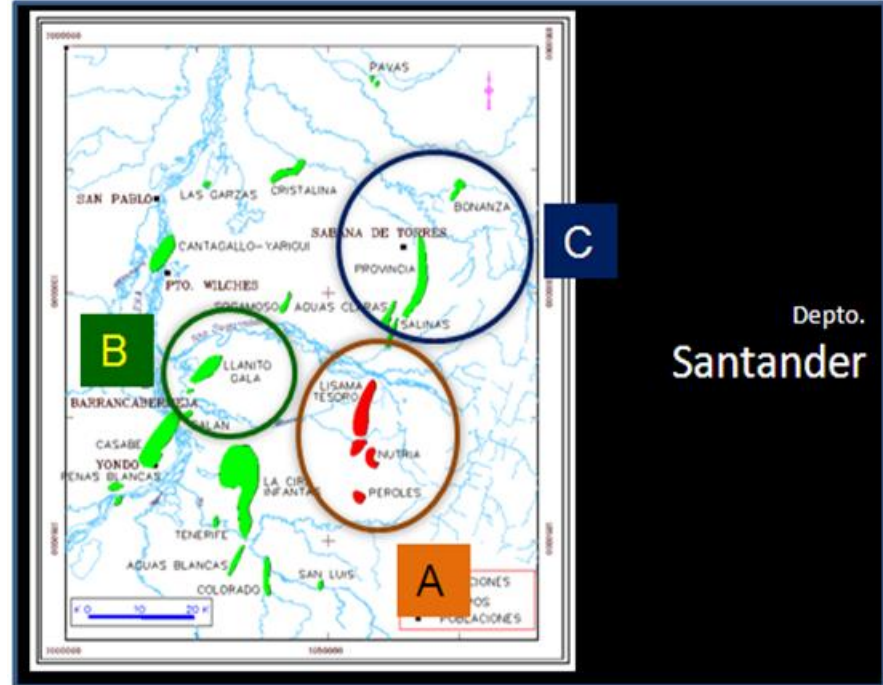
## GRM

Superintendencia La Cira Infantas  
 Superintendencia del Río  
 Superintendencia de activos en Asociación  
 Campo Escuela Colorado  
**Superintendencia de Operaciones de Mares**



## BASIN MIDDLE MAGDALENA VALLEY

- A** Activo Lisama
- B** Activo Llanito
- C** Activo Provincia (Provincia y Bonanza)
- C'** Activo Provincia (Tisquirama y San Roque)



# FIELD APPLICATION

	FIELD	OOIP (MMBls)	RF (%)	WELLS	DEVELOPMENT DATE
PROVINCIA	PROVINCIA	757	26	160	1960
	BONANZA	154	12	39	1964
	TISQUIRAMA	173	4	19	1965
	SAN ROQUE	62	5	7	1966
LLANITO	LLANITO	321	16	104	1964
	GALA				
	GALÁN SAN SILVESTRE	374	8	147	1953
LISAMA	LISAMA	242	22	169	1963
	LISAMA PROFUNDO	25.1	3	1	2006
	TESORO	42.4	17	43	1979
	NUTRIA	115	8	47	1982
	PEROLES	5.9	20	12	1978
	GUARIQUÍES	25.4	0	1	2011
	SAN LUIS	8.11	10	10	1950
	AGUAS BLANCAS	60	2	10	1960
	TENERIFE	21.9	3	3	1968
TECA COCORNÁ	TECA COCORNÁ	602	17	376	1967

TOTAL OOIP (MMBls)	RF AVERAGE (%)	TOTAL WELLS
2989	11	1182

*Ecopetrol S.A. in Magdalena's Valley has the operation of 17 Hydrocarbons fields development since 1950.*

# ***MAIN ECOPEtrol METHANE EMISSIONS***

## ➤ **Venting**

- Artificial Lift System
- Compressors
- Recolection Facilities

## ➤ **Flaring**

- Artificial Lift System
- Compressors
- Recolection Facilities
- Process Plants

## ➤ **Mobile Emissions**

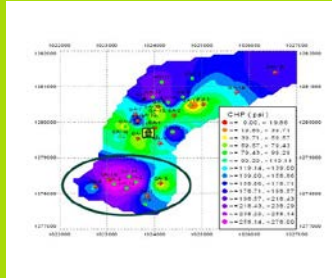
- Mobile Systems (workover, well service and generally transportation)



# PROJECT APPROACH



## METHODOLOGY



Quantification



Alternatives Analysis



Pilots

Elimination Flaring and Venting

Projects

Methodology Structure

Velasquez Field Visit

10 Compressors Pilots

**PETROBRAS**  
Guando field Visit

Gas capture projects Production Wells at Ecopetrol

wells



Mansarovar Energy Colombia Ltd.



ENE 2010

JUN 2010

ENE 2011

JUN 2011

ENE 2012

JUN 2012

ENE 2013

JUN 2013

Facilities

Initiation and implementation of the agreement Ecopetrol – EPA

Gas capture projects Production Facilities at Ecopetrol



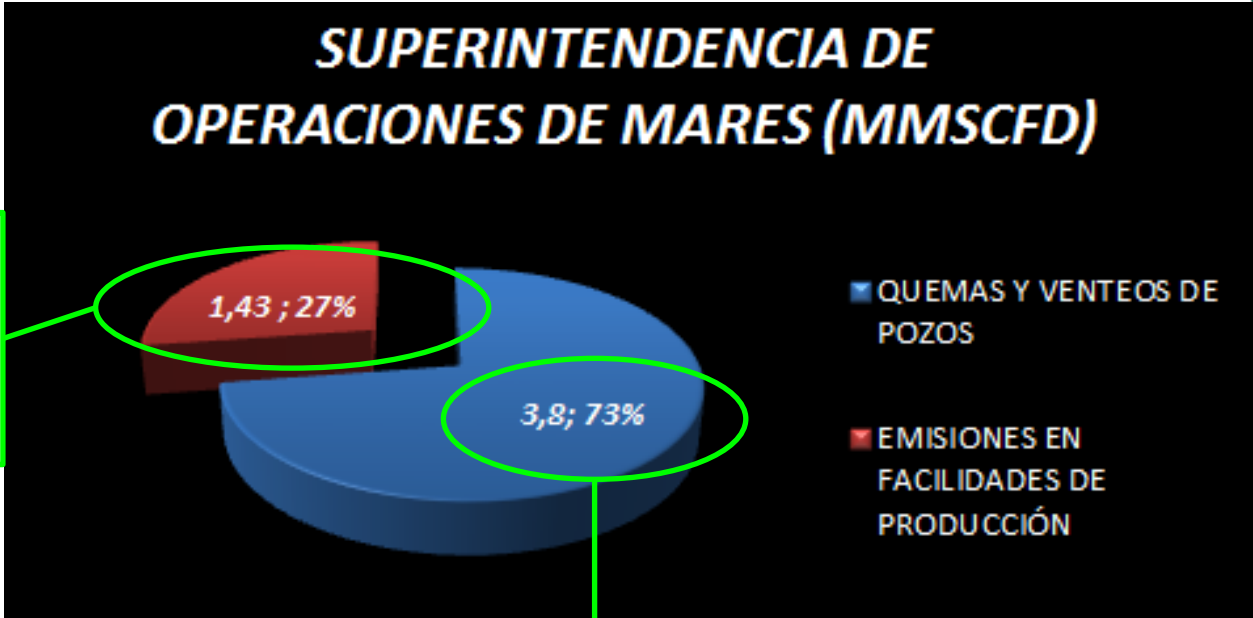
# QUANTIFIED EMISSIONS

## METHANE EMISSIONS



### SUPERINTENDENCIA DE OPERACIONES DE MARES (MMSCFD)

Venting and Flaring, Facilities (27%, 1.43 MMSCFD)



Venting and Flaring, Wells (73%, 3.8 MMSCFD)





# WHAT WAS SURPRISING

## ¿FACILITIES EMISIONS?

### MEASURE STUDY

- The measure study was made in May 2012 in Magdalena Valley Field Facilities:
  - Santos Field Facilities and Compressor Station
  - Suerte Field Facilities and Compressor Station
  - Bonanza Field Facilities and Compressor Station
  - Provincia Procces Plant
- Methane Emissions:
  - 131 MMSCF/Year
  - 30 MMSCF/Year anothers HC.

*Proposed action: Improvements Maintenance Routines,  
Life Cycle Analysis, Technological Adaptations*

VIDEO 1 EMISION



# WHAT WAS SURPRISING

## ¿FACILITIES EMISIONS?

- Methane economy recovery 99,4 MMSCF/Year
- It means:
  - Savings over USD \$559.000 / year
  - Reduction emissions equivalent 40.000 tCO<sub>2</sub>e
  - Liquid value recover
  - Improve safety operations

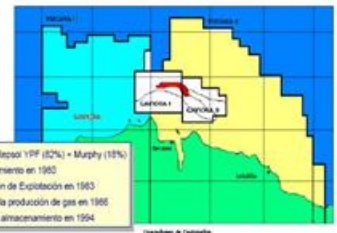


# WHAT WE FOUND IT TO BE IMPORTANT

## PRODUCED GAS APPLICATIONS



- Improve Gas and Oil Sales. (Increase efficiency in artificial lift systems)
- Self-generated energy. (Bonanza Field Applications)
- Wells Stimulation / EOR. (CO<sub>2</sub> projects)
- Gas Storage.



# WHAT WE LEARNERD

## FINANCIAL STUDY

**MONEY LOSSES** (*In Colombia the company operator pays 20% royalties for the vented/flare gas*)

SUPERINTENDENCIA DE OPERACIONES DE MARES			
FIELD	GAS GOBERMENT TAXES FLARING AND VENTING (KPC)	GAS PRICE (USD/MMBTU)	MONEY LOSSE (USD)
BONANZA	97,309	3.6	\$ 350,312.4
LLANITO	9,782	4	\$ 39,148
LISAMA	31,682	5.3	\$ 167,914.6

**2012 LOSSES  
> USD 500,000**

## PROJECT FINANCIAL RESULTS

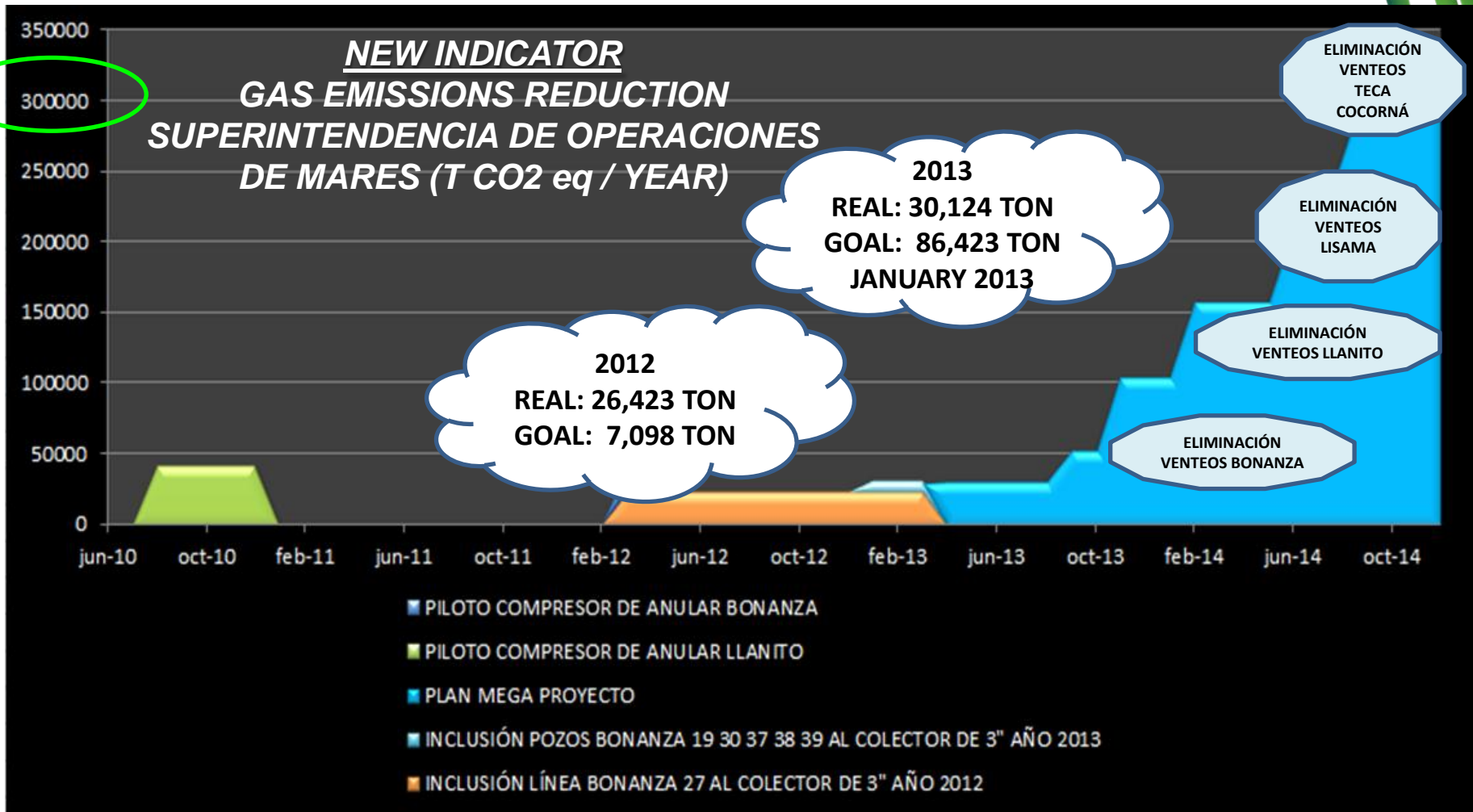
FIELD	NPV
BONANZA	-121,546
LLANITO	2,936,845
LISAMA	2,987,611

**NPV MMUSD 6**

# RESULTS 2010 -2013

## & PLAN 2013-2014

2014 goal!



# ***OTHER OPPORTUNITIES***

## **PLAN 2012-2014**

- 2013-2014 Tisquirama Field. collection and self-generation or gas for oil well stimulations
- 2013-2014 Recovery network system Teca Cocorná Field, Gas for Steam Generation.
- 2013-2014 Gas collection system compression in Suerte, Santos and Tesoro Facilities with Vapor Recovery Units.
- 2013-2014 Compressor system for low pressure Bonanza Field Facilities.
- 2013-2014 CO2 Capture and EOR process, Galán Field.



*Thanks...*



**BAR  
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