



Colombian Sugarcane Research Center

Science, technology and innovation for the
Colombian sugarcane industry

*Nicolás Gil Ph.D.
August, 2014*



AGENDA

Introduction

**Research
programs**

Bio-ethanol

Bio-eletricity



Colombian Sugarcane Sector

Asocaña – Association of cane growers and mills

Cenicaña - Colombian Sugarcane Research Center

Procaña – Association of Cane Producers

Ciamsa – Marketing Company for Sugar and Molasses

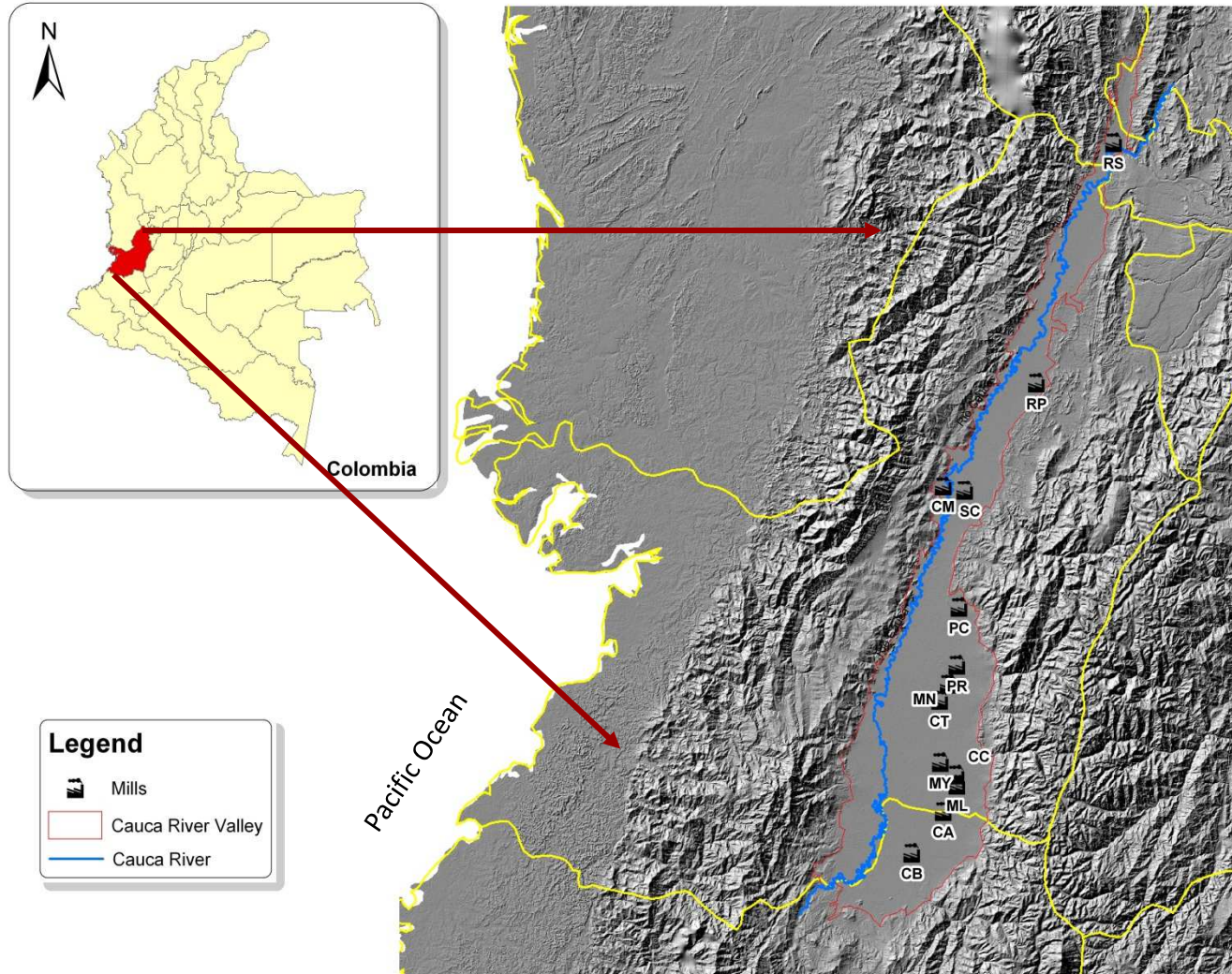
Tecnicaña – Society of Sugarcane Technologists

Sugar mills: 13

Cane growers: 2,700



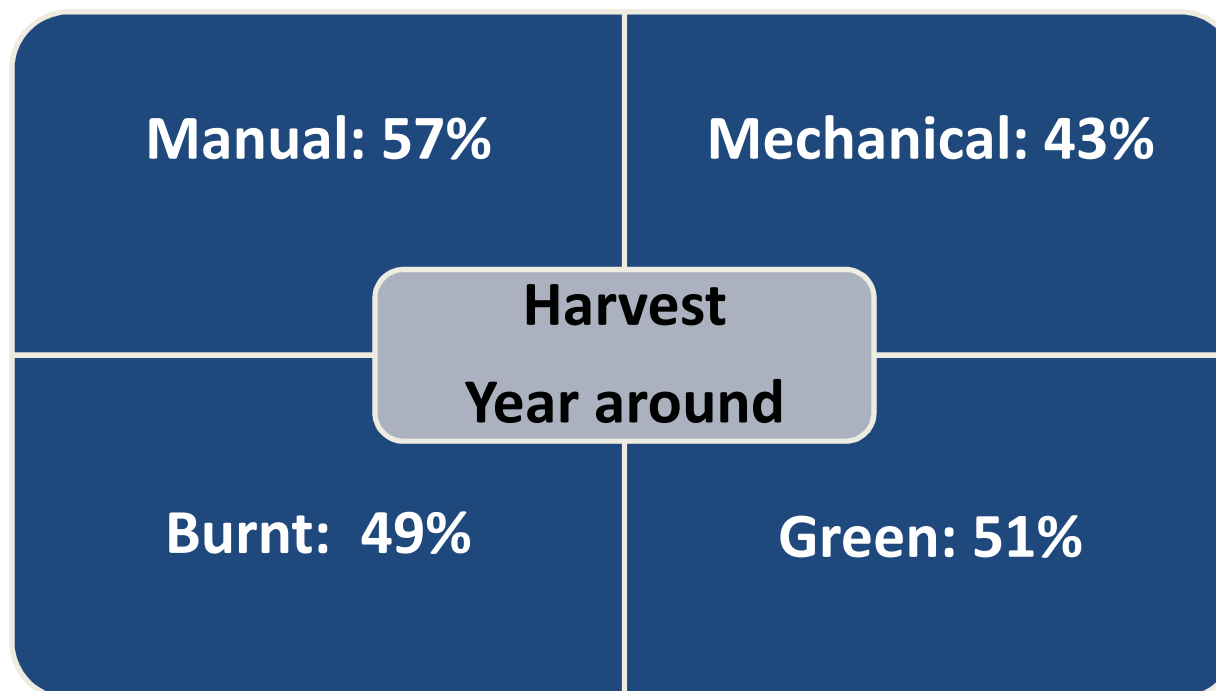
Location of 13 sugarcane mills in Colombia





Crop & harvest characteristics

Crop cycle: 12-15 mo





Colombian Sugar Industry Main Indexes 2008- 2013

Area: 228,000 ha

Crushed cane (t): 22,728,758

Sugar production (t): 2,339,988

Ethanol production (m³): 351,086

Residues estimated (t): 9,000,000

Sugar Yield (99,7% pol): 11.37

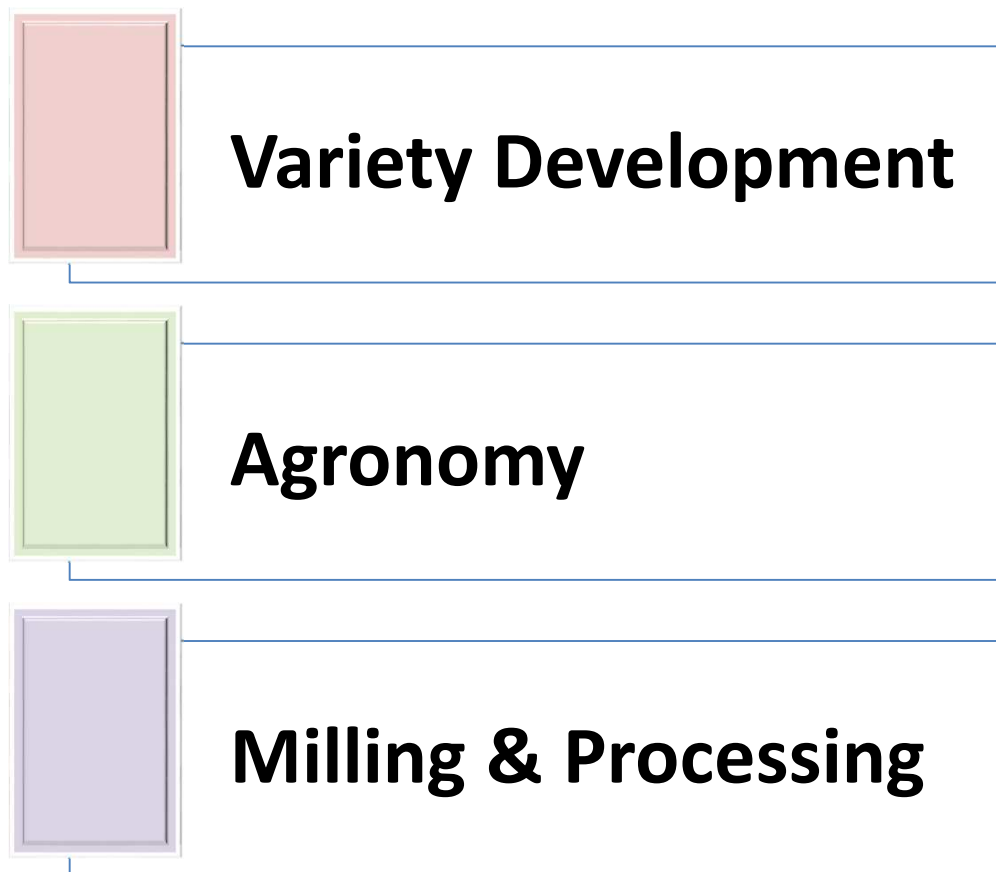
Extraction pol % pol in cane: 95.81

Boiling House Recovery efficiency, %: 91.09

Overall Recovery Efficiency, %: 87.20



RESEARCH PROGRAMS





Research Programs

Varietal Development

- Breeding
- Phytopathology
- Entomology
- Biotechnology

Agronomy

- Land preparation
- Water management
- Mechanization
- Crop nutrition and soils
- Cane ripening

Milling and Processing

- Technology validation
- Research
- Standardization
- Microbiology
- Energy
- Training

Energy, Environmental issues, Climate change

FUNDING

- Sugar mills
- Cane growers

0.65% total sale value of sugar and ethanol



Achievements

- World highest productivity.
- 90% area planted with local bred varieties.
- 50 % of reduction in water use.
- Site specific agriculture.
 - Soil and climate characterization → AG_Zones.
 - Growers characterization.
 - Benchmarking.
- Software for mills settings calculations and energy and mass balance software.
- Strategies to reduce sucrose losses in Factory.

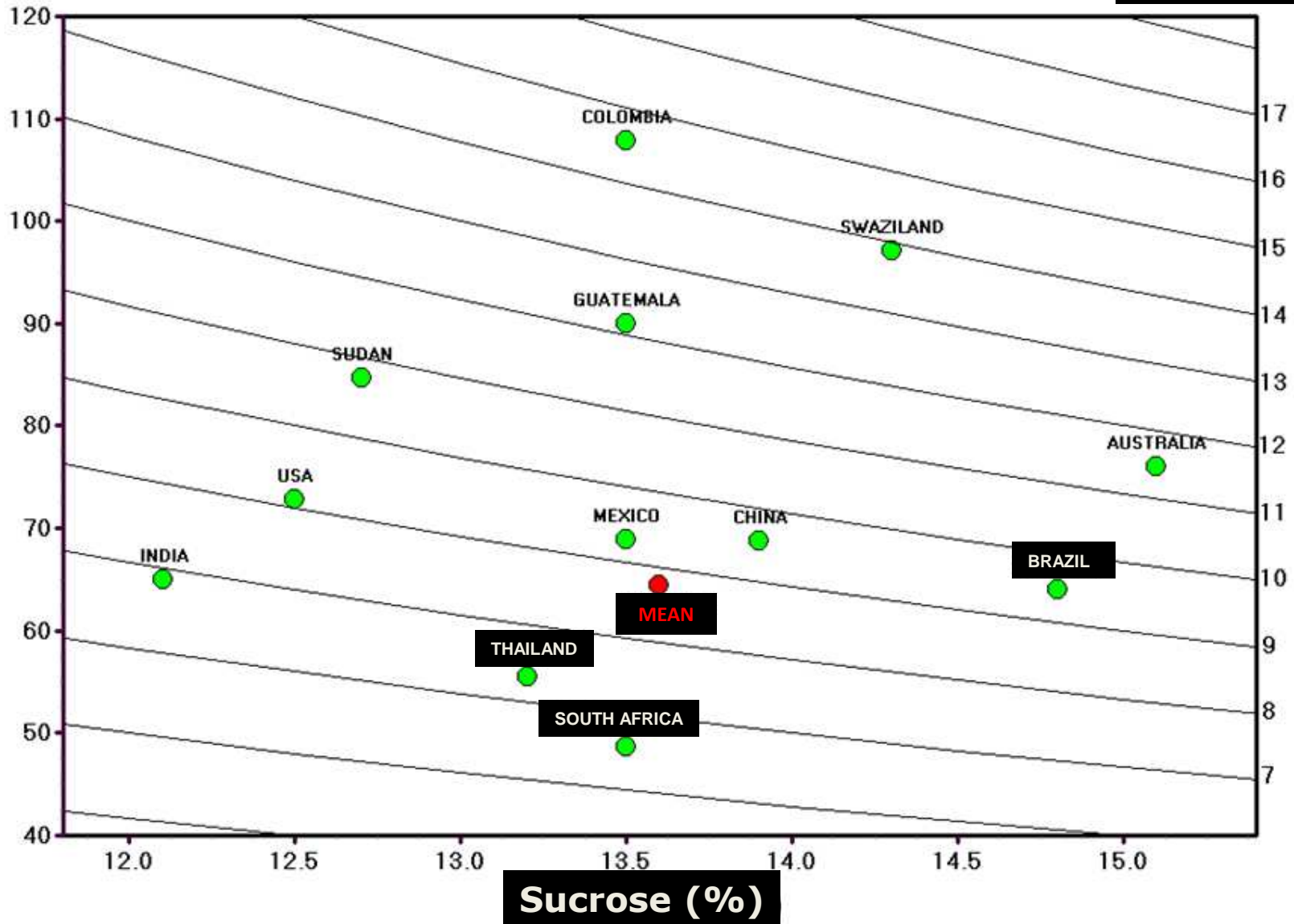


PRODUCTIVITY 2003-2007

LMC, 2008

TCH/Year

TSH/Year





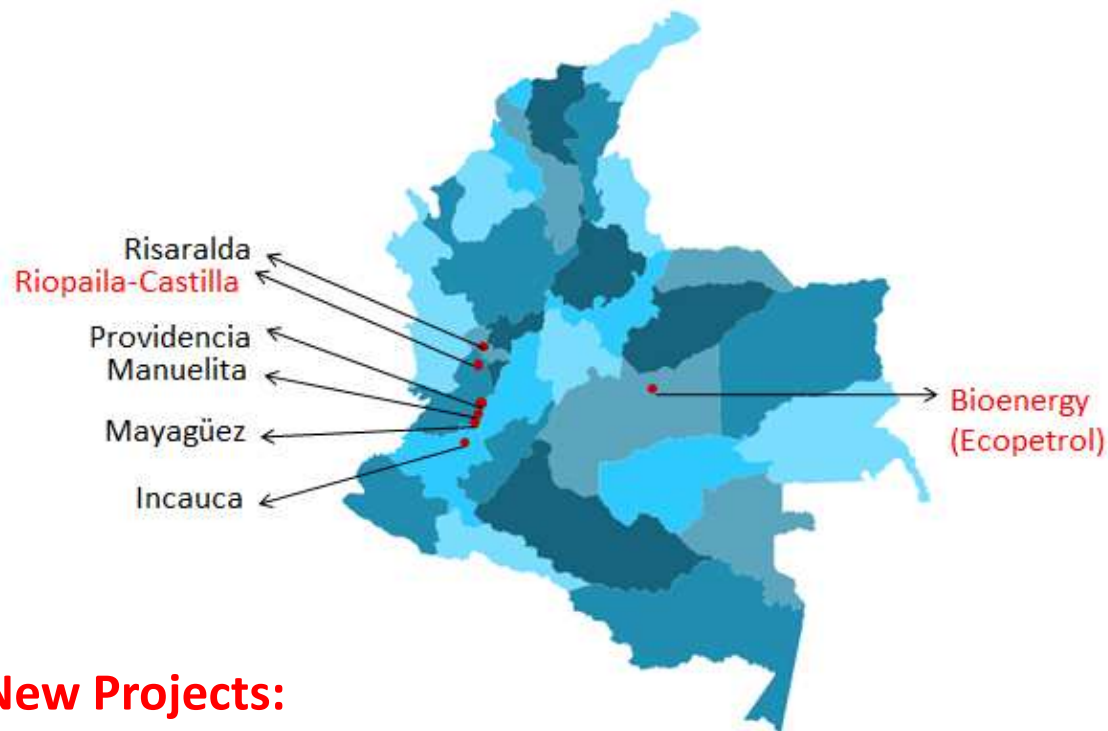
Bio- Ethanol

Ethanol in Colombia



Location of distillery plants and installed capacity

Distillery	Production/ (L/day)
Incauca	350.000
Providencia	300.000
Manuelita	250.000
Mayagüez	250.000
Risaralda	100.000
TOTAL	1.250.000

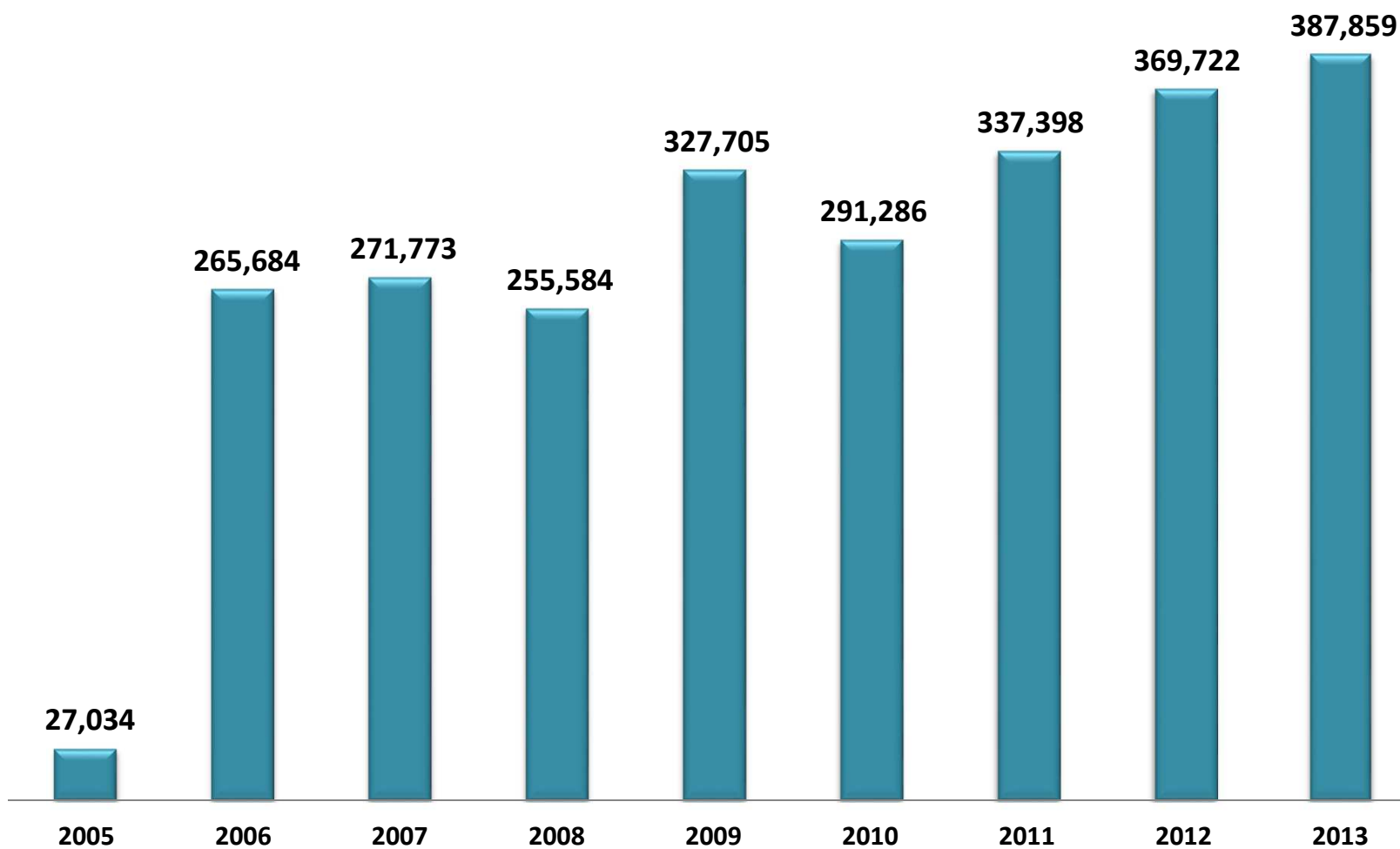


New Projects:

- **Bioenergy (Ecopetrol):** Located in Puerto López (Meta), 480.000 Liters per day. 15.000 new ha in sugarcane.
- **Riopaila-Castilla:** Located in La Paila (Valle del Cauca), 400.000 Liters per day.



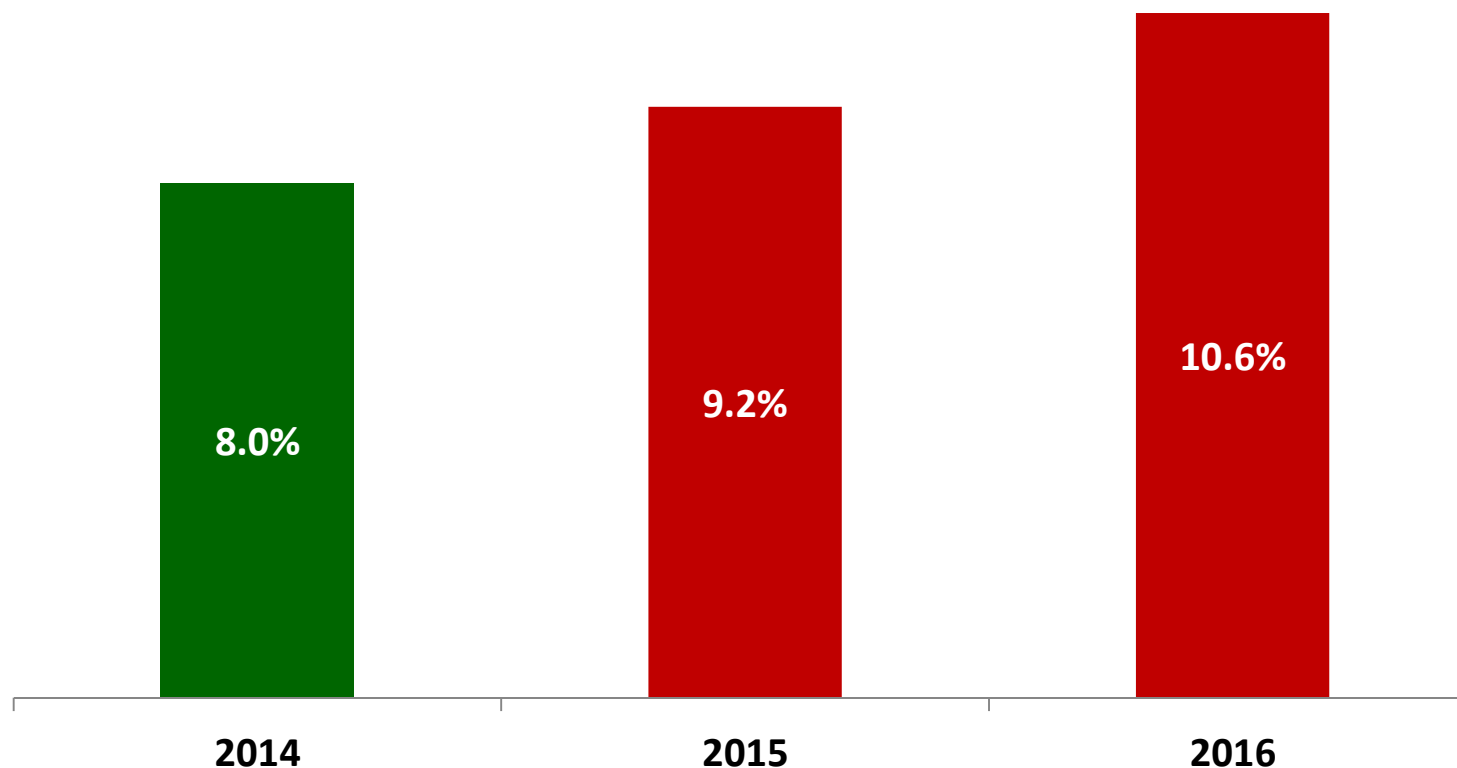
Colombia's Fuel alcohol balance (2005 – 2013) (thousands of liters)



Source: Asocaña



Evolution of ethanol blends in Colombia

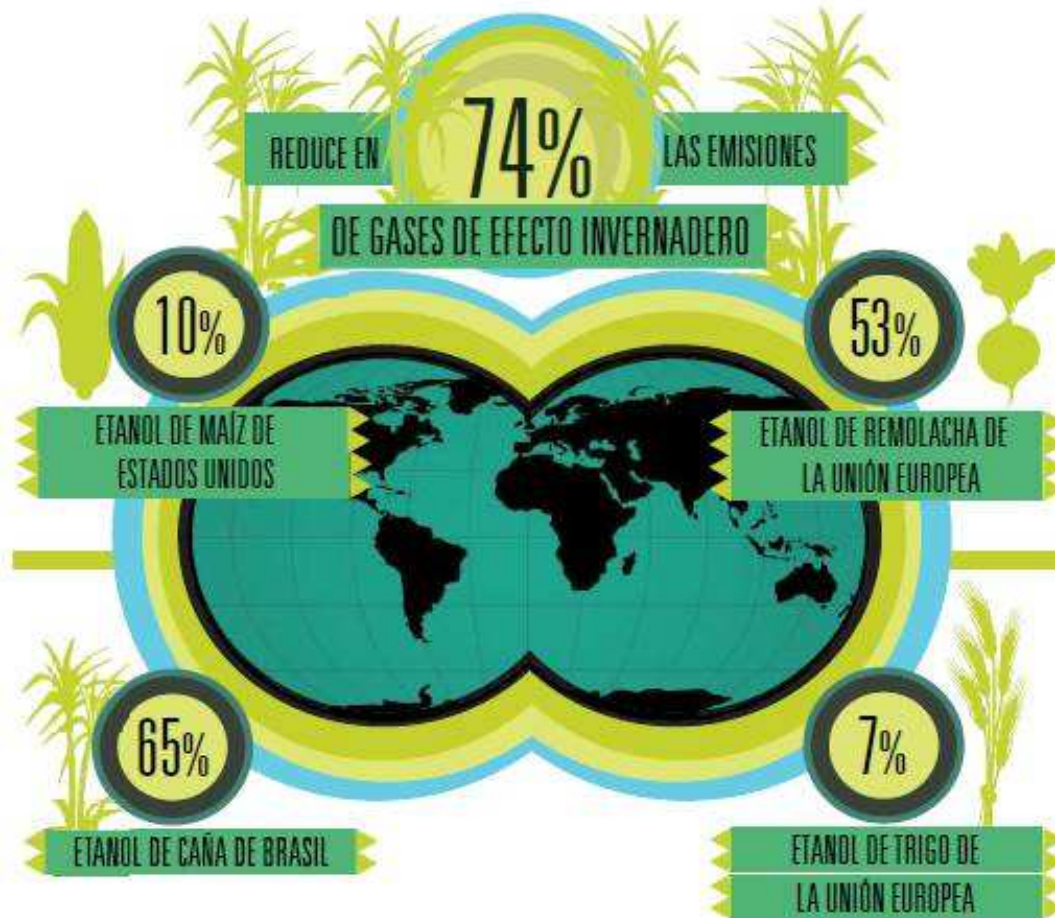


The estimated value for 2015 and 2016 includes the production of Bioenergy and Riopaila.

Fuente: FEPA, UPME, elaboración Asocaña

Life Cycle analysis of ethanol

BIOETANOL DE CAÑA DE COLOMBIA



ESTO LO AFIRMA UN ESTUDIO
CONTRATADO POR
EL MINISTERIO DE
MINAS Y ENERGÍA

INVESTIGACIÓN
REALIZADA POR

EMPA

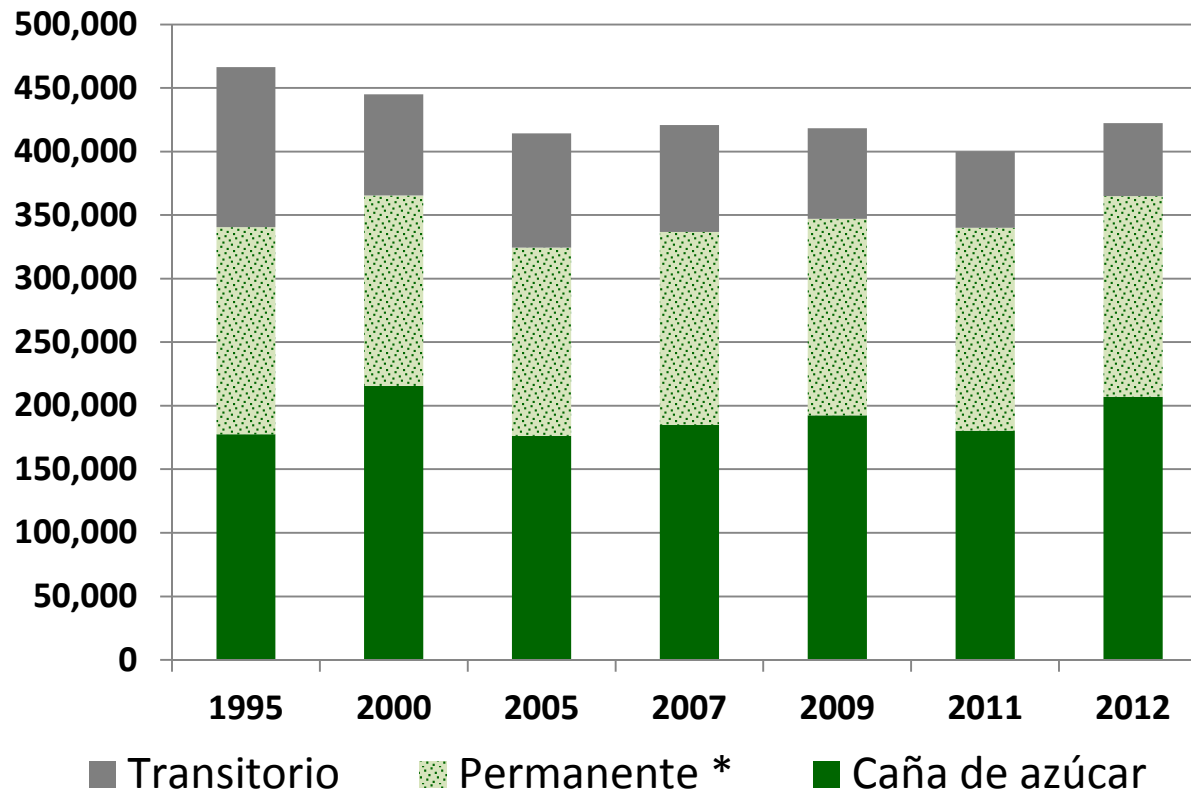
THE SWISS FEDERAL LABORATORIES FOR
MATERIALS SCIENCE AND TECHNOLOGY
OF SWITZERLAND

CNMPL

CENTRO NACIONAL DE PRODUCCIÓN
HÁZ CEBADA + LA UNIVERSIDAD PONTEFICA
BOLIVARIANA SEDE MEDELLÍN
DE COLOMBIA

In Colombia: the area where sugarcane is harvest remains the same

Harvested area in Valle, Cauca, Risaralda, Caldas y Quindío (ha)



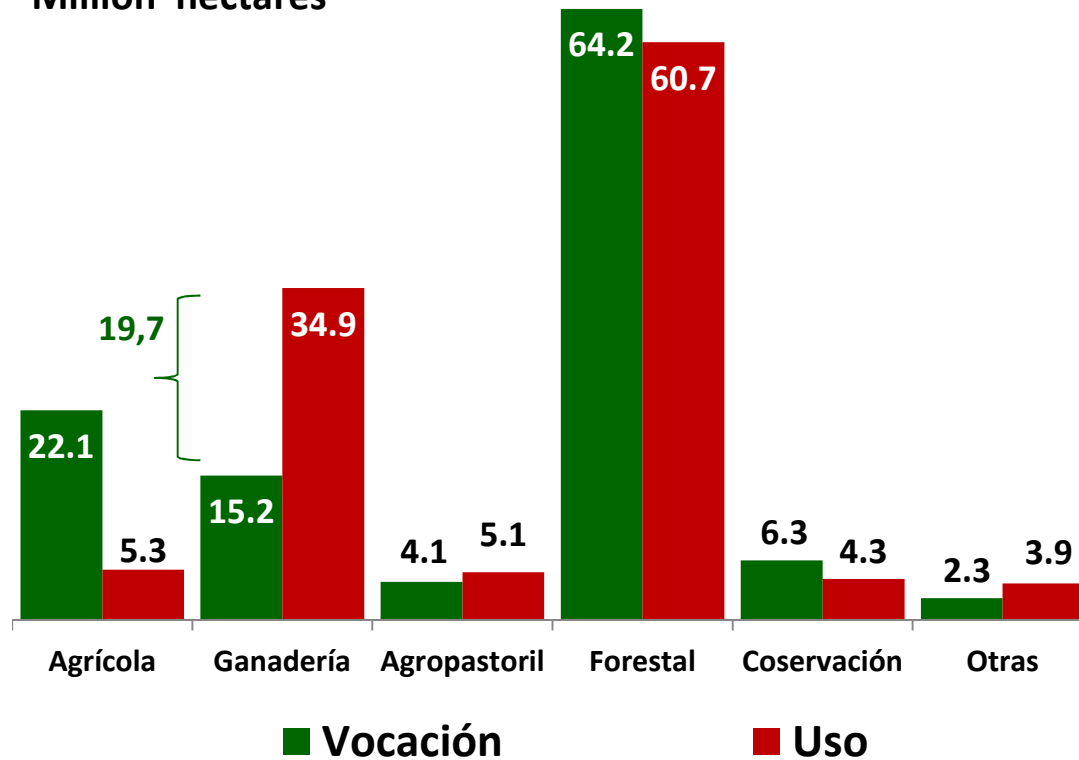
Between 2005 and 2012 the area harvested was similar at those harvested in 2000 when ethanol program had not begun.

* Permanent does not include sugarcane nor coffee

Fuente: Anuarios Estadísticos del Sector Agropecuario – Minagricultura, elaboración Asocaña

Use of the land in Colombia

Million hectares



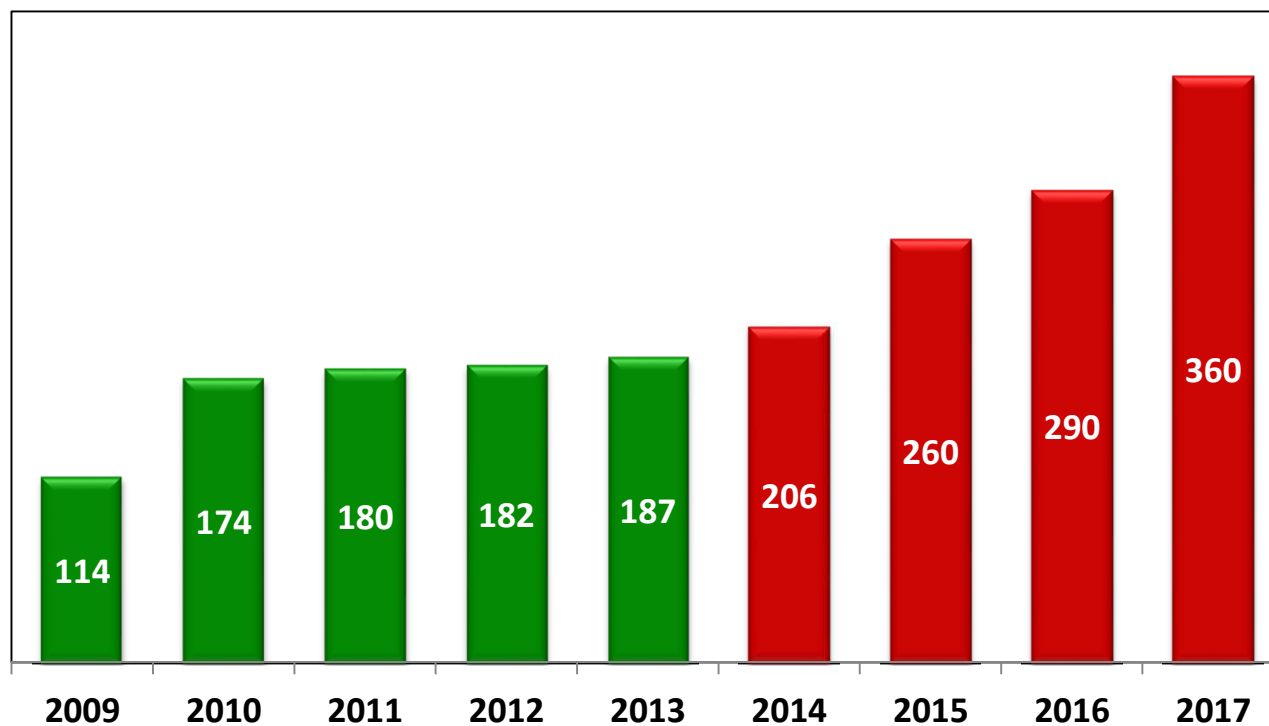
Efficient uses of the land can lead to increase the area dedicated to produce feed and biofuels.



Bio- electricity



Cogeneration Installed Capacity (MW) Colombia



2014 – 2017. Estimated

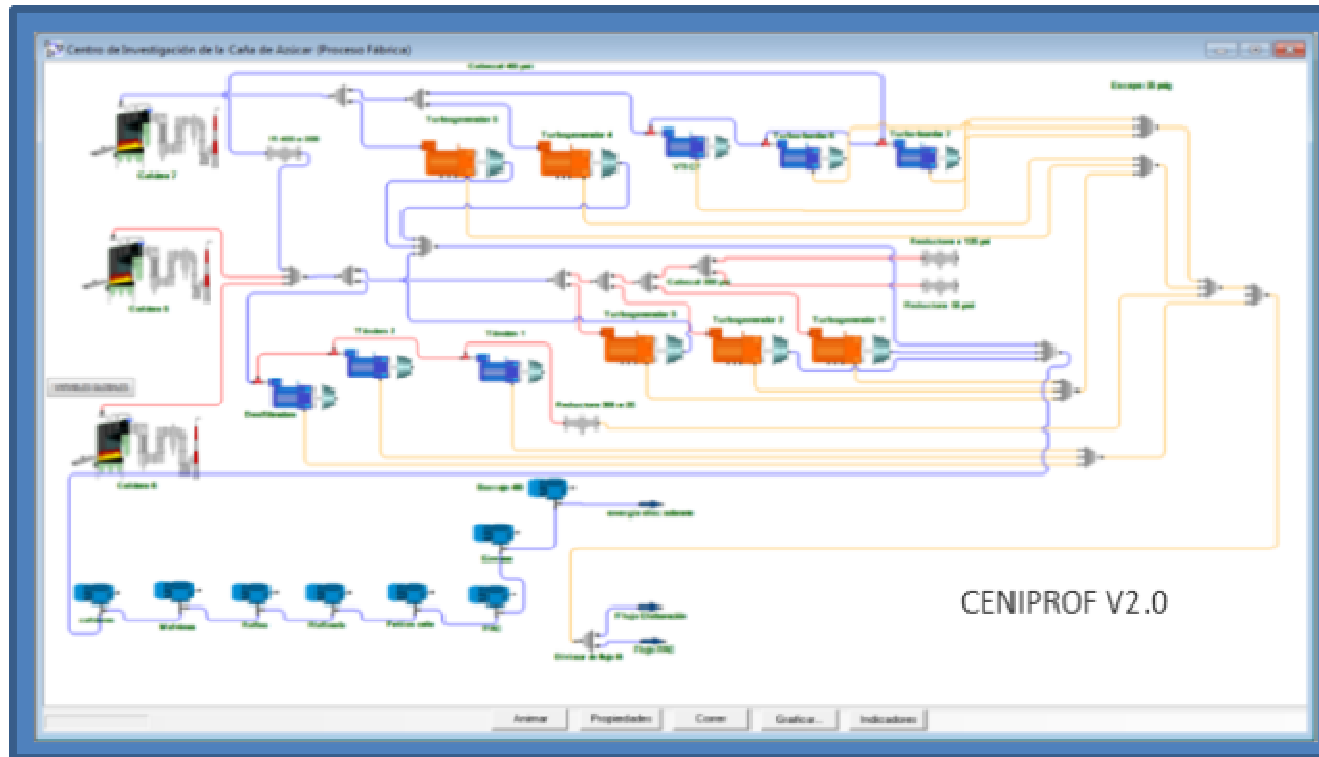
Source: Asocaña



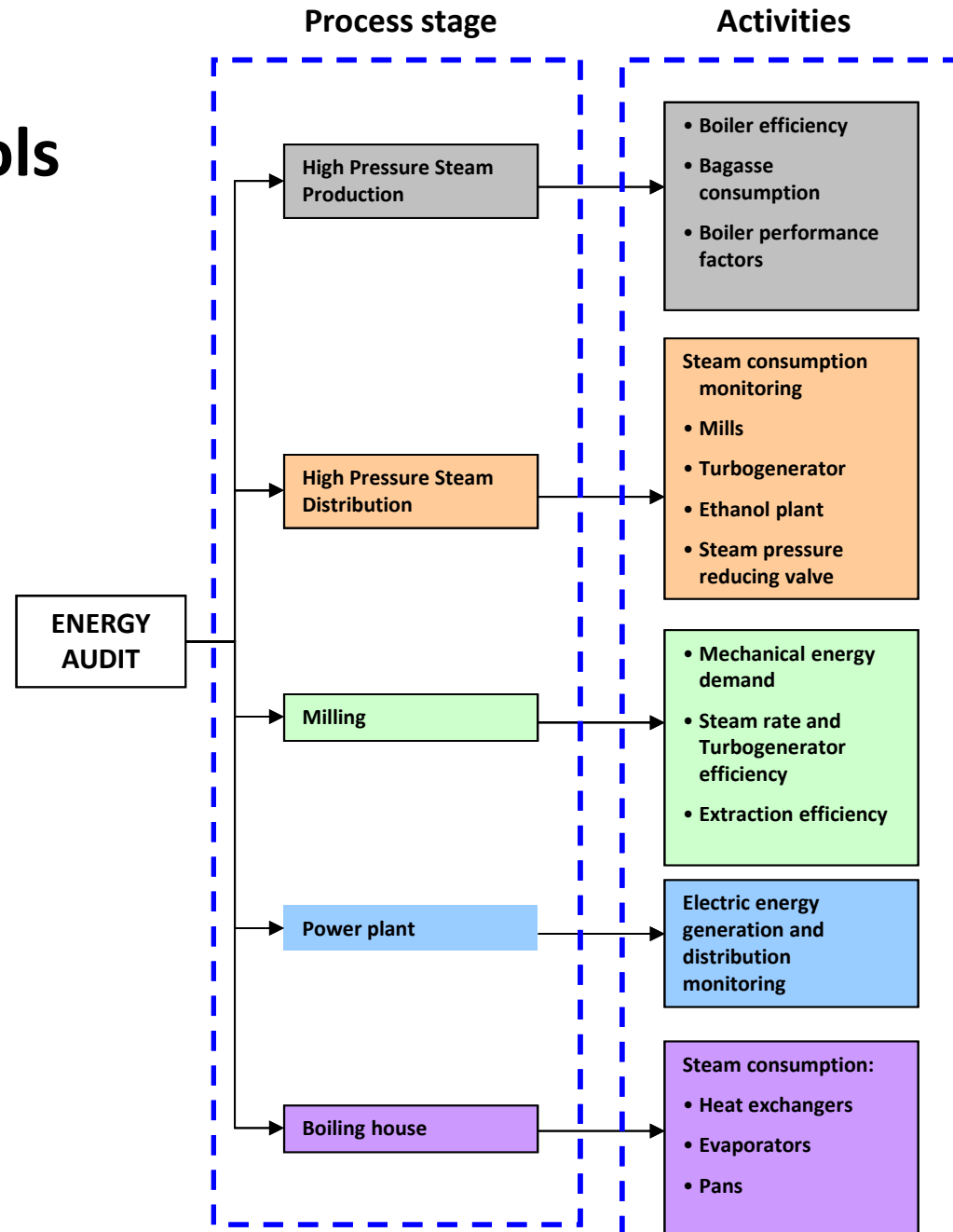
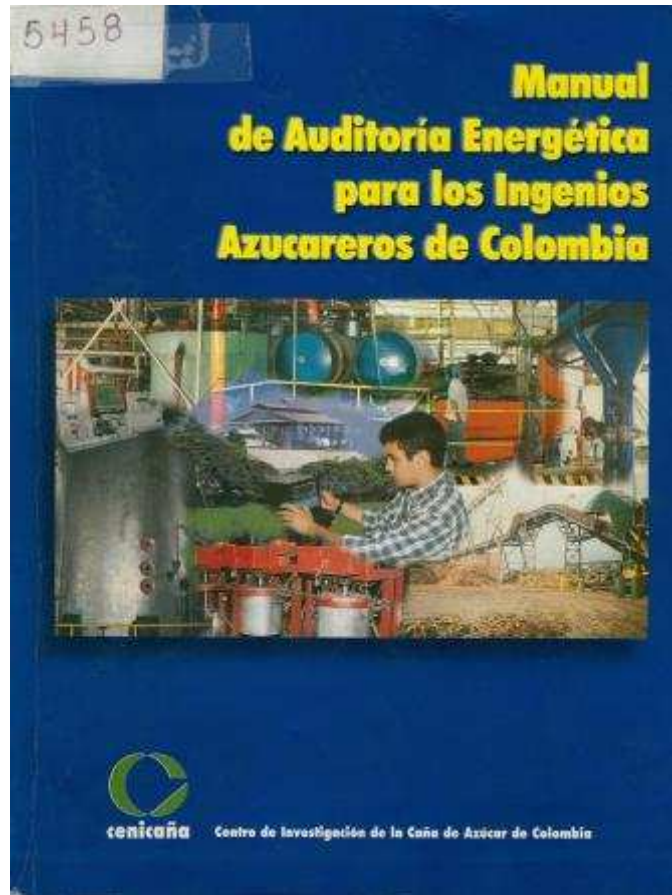
CENIPROF 2.0[®]: Mass and energy balance




CENIPROF is a result of the integration of separate models developed by Factory Program through the years. It's a software, to get mass and energy balance in steady state.



Energy Audit Protocols



Online Energy efficiency performance EEP



cenicana
Centro de Investigación
de la Caña de Azúcar de
Colombia

Eficiencia Caldera DZ	66,96%
Eficiencia Caldera 5	65,21%

REE	30,98%
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Datos de Entrada REE

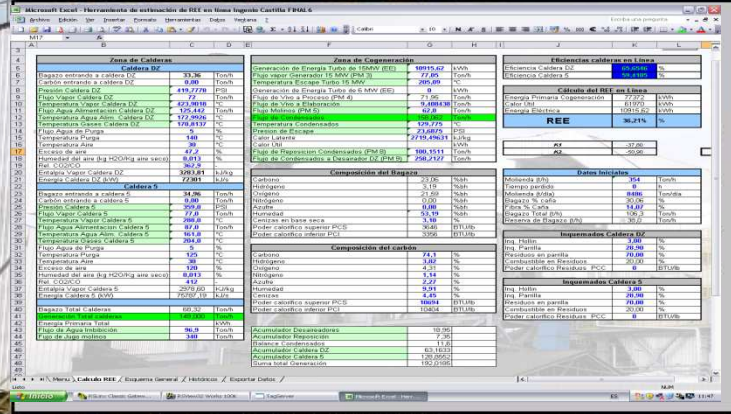
Esquema General

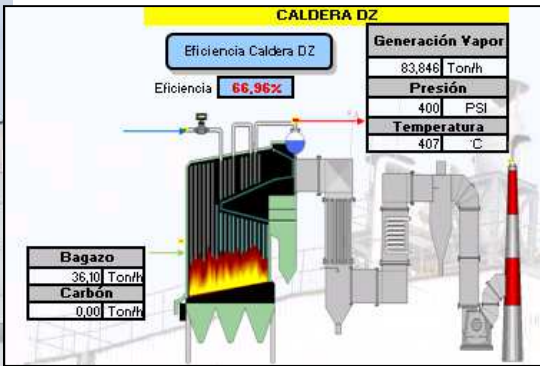
Scada REE

Históricos

Gráfico REE

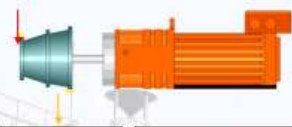
Variables de entrada		Valor
Presion de vapor	PSI	350
Temperatura del vapor	°C	407
Flujo de vapor	lb/h	196156
Temperatura Agua de alimentación	°C	170
Purga	%	5
Temperatura Purga	°C	140
Temperatura Aire °C	°C	30
Temperatura de los gases°C	°C	167,5
Exceso de aire	%	12
Humedad del aire (kg H2O/kg aire seco)	%	0,013
Rel CO2/CO	-	362,9





REE 30,98% SALIR

TURBOGENERADOR 12MV

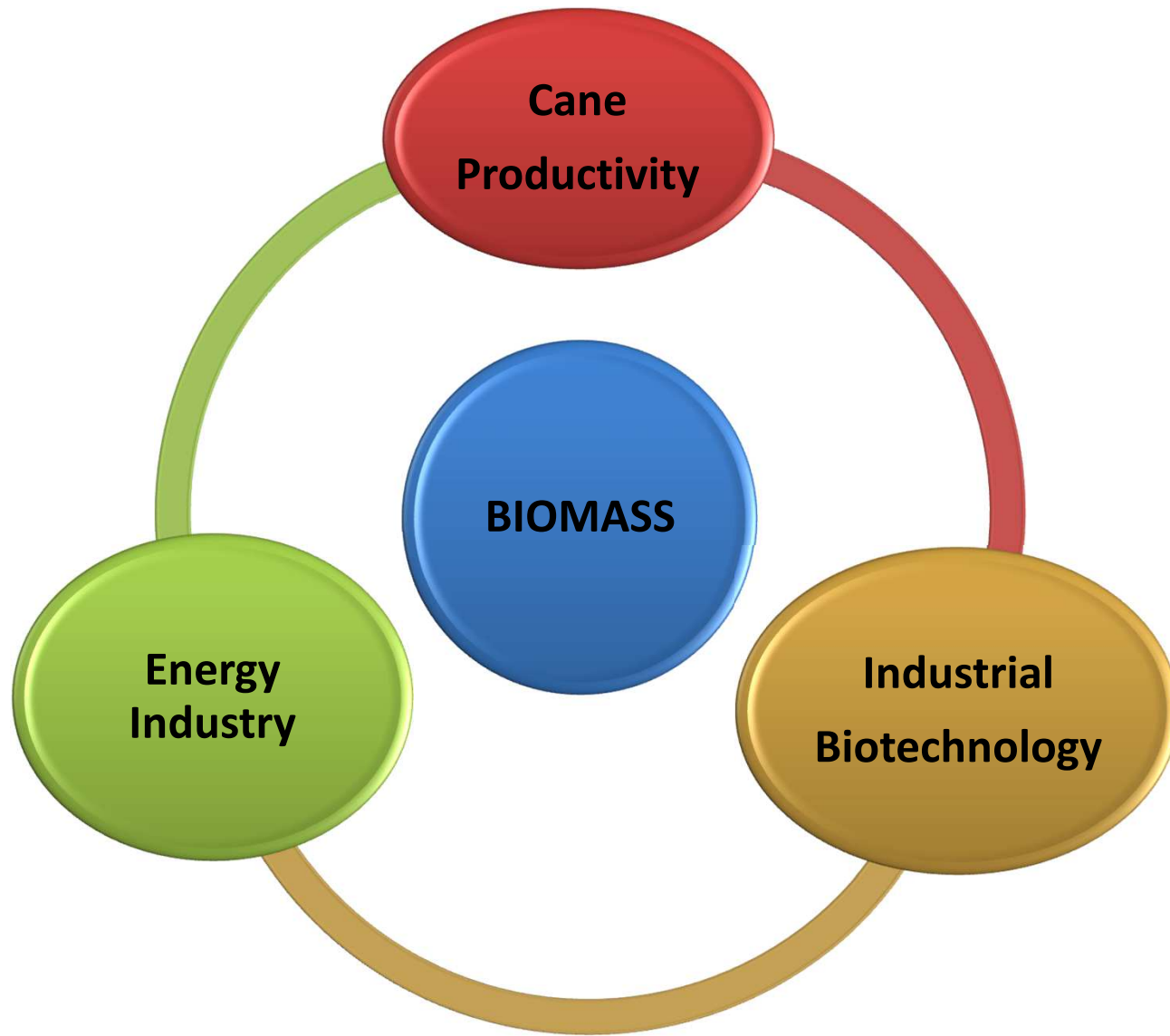


Flujo Generado	Generación Energía
70 Ton/h	9580 kWh

Online EEP was implemented by two mills, which continuously records the fuel consumption in the boiler.

An aerial photograph of a vast sugarcane field, showing the characteristic rows of green stalks separated by brown furrows. The perspective is from a high angle, looking down at the field.

SUGARCANE: RENEWABLE ENERGY

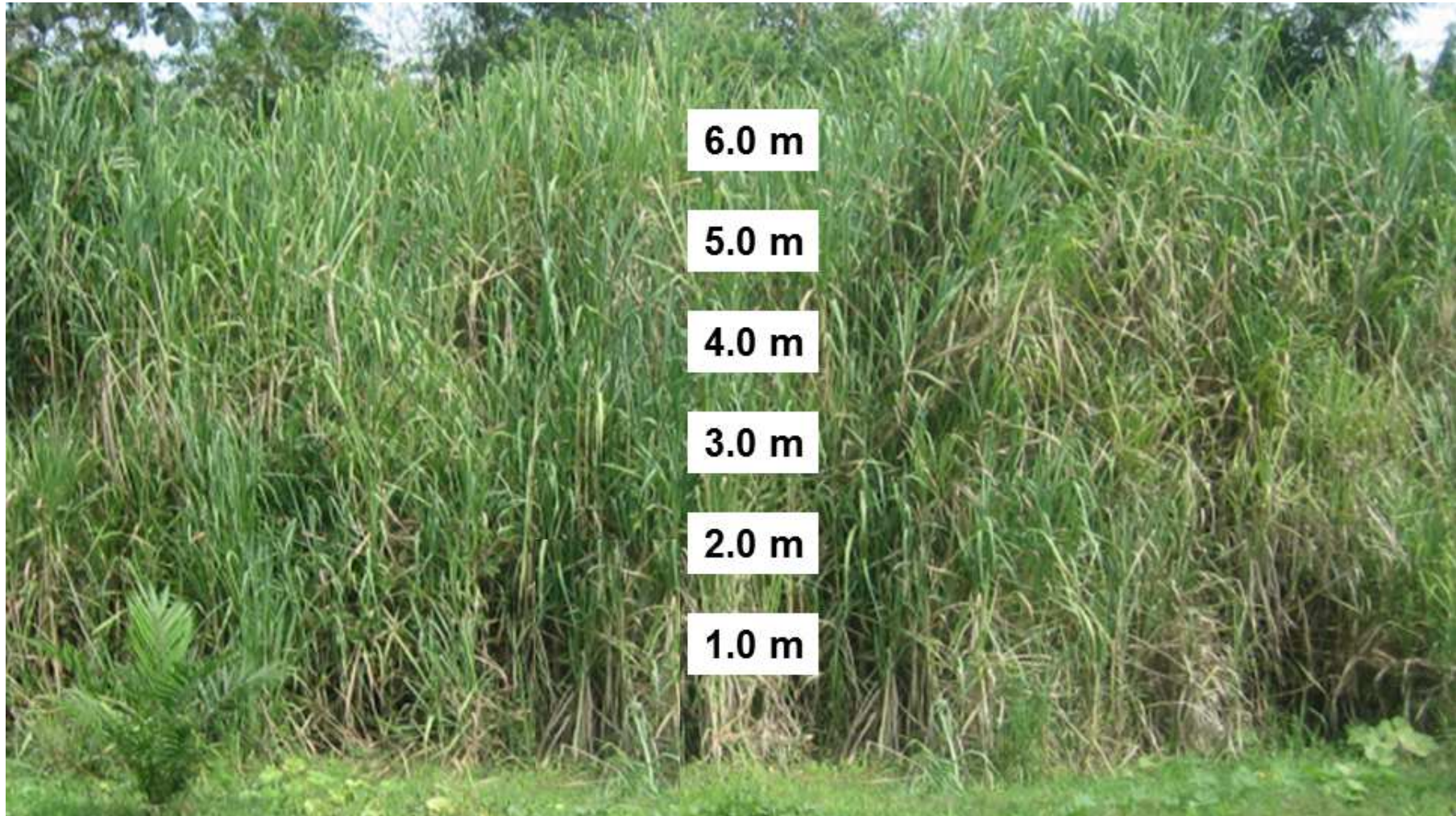





Type of variety for producing sugar today



Type of variety for Biomass & Energy production



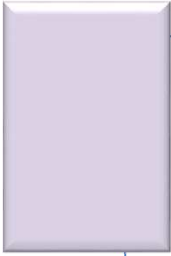
CONCLUSIONS



The investment on R & D generates solutions and benefits for the sugar industry, the region, and the country.



Technological developments will be focused on sugar, energy, added value products and sustainability.



Training and collaborative work with national and international partners will be of relevance in coming years



**Thank
you**