Feasibility Study on the Production of Biofuels in the UEMOA

Dakar, October 1st, 2015

Bain & Company, MMSO and ESALQ formed the consortium responsible for conducting the study

BASIS FOR THE STUDY

- In 2007 Brazil and UEMOA signed a **Memorandum of Understanding**:
  - Cooperation between Brazil & UEMOA in field of bioenergy
- **Technical cooperation** agreement **BNDES-Min. Foreign Affairs**
- **Consortium selected** based on experience

MAIN OBJECTIVES

- **Feasibility analysis** and recommendation of the **most suitable business model** for the production of biofuels in the UEMOA region
- Proposal of **public policies** to develop the market

CONSORTIUM

BAIN & COMPANY

Management consulting firm

- General & Business coordination

MACHADO MEYER
MACHADO MEYER SENDACZ OPICE

Law firm

- Legal technical coordination

ESALQ
Escola Superior de Agricultura "Luiz de Queiroz"

Institute of Agronomic research of University of São Paulo

- Agricultural technical coordination

Study evaluated agronomic, economic, social and legal aspects related to the biofuels industry

May 2013 — **April 2014**

I. Kick-off	II. Data collection and understanding of current situation	III. Selection of Business model	IV. Quantification of impacts and proposition	V. Detailing of the action plan
1 month	5 months *	2 months *	2 months	1 month

1st Visit

- **Objective**:
  - Data collection and validation of assumptions
- **Results**:
  - 70 Meetings
  - 5.000KM travelled
- **Visited countries:**
  - Benin, Togo, B. Faso, C. d'Ivoire and Senegal

2nd Visit

- **Objective:**
  - Validation of the chosen business model
- **Results:**
  - Alignment of the model with UEMOA, governments and local producers
- **Visited countries:**
  - B. Faso and Senegal

* Note: phases II and III have an intersection of 1 month

Our goals for today:

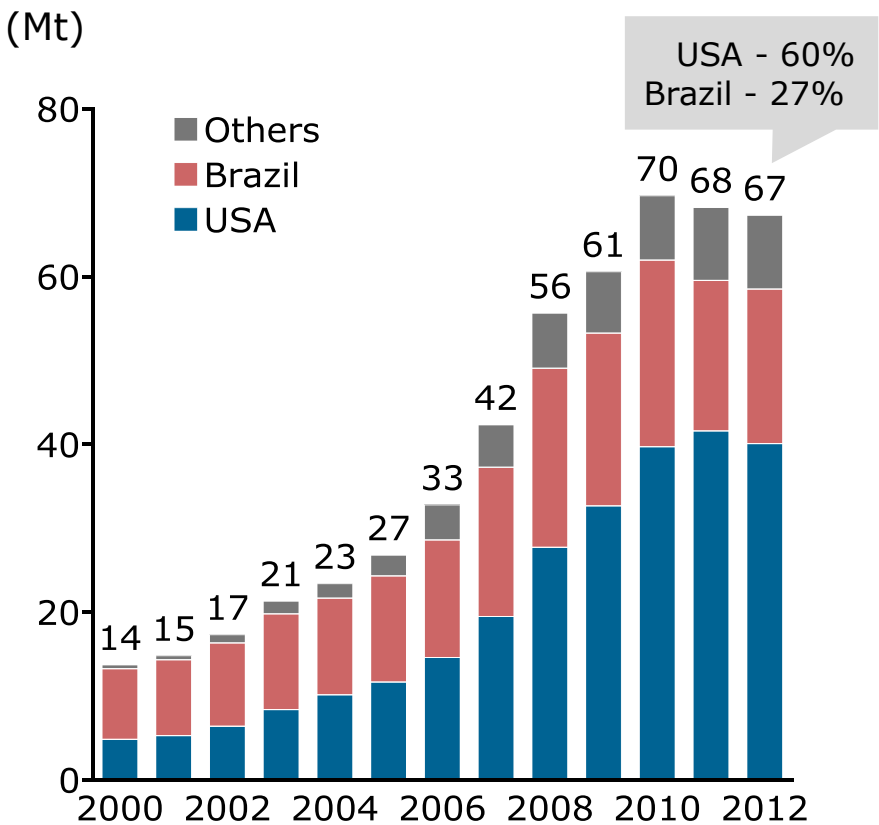
- Brief review of the global **biofuels market** and the **context for biofuels in UEMOA**
- Discuss **attractive business models** of biofuels in UEMOA
- Present **public policies** and **deployment plan** for the creation of the sector in UEMOA
- Discuss necessary changes in the **regulatory framework**

Agenda

- Global Biofuels market & lessons learned
- Evaluated business models
- Public policies and regulatory framework

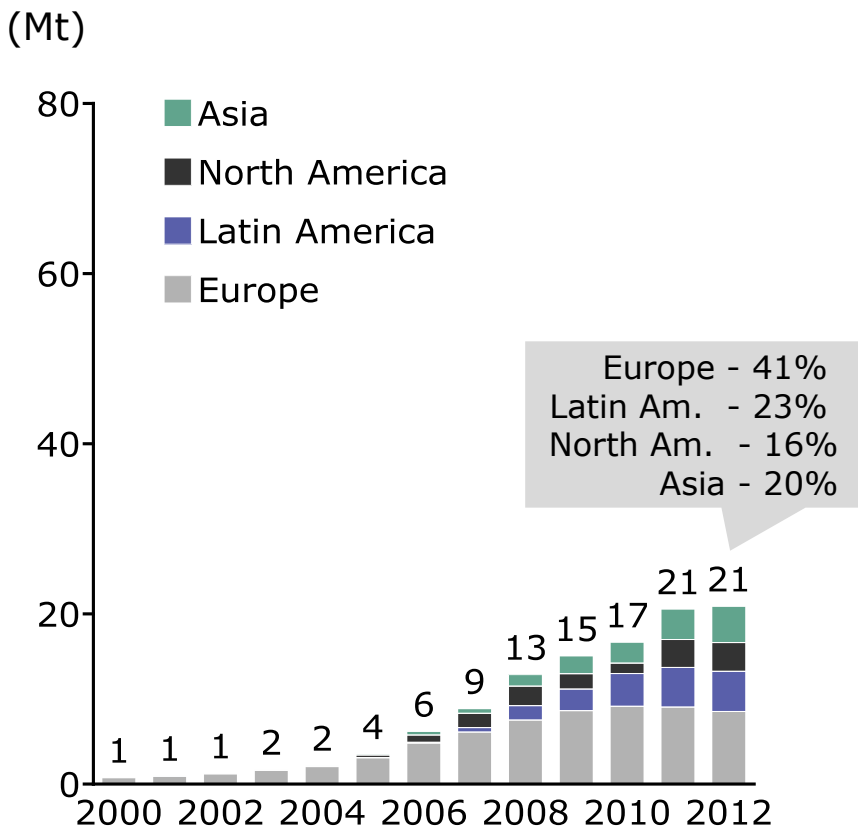
The biofuels market has progressed since 2000, but is still small

GLOBAL PRODUCTION OF ETHANOL



% of gasoline consumption	1,5%	1,9%	2,4%	3,3%	5,7%	6,9%	6,5%

GLOBAL PRODUCTION OF BIODIESEL



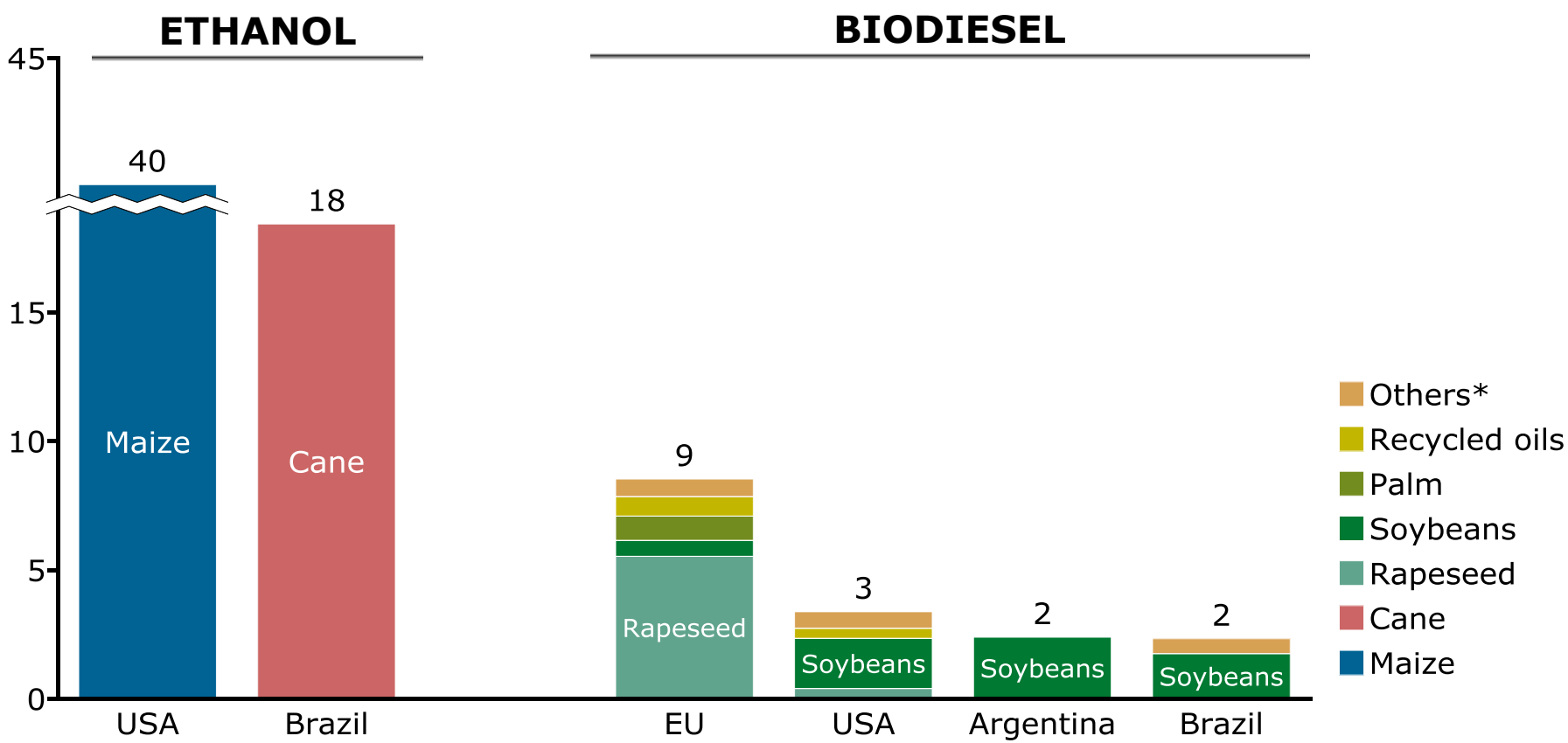
% of diesel consumption	0,1%	0,1%	0,2%	0,5%	1,0%	1,3%	1,6%

Source: EIA

Main producers use different raw materials, leveraging locally strong cultures

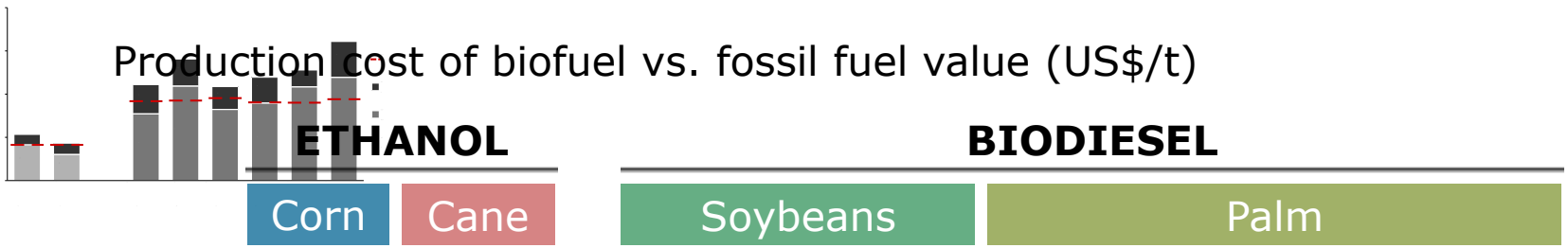
80% OF GLOBAL PRODUCTION

Biofuel Production by raw material and geography, 2012 (Mt)



Note: *Animal fat, sunflower and cottonseed oil.
Source: EIA, USDA

But none of the raw materials has a competitive cost position against fossil fuels



Note: *domestic production priced as export parity and imports as import parity
Ethanol considers average of 2007, 2009 and 2011 and energy parity with gasoline. Values of biodiesel for a non-integrated producer.
Source: IMF, World Bank, EIA, clipping, Bain analysis.

Despite the additional cost, other benefits led countries to adopt biofuels

ECONOMIC

- Reduction of dependence on **imported fuels**
- Incentive to **trade balance**

SOCIAL

- Creation of **jobs**
- Redistribution of **income**
- Form of **indirect subsidy to** the agriculture

ENVIRONMENTAL

- Adoption of **renewable energy**
- Reduction of the emission of **pollutants**
  - Sulfur, particulate matter, CO_2

Adoption of mandatory blend to lever the adoption of biofuels

Source: interviews with experts

Countries that succeeded in the production of biofuels have certain common characteristics

CASE STUDIES


Brazil


China


USA


Thailand


Argentina


Colombia


Indonesia


Malaysia


European Union

Agriculture

- **Surplus of raw materials,** high productivity, competitive prices

Fuels

- **Imports of fossil fuels** with high prices on the internal markets
- **Capacity to absorb the additional costs** via subsidies, tax exemptions or by the final consumer

Legislation

- **Mandatory blending** to ensure demand
- **Robust regulatory framework**, with clear roles and price definition

Agenda

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Based on the global learnings & the local priorities mapped, we identified key success factors for the biofuels industry in UEMOA

Sources:

- Case Studies
- Interviews with experts
- Government information
- Local visits
- Legislation
- Benchmarks
- Literature

Agriculture

- **Increase agricultural productivity** to generate surplus of raw materials
- Work with local governments to ensure **access to land**

Fuels

- Search for cultures that **minimize costs / additional subsidies** to fuels
  - **Imports of fossil fuel** are a sign that there is space for local generation

Electricity

- Offer **cogenerated energy** for **domestic supply**, reducing costs

Legislation

- Establish **mandatory blending** to generate demand
- Incorporate **socioeconomic benefits,** offsetting costs
- Search **regulatory support from UEMOA** to facilitate rapid deployment

Feasibility analysis of the production of biofuels from each culture was divided in 3 steps


Soy-beans

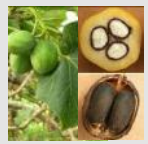

Sun-flower


Castor oil


Sor-ghum


Elephant Grass

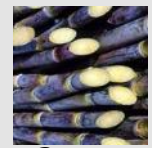

Euca-liptus


Jatro-pha


Palm


Peanut


Cotton-seed


Sugar Cane

Agricultural Analysis

- Soil conditions
- Weather conditions
- Handling and agricultural inputs
- Land use and occupation

Business Model

- Potential demand
- Production Risks
- Cost of opportunity
- Profitability

Impacts on Economy

- Replacement of imports
- Changes in market prices
- Generation of jobs
- Generation of value

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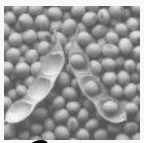
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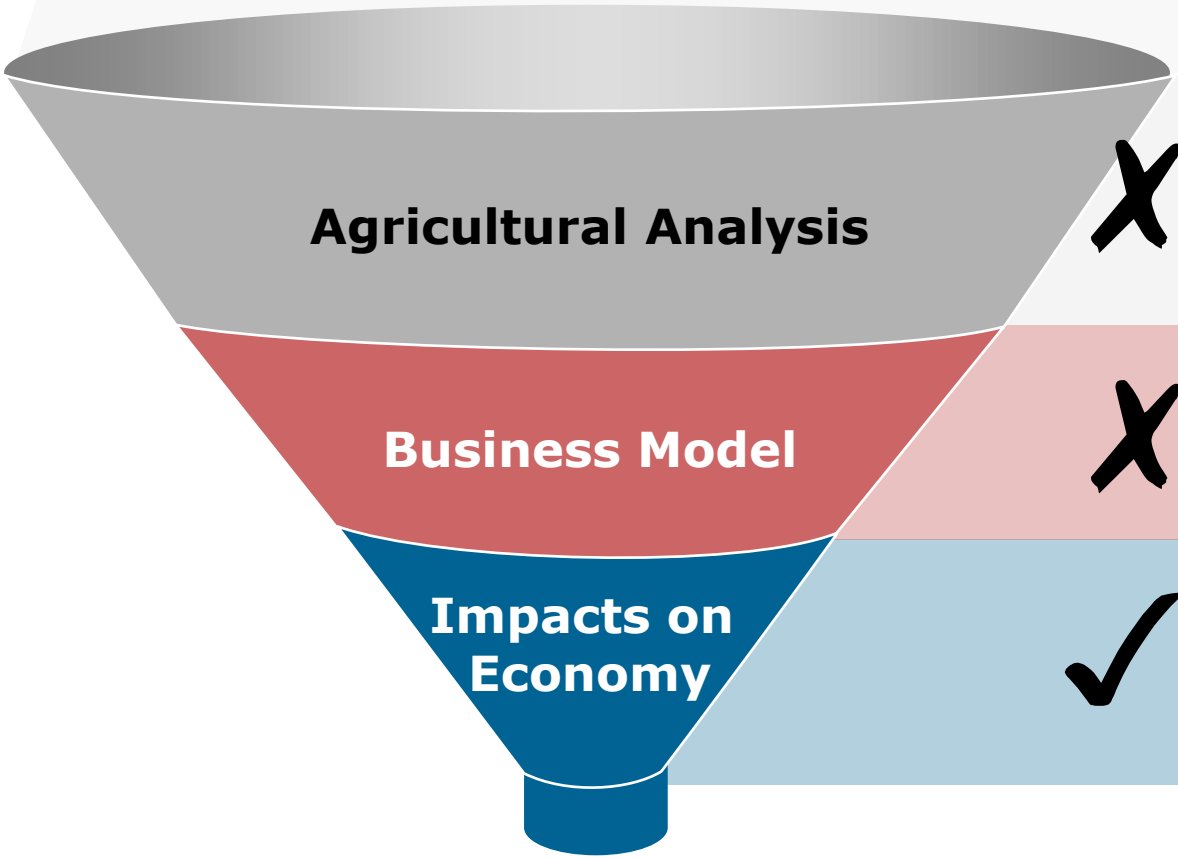

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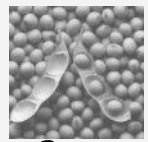
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✗


Jatro-pha


Palm


Peanut


Cotton-seed

✓


Sugar Cane

Sugar cane has 5 agronomic characteristics favorable to the production of biofuels …

Sugar Cane

AGRONOMIC POINT OF VIEW

- Easy **local implementation** technology
  - Vegetative propagation
  - High adaptability for productivity
- **Cheaper** dry matter
  - Low protein content
  - Low oil content
- **Resistant** culture
  - Less dependent on handling and inputs
  - Less vulnerable to pests and diseases
- **Productive Efficiency**
  - Smaller area needed for high biomass production
- Culture **responsive to local irrigation**
  - Possibility to achieve high productivity with irrigation

Note: ETC> rain

… and a business model with competitive cost position able to tap into 3 distinct markets

Sugar Cane

BUSINESS MODEL POINT OF VIEW

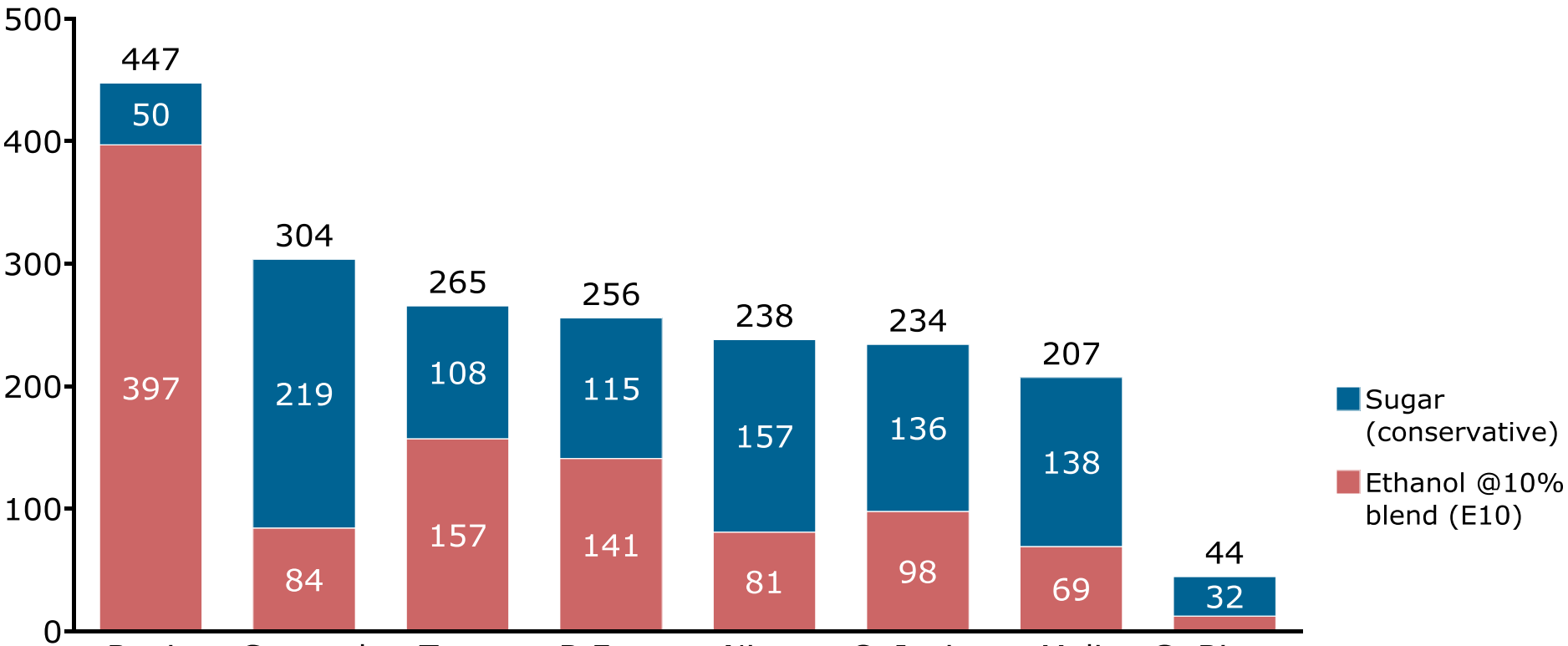
- Best cost position among analyzed cultures
  - High productivity in **irrigated model**: **100 ton/ha**
  - **Local labor** has lower cost
  - **Brazilian technology** can reduce costs
- Focus on the domestic market for sugar and ethanol, in addition to the potential for cogeneration
  - **Sugar: Eliminate** need to **import (950kta)**
  - **Ethanol**: Production for **E10 mix (600k m³)**
  - **Cogeneration:** Energy for own use and for sale
- Demand can be supplied by **1 plant in each country** (except in Guinea-Bissau)
  - Area harvested: **18-34k ha** (~40k ha average mill in Brazil)
  - Industrial capacity: ~**2.1Mt/harvest** (~ 4Mt in Brazil)

The demand for Ethanol (E10) and sugar in UEMOA can reach 16.5 Mt or 165k hectares of cane in 2030

Sugar Cane

2030

Demand for TRS* in UEMOA not supplied locally
(kt TRS, 2030)



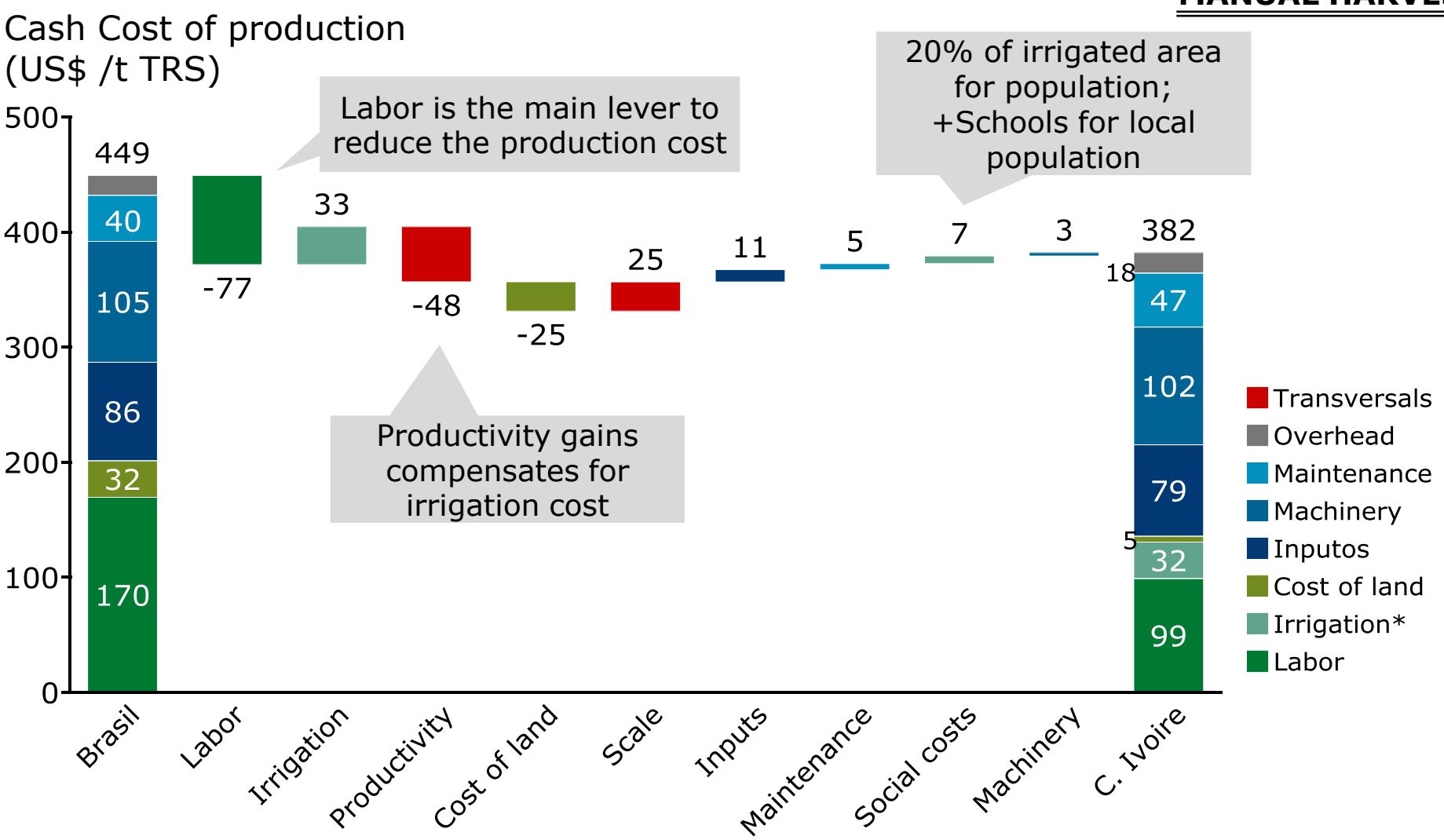
	Benin	Senegal	Togo	B.Faso	Niger	C. Ivoire	Mali	G. Bissau	**Total**
Cane (Mt)	3.4	2.6	2.2	2.1	2.0	2.1	1.8	0.4	**16.5**
Area (k ha)	34	26	22	21	20	21	18	4	**165**

Note: *Total Recoverable Sugar. Considers 136 kg of sugar by ton of cane. Source: FAO, USDA, ISO, World Bank, technical visits, Bain analysis.

Despite the irrigated model, cash cost of production in UEMOA is lower than in Brazil

Sugar/Ethanol

MANUAL HARVEST



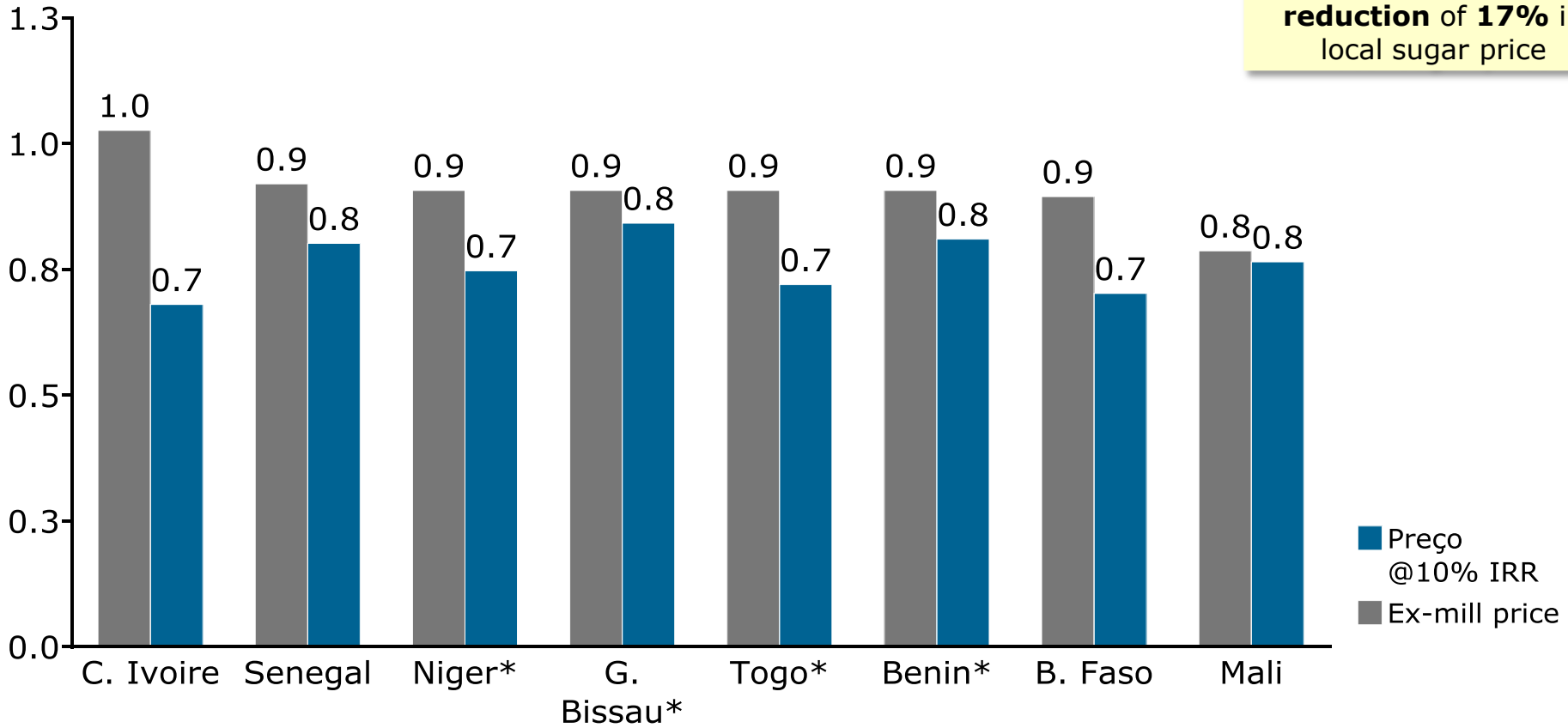
*Includes cost of labor for maintenance of assets of irrigation. Source: Interviews with experts, technical visits to countries, ESALQ, Ministry of Agriculture, clipping, Bain Analysis.

New mills could even reduce domestic price of sugar and generate attractive return

Sugar

Sales price** of crystal sugar, ex-taxes
(US$/kg, Jul/ 2013)

Average reduction of **17%** in local sugar price



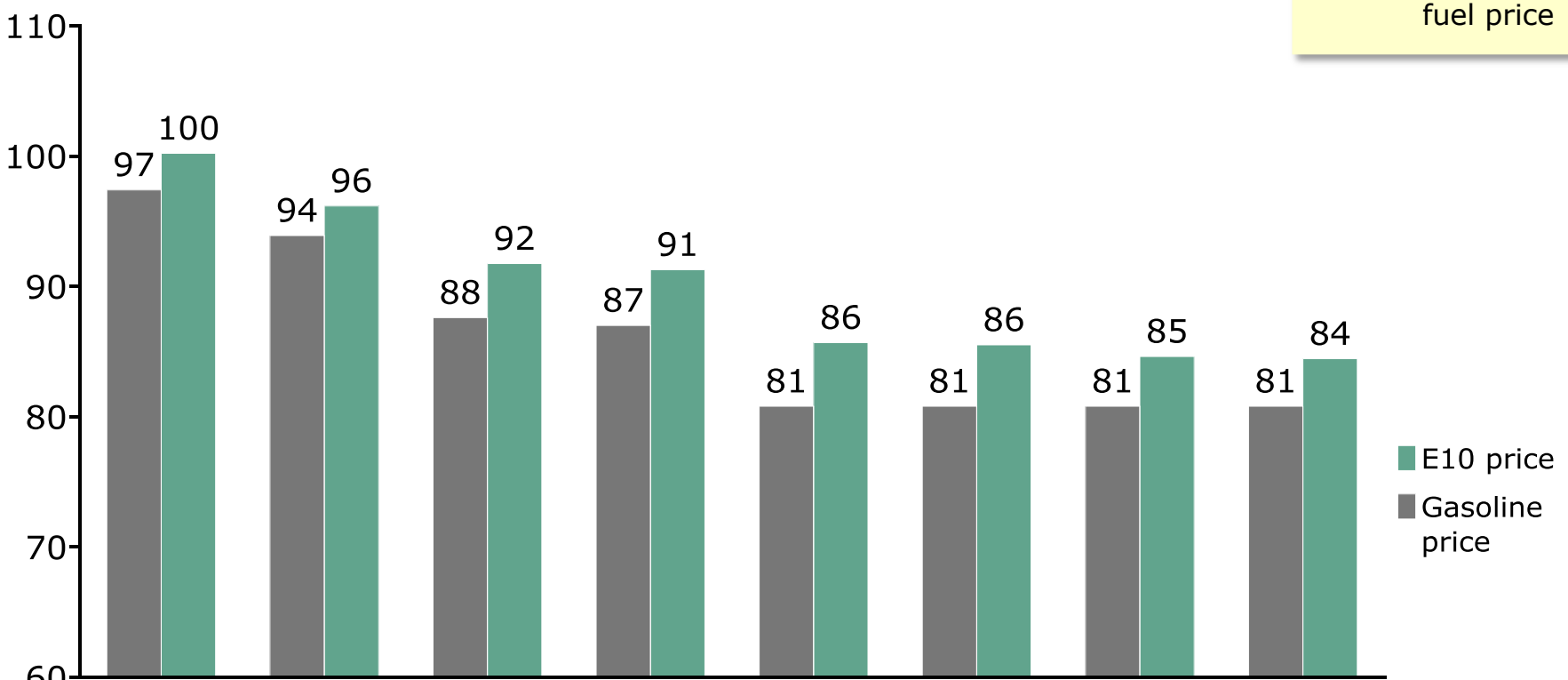
Note: * Ex-mil price defined as the average price of Cote d'Ivoire, Mali, Senegal and Burkina Faso due to the unavailability of data.
Note: **Sold in bags of 50 kg. Ethanol from molasses priced as industrial ethanol.
Source: interviews with experts, clipping, ministries and local governments, visit to sugar mills in the region.

E10 blend generates additional cost of US$2-5 ¢ /L vs. the current price of petrol

Ethanol

Current gasoline price vs. E10 price (US$c/L)

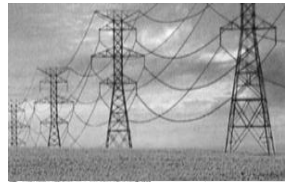
Increase of 2-6% in fuel price



	B. Faso	C. Ivoire	Mali	Niger	Senegal	G. Bissau	Togo	Benin
Add. cost (US$c/L E10)	3	2	4	4	5	5	4	4

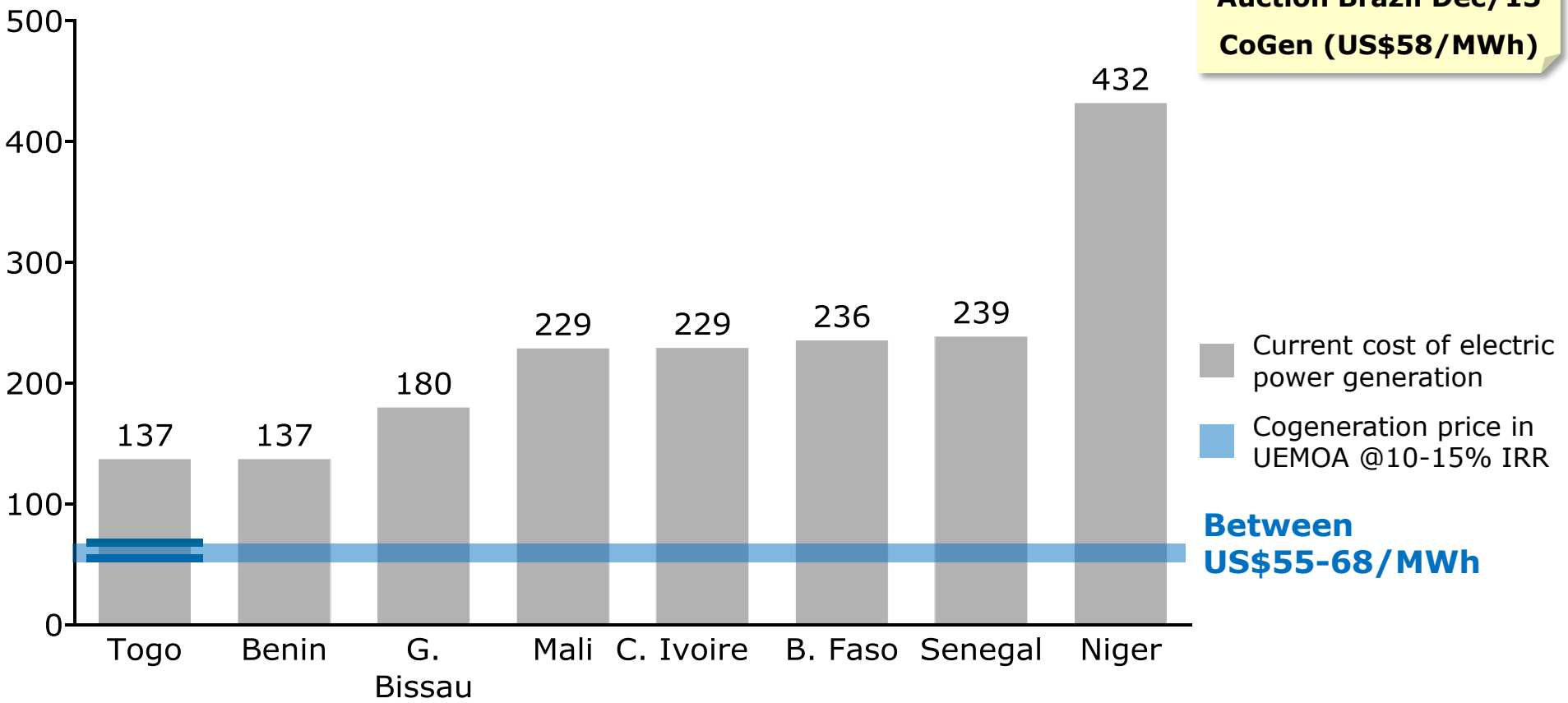
Note: Ethanol price considers 10% IRR and no demand incentives. Source: Bain Analysis.

Cogeneration can bring attractive return and reduce the cost of electricity in countries



Cogeneration

Current cost of electricity generation and price of cogeneration for IRR of 10-15% (US$/MWh)



Source: AFDB, IZF, companies and governments websites, clipping, World Bank, Bain analysis.

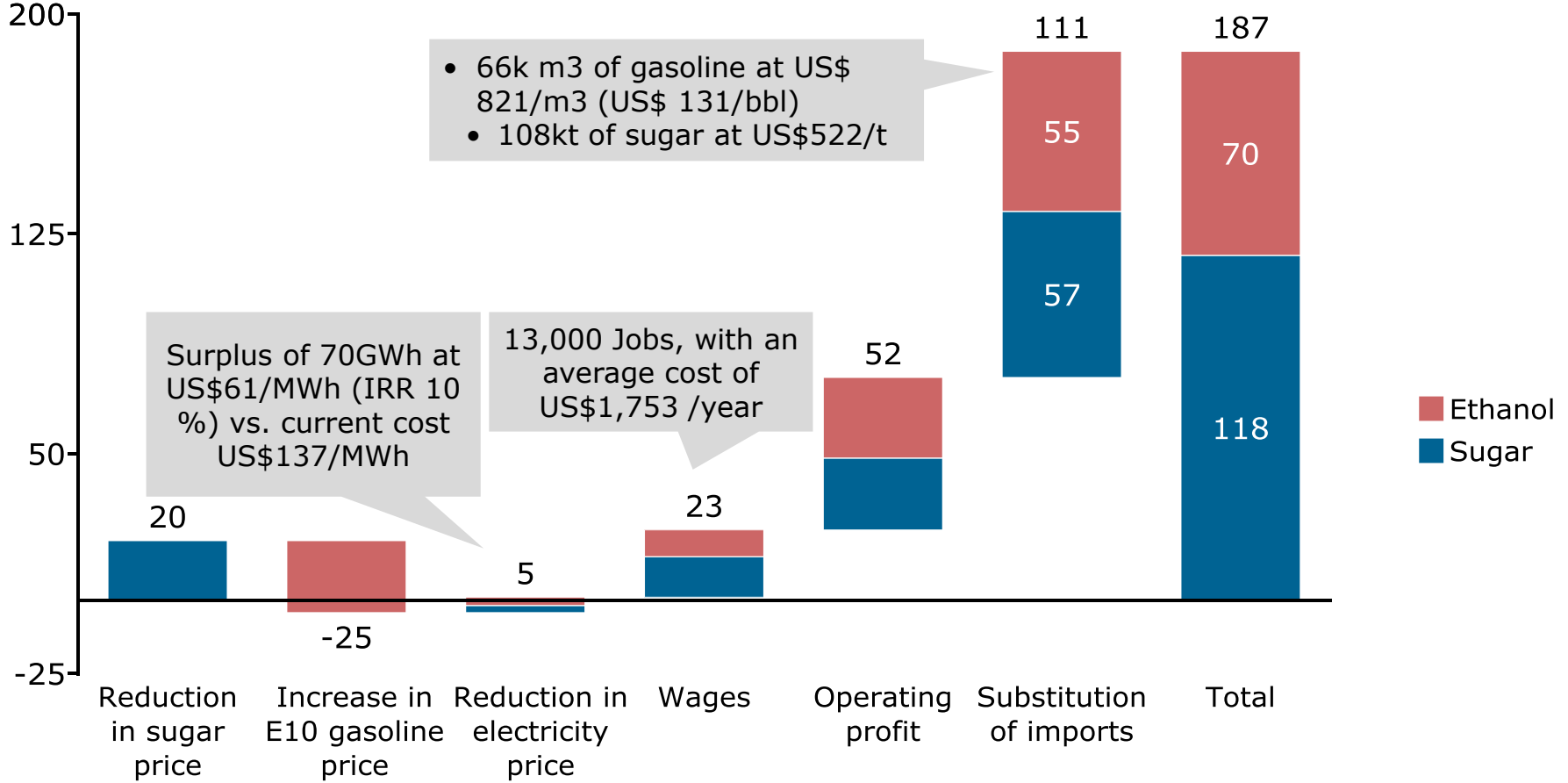
Benefits generated by the construction of the mill compensate for the higher cost of ethanol

Impacts

TOGO **IRR 10%**

Socioeconomic impact of the construction of a sugar/ethanol plant in Togo (US$M/year)

CAPEX (non-recurrent): US$ 425M



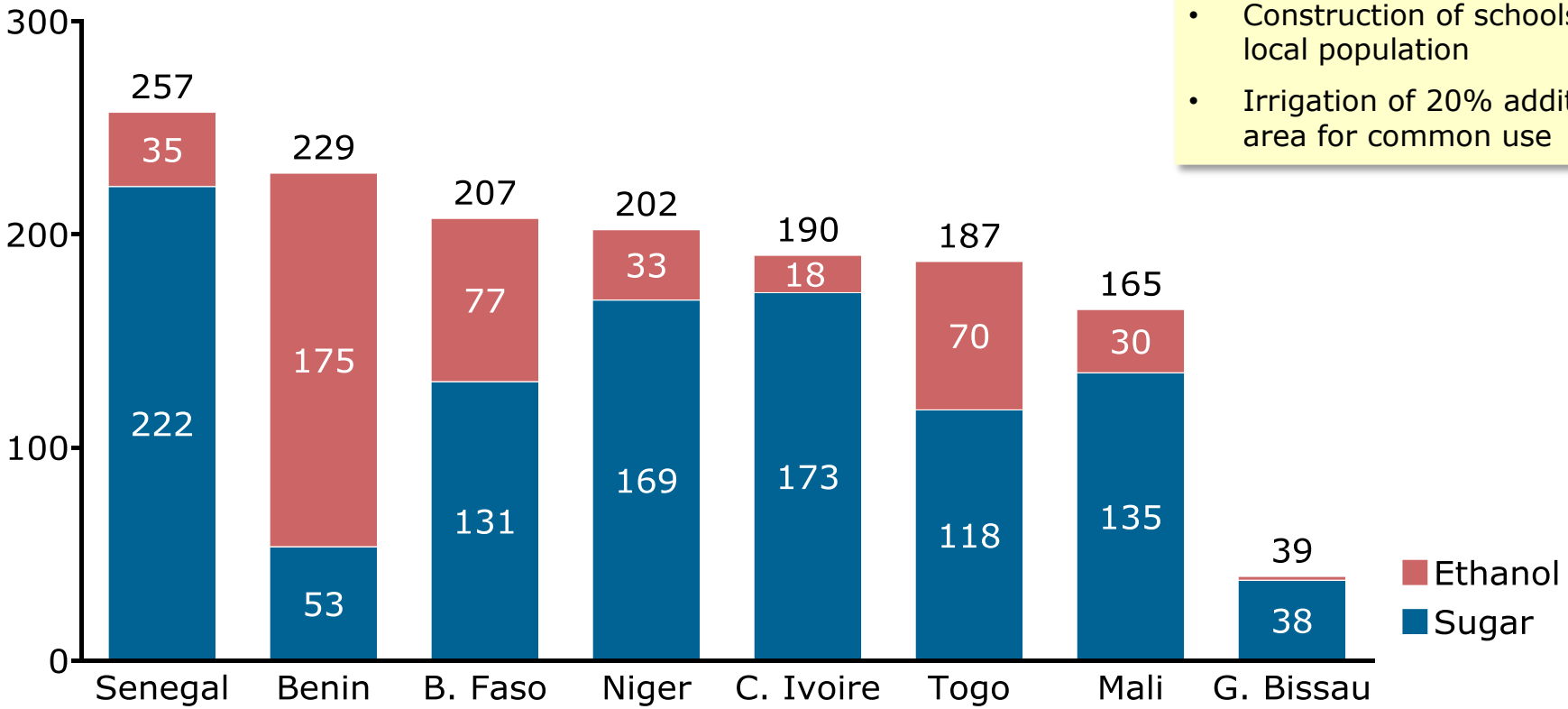
Source: ANP, Brazilian IRS, Bain Analysis.

Expected Impact is of 1-5% of GDP, for the most part due to the production of sugar

Impacts

2030 **IRR 10%**

Socioeconomic impact of the construction of a sugar/ethanol plant for each country (US$M/year)



Additional Social Benefits

- Construction of schools to local population
- Irrigation of 20% additional area for common use

	Senegal	Benin	B. Faso	Niger	C. Ivoire	Togo	Mali	G. Bissau
% of GDP	2%	3%	2%	3%	1%	5%	2%	4%
CAPEX (US$ M)	512	663	412	397	410	425	346	75

Source: ANP, Federal Revenue, analysis Bain

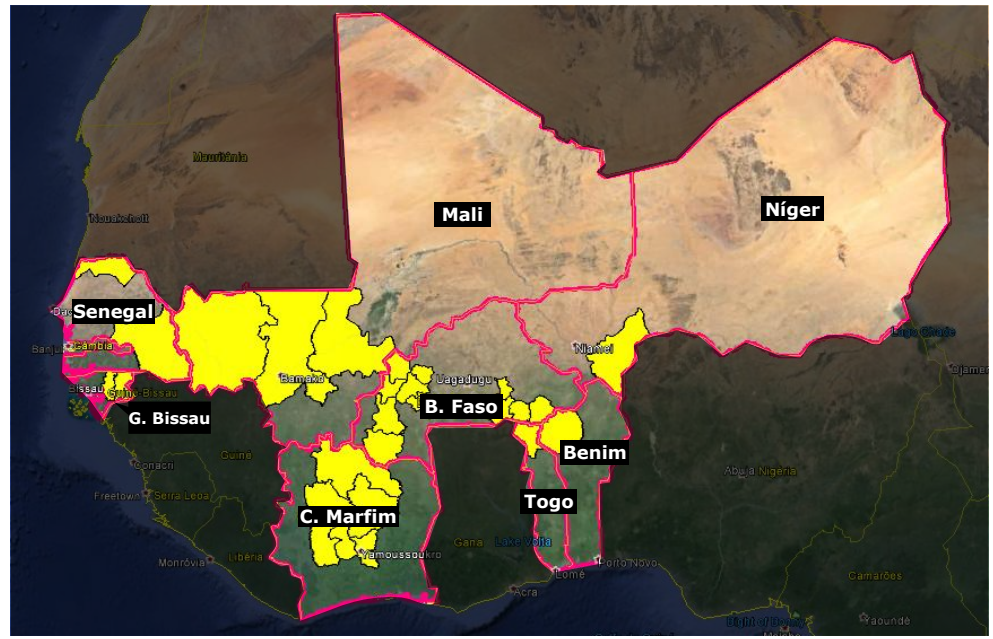
Selection of suitable areas for the installation of new sugar mills was made based on 5 criteria

Suitable Areas

FACTORS CONSIDERED IN SELECTION OF SUITABLE AREAS

- **Agricultural** and environmental **aptitude**
  - Minimum productivity
  - Exclusion of areas of environmental protection
- Access to **irrigation**
  - Proximity to perennial rivers
- Availability of **land**
  - Exclusion of areas occupied by other crops or already populated
- Access to **labor**
  - Exclusion of isolated areas
- Access to **infrastructure**
  - Proximity of logistic corridors and power transmission lines

SUITABLE MACRO REGIONS IN UEMOA



Definition of exact areas for planting should be made by the investor after refinement of the proposed suitable regions

Agenda

- Global Biofuels market & lessons learned
- Evaluated business models
- Public policies and regulatory framework

We divided the necessary public policies for the adjustment and structuring of the sector in 3 phases

PHASE 1
DEFINITION OF SECTOR AND REGULATORY FRAMEWORK

Define productive areas and simplify access to **LAND** to ensure offer

Establish **MANDATORY BLENDING** of Ethanol to ensure demand

Establish **RULES OF OPERATION** and **PRICING**

Governments define basic conditions of market

PHASE 2
CREATION OF VALUE CHAIN

Obtain and distribute **CAPITAL** (treasury, multilateral and commercial)

Coordinate public and private investment in **INFRASTRUCTURE**

Create **PRODUCT CONSORTIUM** to support blend and pricing

Facilitate imports of equipment and inputs from **SUPPLIERS**

Investors are mobilized and Governments define fiscal and financial incentives

PHASE 3
LOCAL STRENGTHENING AND DEVELOPMENT

Educate specialized local **LABOR FORCE**

Promote development of local **TECHNOLOGY**

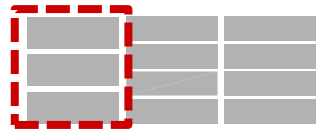
Promote expansion of the **DISTRIBUTORS** network

Boost association in **CLUSTERS**

Investors and Governments refine policies for greater sustainability of the value chain

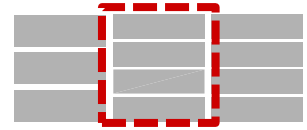
Phase 1 – Definition by the Government of the basic market conditions

PHASE 1
DEFINITION OF SECTOR AND REGULATORY FRAMEWORK



Define productive areas and simplify access to **LAND** to ensure offer	• **Production** areas for cane • Plan of population **expropriation and relocation**, minimizing the impacts
Establish **MANDATORY BLENDING** of Ethanol to ensure demand	• **Institution of the mandatory blend** in gasoline (at least the equivalent to the production of molasses) • Promotion of **sugar cane as the main source for ethanol** • **Maximum and minimum limits** of blending • **Commission for management of mix**
Establish **RULES OF OPERATION** and **PRICING**	• **Roles and limits of the actors of the chain** (mainly for sugar and ethanol) • Commission for **supervision of the commercial rules**

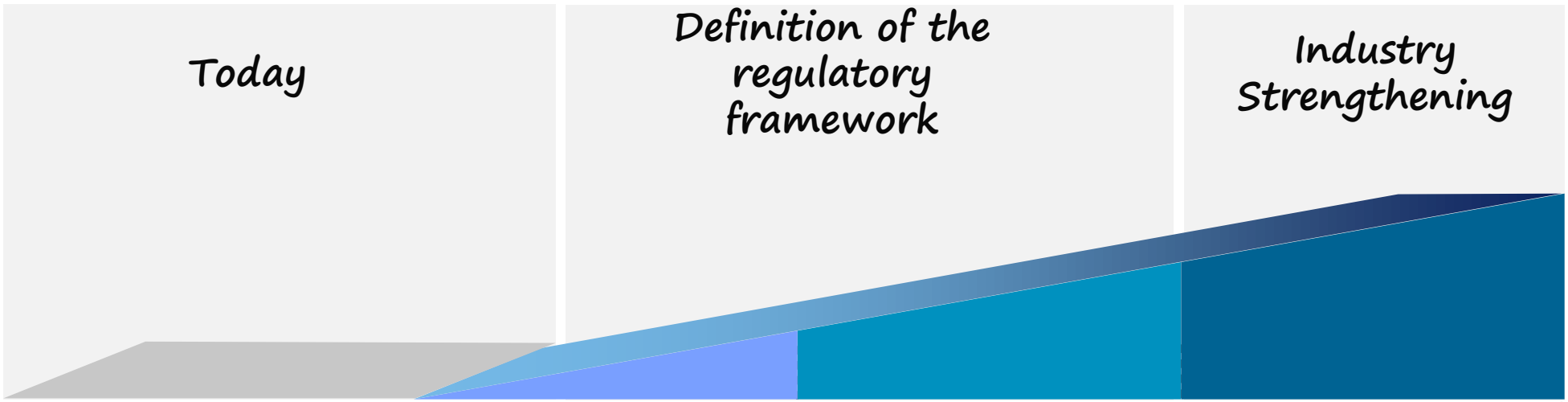
Phase 2- Creation of the productive chain and definition of fiscal and financial incentives for the industry



PHASE 2
CREATION OF VALUE CHAIN

Obtain and distribute **CAPITAL** (treasury, multilateral and commercial)	• Investors: **presentations** for major commercial banks • UEMOA: involve **development banks** and create **technical committee** for the evaluation of projects • Governments: Assess interest in **direct investment**
Coordinate public and private investment in **INFRASTRUCTURE**	• UEMOA: **Integrated infrastructure plan** • **Differentiated credit and/or tax exemptions** for projects that require construction of infrastructure
Create **PRODUCT CONSORTIUM** to support blend and pricing	• **Consortium of investors** to coordinate the **application of pricing rules** and production planning
Facilitate imports of equipment and inputs from **SUPPLIERS**	• Adjust the **import and local incentives policies** - Facilitation of imports of equipment and inputs - Development of local suppliers and tariff protections

Role of UEMOA in the definition of the sector is based on 3 tools: guidelines, additional act and regulation



- **Basic Policies:**
  - Agriculture
  - Industry
  - Renewable energy
- **Study on biofuels regulatory framework** in 2010

- **Guidelines**: Directing the member States
  - Goals of production and mix
  - Manual of best practices
- **Additional Act**: Definition of common policy for biofuels
- **Customs Code:**
  - Exemption of taxes on imports of equipment and technology

- **Regulation:** Mandatory for all member states
  - Percentages of mixture
  - Licenses
  - Environmental Impacts

Working within the current framework of UEMOA

Creation of internal organism specific to the sector

Source: interviews with experts and governmental agencies, research of local laws

Relevant guidelines to be included in local regulatory framework by the use of tools of different levels

	Law	Decree	Infra-legal Normative Acts
	• **Overarching principles** to stimulate market • **Low flexibility** for changes	• **Rules** of matters already defined in the law • **Greater flexibility** for changes	• Definition of technical standards • **Need for improvement** during development
Examples	• **Essential clauses** of land contracts • **Minimum and maximum** blend percentage • **Range of premiums** linked to internal price of sugar • **Simplified procedures** for running the business • **Fiscal incentives** for biofuels	• Rules applicable to **friendly expropriation** of land • **Criteria** to fix **percentage of blending** and **premium of ethanol price vs. sugar** • Rules of **operation** and deliberation of the **Ministerial Council**	• Definition of **blending percentage** • Definition of **price premium** • **Quality standards** of ethanol • **Supervision** and application of penalties

Existing rules in countries can be used

Rules must be edited by Ministerial Council established by law

Main conclusions of the study

Agro-energetic focus is important

- Production of biofuels should ensure **food supply** and generate energy from **cogeneration**, priorities of local governments

Model of Ethanol from sugar cane is feasible

- Culture with **best cost position** in the region
- Business Model generates **positive financial and socioeconomic results**

However, mobilization of governments is necessary for implementation

- Ensure **access to land**, establish **mandatory blending**, structure **pricing** and create awareness of population

ESALQ
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