



# *An Assessment of Bioenergy Opportunities in St. Kitts & Nevis*

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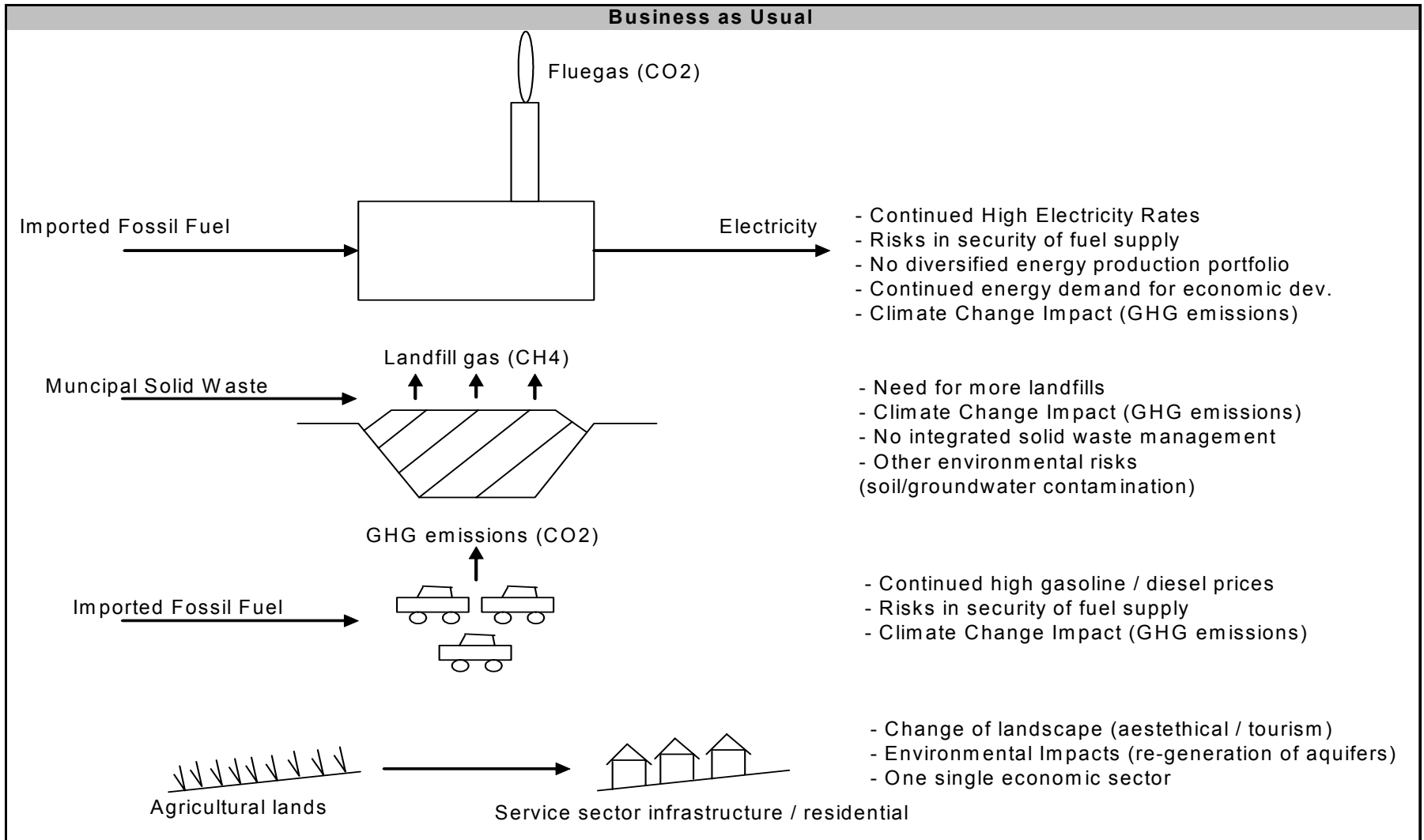


## Bioenergy: Why It Matters for St. Kitts & Nevis



- Shutdown of the sugar industry ... after 350 years of operation, resulting in:
  - Unemployment
  - Decreased sources of income
  - Loss of environmental and tourism benefits from sugarcane
- 100% of the electricity and transportation fueled by imported petroleum products, whose costs are high and rising
- Environmental impacts associated with diesel generators and transportation fleets have negative effects on the environment and tourism economy
- Current waste management practices
  - Health impacts
  - Environmental impacts

# Bioenergy: Why it Matters for St. Kitts & Nevis





# Background of the assessment

- Global Sustainable Energy Islands Initiative (GSEII) – OAS
  - Partners: Energy & Security Group, Climate Institute, OAS
  - Financial support from: UNIDO, UNF, RBF, REEEP, Governments of Austria, Italy and USA
  - Long-term collaborative support to catalyze transition to sustainable energy
  - Sustainable Energy Plans (SEPs)
  - Geothermal feasibility assessment, policy, and capacity building
- Request from SKN Federation Government for technical assistance in assessing potential for conversion of sugar cane to bioenergy



# BACKGROUND DISCUSSION PAPER

on Bio-energy Potential for St. Kitts and Nevis



The General Secretariat of the **Organization of American States (GS/OAS)**  
And  
**Energy and Security Group (ESG)**  
As part of the **Global Sustainable Energy Islands Initiative**

Funded by UNF  
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# Methodology for the Assessment

- Broad stakeholder consultation
- Interviews with key local experts
- Data gathering/research via local sources, international, and other
- Regular consultation with government officials, sugar industry reps, electric utility
- Interviews with multiple international bioenergy industry reps
- Preparation of draft assessment report
- Consultation/reporting out on findings...



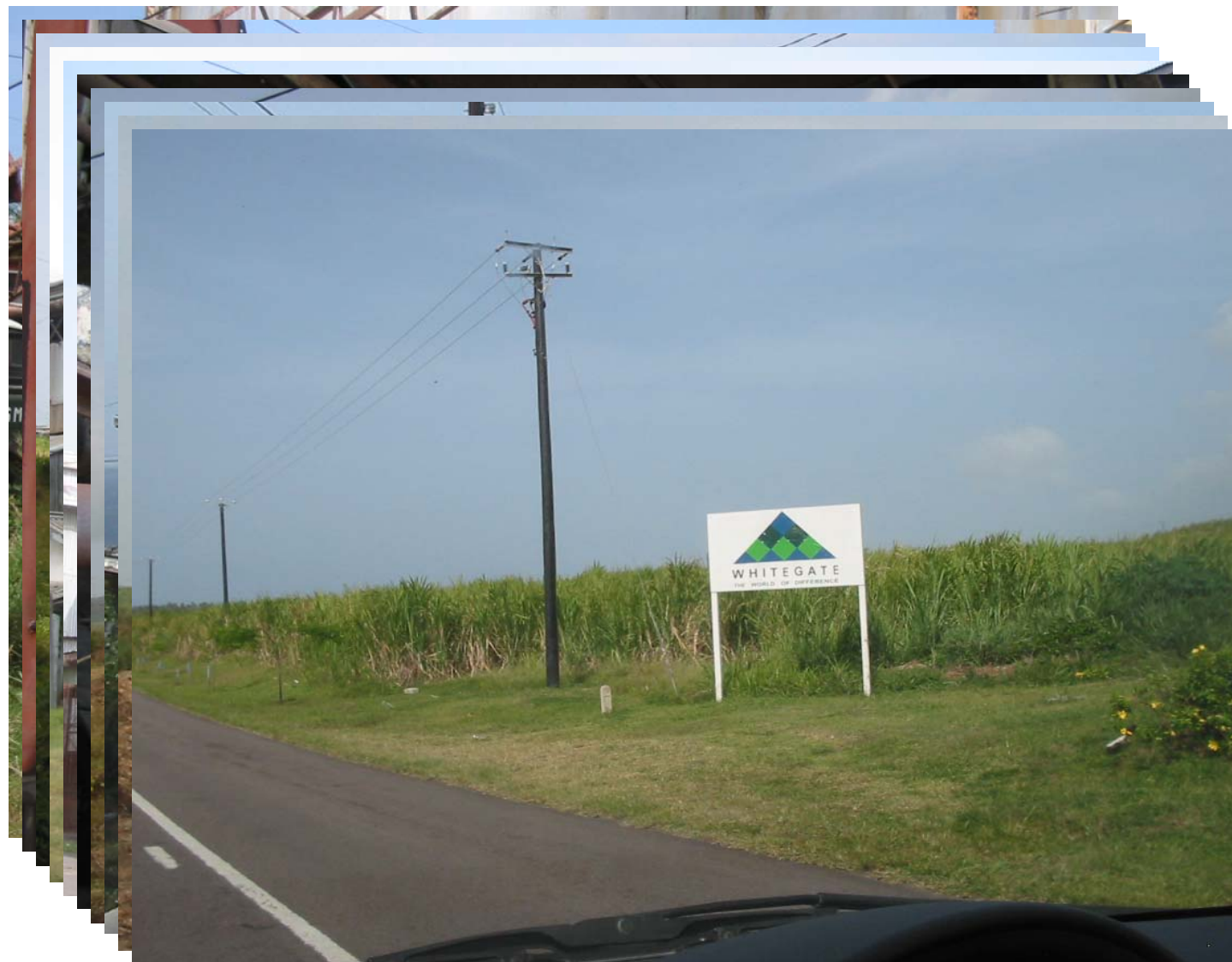
# Considerations for the Assessment

- Product(s) should be profitable – commercial
- Competing interests for the land (housing, hotels, golf courses, light industrial...)
- Product(s) should address multiple challenges (energy, reduce imports, protect the environment, create jobs...)
- All output scenarios assume improvements in infrastructure (i.e. transport system), agricultural practices (i.e. mechanized harvesting), and modern commercially available conversion technologies



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# Sugarcane in St. Kitts Today







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# Current state of waste management





What were the key inputs for the assessment?

## What are the quantities and qualities of potential feedstocks? ... The Sugar Sector

Parameter	Typical	Value range	Unit
Available cultivable area	6,000	5,500 – 6,500	acres
Sugarcane yield*	24.5	20.5 – 32.3	tons/acre
Average distance of fields to mill	12.4	10–15	Miles
Sugarcane production	147,000	112,750 – 209,950	tons/yr
Sugarcane production	1,225	805 – 2,100	tons/day
Sugarcane fiber content (d.m.)	18.5	-	% d.m.
Projected bagasse production	27,930	21,423 – 39,891	dry tons/yr
Average length of grow cycle	303	303 – 365	days/yr
Duration of crushing/harvesting season*	120	100 – 150	days/yr
Amount of reaping per ratoon planted	5	5 – 6	reaping/ratoon
Estimated cost of sugarcane as delivered to the processing plant*	32.7	32.7-49.5	US\$/ton
Amount of reaping per ratoon planted	5	5 – 6	reaping/ratoon



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## What are the quantities and qualities of potential feedstocks? ... Municipal Solid Waste

Waste category	2004 Weight (ton)	Organic fraction (%)	BMW (ton)
Green waste	1,455	90	1,310
Household	10,390	42.5	4,416
Land clearing	3,514	75	2,636
Institutional	150	90	135
Sludge (Septic tank waste)	1,876	-	-
Ship generated waste	6	42.5	2.6
<b>Total</b>			<b>8,500</b>



## What is the potential demand for bioenergy products? ... The Electricity Sector (St. Kitts only)

Current installed capacity:	33.5 MW (2005)
Peak demand:	20 MW
Firm capacity:	19 MW
Demand Growth from 2005-2015:	84.5%
Average electricity price in St. Kitts:	.169 US\$/kWh (2005)*
Average electricity price in USA:	.076 US\$/kWh (2004)

\*At diesel fuel cost of 1.588 US\$/gal, currently diesel fuel cost is 3.37 US\$/gal





What is the potential demand for bioenergy products?  
... The Transportation Sector (St. Kitts only)

- 12,217 vehicles registered
- Majority of vehicles manufactured in 1970s & 1980s
- Gasoline imports approximately 3.3 million gallons at an estimated cost of US\$10.6 million  
(2005 data)
- Ethanol export (CBI) potential...?



# What are the Key Results of the Assessment?

## Summary of the Results Scenario 1 – Focused on Ethanol Production

Input/Output	Average Value	Unit	Range
Land under cultivation	6,000	Acres	5,500 – 6,500
Sugarcane feedstock	147,000	Ton/yr	112,750 – 334,100
Ethanol Produced	2,736,872	Gallons/yr	2,099,199 – 6,220,332
Estimated Cost of Ethanol Production	2.13	US\$/gallon	1.856-2.867
Electricity Available to the Grid	8,609	MWh/yr	6,603 – 19,566
Estimated Cost of Electricity Production	0.087	US\$/kWh	0.075-0.117

# Scenario Conclusions - Ethanol

## ❖ Price

- ❖ The projected cost of producing ethanol in St. Kitts according to this study would **exceed US\$2.00 per gallon (range: US\$1.85 to US\$2.87 per gallon).**
- ❖ This compares with ethanol production costs of approximately US\$0.75 per gallon in Brazil, US\$1.80 per gallon in the United States, and US\$1.40 per gallon in Guyana
- ❖ Some pricing trade offs may be effective vis-à-vis electricity sales

## ❖ Quantity

- ❖ With batch blending of approximately 10% with gasoline - Approximately 409,619 gallons/year of ethanol may be utilized domestically (out of approximately 2.7 million gallons produced - As a result, **an excess of 2.3 million gallons of ethanol would be available for export**
- ❖ Remaining bagasse could be used for limited supplies of electricity

## Summary of the Results for Scenario 2 - Focused on Electricity Production

Input/Output	Quantity	Unit	Notes; Cost range
Sugarcane feedstock required for 19.5 MW power plant	64,313 536	Ton/yr Ton/day	
Land required to product necessary sugarcane feedstock	2,625	Acres	
Estimated power conversion load factor	0.7		
Electrical efficiency	0.26		
Electricity to grid	39,484	MWh/yr	The entire electricity supply is generated and delivered during 100-150 days per year
Excess energy (heat)	52,684	GJ/yr	More primary energy available than consumed by the power plant
Estimated Cost of Electricity	0.13	US\$/kWh	0.085-0.170



# Scenario Conclusions - Electricity

## ❖ Price

- ❖ The projected electricity production costs for St. Kitts according to this study are **estimated at US\$0.13/kWh** (range: US\$0.085 to US\$0.17/kWh)
- ❖ This compares with an estimated electricity production cost US\$0.17/kWh; 2005)

## ❖ Availability (timing and quantity)

- ❖ **Generation limited to harvest months (4-5 months per year);** no irrigation; limited fuel storage potential
- ❖ Given limited production period, cane supplies could satisfy full demand during 100-150 days of generation, with >full use of land
- ❖ Cane juice available for rum, ethanol, or other by-products

## Optimization Alternatives

Several alternative approaches may be considered:

- Import hydrated ethanol/combine with local product to produce product for export
- Consider sugar cane irrigation system and/or modified cane varieties to extend harvest season
- Adapt electricity generation system to co-fire with alternative fuels (i.e. coal) during non-harvest periods
- Utilize innovative electricity generation technologies (i.e. gasification)





# What next in SKN?

- ❖ Consultations with SKN Federation Government
  - ❖ August 28-30, 2007
  - ❖ Move toward a commitment to proceed down bioenergy pathway
- ❖ Initiate partnership with US-Brazil Biofuels Agreement
  - ❖ SKN, Dominican Republic, Haiti, and El Salvador will participate
  - ❖ OAS, IADB, and others will support US and Brazilian governments in providing assistance
- ❖ Determine key land, infrastructure, ownership, sales, and other variables for development
- ❖ Initiate search for developer(s) [also considering prior expressions of Interest]
- ❖ Launch development ... continue collaboration...



## What Lessons Learned May Apply to Other CARICOM Countries?

- Size matters
- Consider multiple energy products
- Advanced technologies will be key to solutions
- Energy efficiency must be part of the solution
- Local market structures matter
  - Electricity sector organizational arrangements (monopolies?)
  - Entrenched transportation fuel interests
  - Policies and bureaucracies
- Electricity Sector Organizational Arrangements



**Thank you!**

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