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ENERGY FOR THE CARIBBEAN:

THE MEDIUM TERM

WALLACE C. KOEHLER,JR., Ph.D.

AND.

SDAN A. BONNET, JR., Ph.D., PLE.

CENTER FOR FNERGY AND ENVIRONMENT RESEARCH

UNIVERSITY OF PUERTO RICO

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Abstract

Luergy use patterns are chonging In the Caribbean for a variety of reasons. These inchide growing populations, increasing urbaniza~ tion, ew ?industries. increasing energy import eosts (over the long run}, general modernization, and development, among. others. The curmint? stutus of energy production and consumption are explored, Possible changes in demand ana supply are considered, and estimates of demand Ahrough the year 2000 are made. The chances of effectively meeting these necus with domestic resources are poor. Given the Present stute of development of renewable energy technology and the estigated possible contribution of the technologies to the energy mix of Caribbean ?countries ané probable increased demand, the Caribbean will

find it necessary to import ever increasing levels of energy tesources,

?The United States Coribbean Basin Initiative (CBI) and other programs

should consider the development of the energy infrastrneture of uach

country, conpatible with the development strategy of cach.

INTRODUCTION

This paper explores the onergy requirements of the insular

Caribbean through the year 2000, It must be recognized that the

sil and subtropics! istands

aiffer from those available to much of the rest of the world, While

solar resources (sun, wind, biomass, sea) are relatively abundant, the

energy nectis and the options oper to trop

more conventional fossil resources (oil, nutural gas, cost) are produced

in only three of the fifty-one inhabited islands of the Caribbeun, And only one country, Trinidad and Tobago, is 9 net exporter. Most of the {islands are very small, seriously limiting economies of scale possible in other lund masses, Data on the Caribbean are shown in Table 1.

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TABLE 1

As Table 1 shows, the size of the countries range from tiny Bermuda (58 sq. km.) to the "giant" Cuba (113 960 sq. km.). Populations too are relatively small, ranging from 6500 on Anguilla to 9.8 miltion in Cuba, Per capita gross domestic product (GDP) is low, typicst of developing countries, ronging from US $3172 in Puerto Rico to $260 in Haiti. The governments of many developing countries are taking shifting economic dependencies into consideration as they plan national energy polley (1¢), Size limits the potential of large-scale electric yoneration schemes. We are toli, lor example, that Antigua wishes to expand its generation copseity by 6 NEE, and to do so with two 3 MIE units

Only the larger islands heve sufficient demand to even remotely justify. nue

power. ?Lhe smallest U.S, commercially available power Peactor is the 600 MVE pressurized water reactor (PNR). Consider the impact, not even takiny cost into account, of such a system in mast of the Caribbean, where installed capacity (excluding the larger islands of Cubs, Hispanola, Jamaica, and Puerto Rico) ranged in 1980 fron 14 MWE in St, Kitts ~ Nevis to 454 MWE in Trinidad and Tobago (21). Even in Puerto Rico, which nas the largest installed capacity of the islonds ~~ 4290 AWE in 1980 -~ one of the stullest units would represciit tifteen percent of installed capacity. In tact the total installed capacity of these sma! islands is only 1630 WWE (see Table 6 below). A 600 MWE reactor would represent 37 percent of current installed capocity of the small Islands,

As a rule of thumb, no electric unit should be of a copacity greter than 20 percent of the actual, available installed capacity. One ?small nuclear reuctor represents for most marked excess capacity, very high costs, und very limited options when the reaetor is down (6,14). However, once electricity transmission is economically feasible across or under water, cooperative arrangenients nay be possible, These too

would face serious institutional, political, and social constraints (16).

Only one country, Cubs, is pursuing the nuclear option, There are

two 440 WWE PWR units currently under construction by the Soviet Union.

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In the mid 1970's Puerto Rico bought a 600 MWE PWR Westinghouse unit,

but cancelled it for political, economic, and ecological reasons.

Coal generated electricity is also ?cing considered, especially in

the Dominican Republic and Puerto Rico, As there are virtually no

, coal would have to be

imported, just as is off. Both the United States and South Americs,

principally Colombia, are major possible exporter to the Region. Once

Solid fuel reserves and ne known bituminous co:

could represent un economic source ot coal. Colombia, bordering on the

the Tennessee - Tonbigbee waterway is completed, the United si

Cambbea: Sen is already well located to export to the Region (9).

The distances involved, transmission across water, and the

iy of the Region ere:

impediments to cooperative ventures. This is not to say that thene

political, economic, and cultural div

have been 10 efforts in this regard. The Regional Energy Action Pian (REAP) of CARICOM (the Economic Community of the Anglophone Caribbean) is « serious attempt to coordinate planning at the nationat level und to develop regional solutions (5). ?Through a grant from USAID, the Caribbean Development Bank (CDB) provides loans for

cnergy and other development R&D in the Region. Tho Organisation of Eastern Caribbean States (OECS) is secking solutions for eastern Curibbeun stetes. There are also other international actors in the

Region. ?These include international orgunizutions like the Oxyanixution of American States (OAS), the Lutin Americun Orgunization for Energy (CLADE), and the United Nations and its Specialized agencies.

Other countries have taken an active interest. Among them ure regional ones like Colombia, Mexico and Venecuela. The San José Accords is a regional reponse to oil prices. The governments of Colombia, Mexico, and Venezuela have provided preferential prices for countries of the Region, low interest loans to permit them to purchase oil, and incentives to develop alternatives. Canada, France, the Soviet Union, the United Kingdom, and the United States have assisted in identifying various resources und have provided funding to help develop energy and other resources und to build the development infrastructure necessary.

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There are no perfect sulutions for Caribbean energy problems. We hove argued elsewhere that there are at least six important obstacies to progress (17)

1, shortage of trained perscnnet

2. inadequate research

8. absence of organized markets for indigenous

renewable tuels

4. luck of investment capital

reluctance of regional governments to consider

cooperative ventures, as well as the absence of

9 non-goveran

ntal network.

subcritical size of national energy systems.

Some of these arv already being addressed by various groups.

Yet, sorious inf

ructural probienis =

malt (4,20). However, if the

Caribbean is to deai ettectively with its energy problems, it witl have to

grapple successfully with obstacies to progress.

CARIBBEAN ENE:

WW STATIS!

duction ane Resources

There are relatively few conventional energy resources exploitable

in the Curibbeon. As is seen in Table 2, Trinided and Tobago and to

8 far less extent Cuba und Barbado, produce liquid fuels; Trinidad and

Tobago and, again to u far less extend, Barbados produce natural gas;

and only six gem

rate electricity from hydropower. Several of the
islands may possess potentially exploitable oli or gus reserves. These
are the Pominican Republic

the Bahamas, Jumaica, Puerto Rico and the
Netherlands Antilles. Thure are indications of lignite deposits in the
Vominican Republic, Haiti, Jamsica, and Trinidad, There ure peat
deposits in Jumuica ond evidence of peat in the Dominican Republic and

Haiti, Geothermal resources exist in Dominien, Montserrat, St. Lucia,
St. Vincent und perhaps the Dominican Republic, Haiti, and the
Netherlands Antilles (23).

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TABLE 2

Some st

istics exist for "non-conventional" energy production.

Fuelwood is thought to supply 80 percent of rural energy needs. In 1976 fiaiti's fuelwood production was twer

ry times that of its conventionat energy production. In the Dominican Republic, it was nine times higher; for Cube, only 2.5 times higher. In the eastern Caribbean, fuelwood produetion may be the only source of nationally produced energy (22). ⁉t is known that detorestation to provide {uel and building material has been serious problem throughout parts of the Caribbean, particularly in Haiti, It is estinsted that 35,000 hectares fare deforested in the insular Caribbean each year while only 10,000 are aforested (11). From the 1920s to the 1970s, forestation feli from 50 ereent of the totel land ares to 18 percent (19). To counter this,

governments uve instituted programs to plant fast growing trees such as leuceana, ana to offer incentives for doing so. The Dominican

Kepublic, for example, otfers « pig for every 2000 government provided trees planted. This said, forest resources can and do provide «nergy reseurces, particularly in the eastern Caribe:

Resources

Much thought live been given to the role of renewable energy for the Caribbean. Table

3 isu catelog of those resources and the degree to which they nioy and nme exploited.

TABLE 3

Wind und solar energy are judged to provide the best opportunities for economical development in all islinds, while biomass, geothermal and hydropower receive nixed results (2,18). Relatively little ts known of the impact these resources might make economically, although it has been estinuted that bagasse fom sugar cane could replace 19 percent of energy nieeds in the Eastern Caribbean (5). Similarly, Puerto Rico

could reduce the ofl used to generate electricity by 12 percent and eliminate completely the dependence of the rum industry for imported

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molasses through the planting of 70,000 acres of energy cane - 4 species developed to produce additional bagasse (3). Estimates of the potential contribution for six countries of both bagasse and rice husks are provided in Table 4.

TABLE 4

The fifth column of table 4 indicates the total potential encrey

contribution of the two ogricultural byproducts. Compare this column {© column six. Significant contributions appear to be possi

le for these

?es. Column seven indieates the percentage that agricultural byproducts could contribute to displece oil imports. The case for a

fhuition agricultural progrem appears compelling.

six count

Mt should be noted that much of the renewables focus is on oil substitution for electric generation. It is shown Inter on that while nearly cll electricity in the Caribbean is oil-fired, electricity generation is only # small part of the oil bill, It is also necessary to bear in mind thet there do not yet uxist adequate solar and wind data for nist of the Caribbean, making it difficult to estimate the potenti! various renewables nay have for replacing conventions!

Energy Consumption

As was previously indicated, there exist few statistics on rural energy use in the Caribbean. Vardi (28) estimates that for Haiti, firewood. charcoal, and bagasse represent 80 percent of primary energy consumption, the "modern sector" consumes 91 percent of clectricity

while only 4 percent of all households have It. According to Vardi, one Percent of Jamaica's energy is derived from hydro power, nine percent from bagasse, and the balance from oll.

?There ure also few statistics on sectoral energy use. Table § fives energy consumption by fuel type for each island and per capita,

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TABLE 5

Just as Luxembourg has the highest per capita energy consumption in the world because of energy intense industries, two Caribbean islands have greater per cupita consumption than the United States for the same reason.

Toble 3 makes it clear that liquia fuels, or petroleum dominate the Curibbean energy menu. Solid fuels are mainly employed in but three countries: Cuba, the Dominican Republic, and Jamaien; « minute portion of the consumption in ench, Natural gas associated with oil produetion fires clectrielty generation in Barbados and Trinidad and Tobago. Hyareclectric power is produced in but six of the Caribbean islands. But ?t should be noted trom Table 2, that eight islands have poor hydroelectric potentiel, others none, limiting its contribution to the Caribbean energy system.

Ht is clear from Table 9 that oll is the primary fuels for thermal electrical generation, since liquid 1vels ure the single conventional fuct consumed in most Caribbean countries. Moreover, as is shown in Table 6, oll-fired electric generation is the predominant source of clectricity in the Region.

TABLE 6

Tuble 6 shows both net installed ?nameplate? capacity for 1980, and that year's production. Only in Haiti does hydroelectric power more than compete with ofl-fired, where 41 percent of capacity ond 70 percent of Haiti's hydropower potential. Production of hydroelectric Power for the balance ranged between one percent (Cuba) and five per cent (Puerto Rico).

TABLE 7

Table 7 attempts to disaggrogate the petroleum sector inte elec:
trical and non-electrical. Usually the non-electrical sector is further

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aggregated into residential, commercial, industrial, and transporte-
tion. Tuble 7 offers a very broad estimate and care should be taken in
interpreting it. Most of the petroleum imported into the Caribbean goes
into consumption sectors other than electricity production, Ae we have
seen, renewable strategies for oll substitutiсn policies will have to be
designed for other sectors as well. Research into elcohol motor fuels,
solar Industrial heat, high and low grade hot water, among others, is
alreudy underway to varying degrees in the Caribbean. Policies such
8 mits on automobile engine size and building code restrictions have
been implemented by several governments, including the Dominican
Republic, Jumaico, and Puerta Rico, among others,

ood sectoral date for the Caribbean are difficult to find, ?There
wee, however, According to Vardi (23) in 1980 in Antigua 10

percent of electricity sales were tourist oriented, 98 percent corimereial, and 17 percent residential. In Barbados, the breakdown of oil and gas ?consumption is: electricity genoration 45 percent, transport 23 percent Sugar industry 4 percent, manufacturing 18 percent, and residential & Percent. Hotels took 25 percent of electricity sales. The mujor con suming sectors of the Dominican Republic were: in Wwansport 20 percent, donestic 21 percent, government 1.5 percent, and mining vurles with the vagaries of international prices. Again ac cording to Vardi, Radio Antilles is the mojor consumer of electricity in Montserrat, representing 25 percent of consumption. Household demand is 3 percent,

lustry 44 pexeent,

TABLE 8

?Table 8 provides some fairly dated uta. Energy end use psttems very throughout the Region. Compare the data in the Table and the more recent Dominican Republi

data sbove. Energy use

industrial sector rose from 26 percent in 1975 to 44 percent in 1980,

thy

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ary

It has been shown that there exist limited conventional energy Fesources in the Caribbean, although there is some potential for evelopment. The possible contribution of renewables for some is ck yet the degree to which they can contribute and the costs associ tea with them is: problematic. Moreover, like conventional fuels, renew- uble resources are not evenly distributed throughout the Region.

?The cata for rural energy consumption are incomplete. In some cases, renewables alzeady contribute significantly to the national energy system (e.g. Haiti). It also appears that urban areas consume not only more energy per cupite but more conventional energy than do their rural counterparts.

Liquid fuels by far dominate the energy systems of the Caribbean fslands, almost ail of which is imported.

CHANGES IN DEWAND PATTERNS

The stotus of the present energy situation was shown above. We Suggest that this picture will change, that demand for conventional energy, including electricity will grow significantly by the end of the century. This will be driven by several factors. Among these

A. population inereases

1, increasing urbanization

©. modernization

D. industrialization

A. Population Increases

?As is shown in Table 9 the population of the Caribbean is increas~

Ing at on average onnual rate of 1.5 percent with intraregional vartation ranging from 0.9 percent in Barbados to 2.8 percent in the Dominican

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Republic. Given this rate of increase, the 1981 population of 30 million will rise to just over 42 million in the yeer 2000, a scant fifteen years from now. If we assume that per capita energy consumption will remain constant, then energy demsnd will rise from the 1980 level of 0 million metric tons coal equivalent (MMMTC) to nearly 72 MMMTC (see Table 7).

TABLE @

H. Increasing Urbanization

The urbanization rate of the Caribbean is also increasing, as is shown in Table 9. The overall rate of increase is estimated at just under one percent per year. One observer (1) concludes thet the urben Latin American citizen consumes between six and thirty times more conventional enevgy than his rural counterpart. We estimate that

Bf this trend holds, if, urban ané rural demand remains constant, and

if the disparity between urban and rural consumption rates is 10:1;+

energy demand will be of the order of 100 MMMTC. This is double the

1980 demand,

Constant per capita demand is unlikely however. Despite two oil

Price shocks and an economic cooling, the Region experienced growth in

demonid at @ conservatively estimated annual rate of 2.4 percent in the

1870s, Even uncompounded, assuming historical birth and demand

rotes, energy demand for 2000 can be estimated at nearly 100 MITC

11 urbonization ana the historical 2.4 percent rate are considered,

?energy demand in the Caribbean will be of the order of 123 MMMTC.

We do not believe that energy demand will increase at an uncom-

Pounded rate et 4.4 per cent. We think it will be significantly higher.

There are @ runiber of factors driving this prediction. First, the Carib-

ay {Me BaIREVE Tis to be a conservative estimate, In Haiti there is 9:1 rutio in the electrical? sector, not taking into account further Gisparitins in oil.

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Dean economies are improving, It would be foolish to make this a fifteen year prediction. But changes are occurring which give rise to this view.

Estimating Demand

?Two factors, population ond urbanization increases, have already been explored to predict future demand. Development and energy demand in developing countries have been clearly linked (8). As is shown in Table 9, the economic structure of the Caribbean is under Going @ metamorphosis, That change is more clearly demonstrated in Table 10, Lhe Curibhean econonie structure is changing from one Which was typically "underdeveloped" toware a ?developed? model. The lust two entries ir Table 10 provide unweighted averages for four Meveloped and three developing countries. ?These are provided to give su indication of sector importance for these two groups. In three

Sectors, important difference ean be seen: ugriculture represents a

product (GDP) of develop~

ing countries, but only @ smal! proportion of the developed. Likewise,

the contribution of the industriel sector was, in 1977,

the developed countries that of the developing. The same is true in

significant proportion of the gross domest

Imost twice in

?other?, yeflecting the diversity of the economies of developed

countries. ?The Caribbean metamorphosis is most clearly borne out in

the ogricultural sector. In slmost every case there hus been a

consistent lessening of the contribution of ugriculture to the GDP,

notwithstanding the fact that agricultural production has risen in

Most (see Table 9). The contribution of industry to CDF has, for

most, also risen consistently, approuchings and sometimes exceeding the

developed average. The same car be said of the "other" sector. In

addition, as Caribbean societies continue to modernize, thelr populations

will consume more energy intensive goods.

TABLE 10

?This fs evident im the inereuse in the number of automobiles,

trucks, televisions, telephones, and se on throughout the Caribbeun

ne

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(sec Toble 9). The Caribbean Basin Initiative, by opening the U.S. market and through cther incentives may further expedite Caribbean development.

?These changes in economle structures and demand patterns will aftect energy demand in the Caribbean, The change will be from labor intensive to energy intensive: witness the inerease in the number of tractors, for example, replacing human and animal energy with diesel.

TABLE 11

?Table 11 provides estimates of denund rates and predic

in the year 2090. The Table includes esti

demand

nates of demand increases

both world wide and in the developing world. These estimates provide

© preaiction of total Caribbean demand,

Estinates of increases in annual globol energy demand are rela

?

vely low, ranging between 1,2 and 2.4 percent, as are the resulting Genund predictions. it is unlikely, however, thut Caribbean demand Will be as low as global demand, an¢ that too is reflected in Table 11.

Estimates of increasing demand for developing countries range between 1.8 percent and 7.1 percent. Three of the figures ure popu-lotion driven, and are explained above. The 7.1 percent figure is the actual growth in energy demand in developing countries from 1960 to 1908. This provides an interesting benchmark because this growth was unimpairee by the energy price shocks ani

1970s. Also provided is the actual growth rate for the Caribbean from 1072 to 1980. That growth rate was impaired by the 1970s.

economic recession of the

We believe that the increase in annual energy demand from the Present to 2000 will lie somewhere between 2.4 and 7.1 percent. We accept 7.1 percent »s the upper limit for several reasons. Although the Curibbean is boucfiting from the end of the recession in the Ueveloped world, the structure of growth in the next fifteen years will be different fron tht of the 1960s, There is greater awareness of the Uenefits of conserva~

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tion. New infrastructure will be more efficient. ?There will be some evelopment of a low energy demand service sector, And, finally, there ave

ready in place highly energy intensive industries -~ cit
refining ena aluminum smelting. ?These will expand es the global ccono-
my improves, but we do not expect the degree of growth experienced in
the 1960s. For these same reasons, we believe 2.4 percent to be the
lower limit. And because of economic and industrial expansion should
be above that of the 1970s, energy demand should also be higher.

These upper and lower limits provide » wide range of possible
demand in 2000, 80.5 NINMTCE ond 197.5 MVMTCE, the lurger figure
more then double the smaller. Actual 2000 demend will Ne somewhere
between these two figures. Goldemberg has recently suggested a
growth vate for Latin America (1980-1990) of 5.2 percent (12). If that
number applies to the Caribbean, 2000 demand will be 198.1 NINMTC.

The Cevibbean differs from the rest of the world, Table 12

Presents energy denand by primary fuels. Oil provides neurly 46
Percent of globsl demand, almost 7 percent of Latin American demand,
Yut 90 percent in the Caribbean. If this pattern continues, oft
Genand, almost ull of which must be imported, will exceed 124 MNINTC

in 2000 Gower case: 71 MMMTC, upper ease: 177 NMC). That will be @ dliticult economic ourden for the Caribbean to beat.

TABLE 12

But there exe few options, for most ether conventional fuels will Bkewise be imported, And while oll Is morw expensive to inport then other conventionals at present, thelr reletive prices in fifteen yeurs

nnot be ucevrately predicted,

Nuclear poner might displace some oil or other fuels in the Caribbean import menu. Yet, there are serious problems of scale, the

nae

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technical probioms associated with transmission must be solved, and the economics appear tobe worsening. Moreover, facilities must be built, requiring significant up-front investment, And even if construction

began today, it would be at least eight years before the firs would begin to produce.

O11 will continue to be imported into the Caribbean. If governments, the private sectors, and universities of the Region cannot work to find economic substitutes for ofl, to reduce the rate of increase, the cost of those imports will continue to cuuse serious balance of payments Problems anc in all Likelihood will badly impact the societies of the Caribbean. And thet could render further development impossible

There ure two obvious alternatives to energy imports: greater efficiencies und renewable energy. Auch of the work done on renewbles has tocused on the substitution of oil (or other fields) in the clectricity sector. That will help. But because much of the oil consumed In the Coribbean is not consumed in the electricity sector, ever nore research into those areas is clearly needed.

Goldembery has distinguished between two types of energy pian ners which he labels "geneticists" and "teleologists? (12). A geneticist Sees plan goals es constrained by historical situations and the inherent, objective tendencies of the country. For a teleologist, the purpose is

to modify existing streetures in order to meet plan objectives. To waderstand and plan fer the Caribbenn is to be of both minds. The constraints are massive, the options limited. Yet we know that energy Gemand must be targeted, snd that the target will be @ difficult one. 1 Js crucial thet talent be brought to bear on current und future

Problems; that cohesive recommendations reflecting Caribbean realities be made; and that those in authority to act, do act.

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TABLE 1

The Caribbean

Couey Faden: Popala= Pop. bans. xi9b US) FT Ga

date (or setrop.) eon (per'sq. ka.) *ZOP/GNPAS) AcDP /oxPRAUSS

Anguilla (U.k.) 6,500 a n 2.08 wei

Antigua (1981) 17,226 280 276 7.18 1,039

Bahamas (1973) 209,503 13,940 1s 3.0% 4, 76088

Berbados (1966) 252,000 430 586 950.48 81788

Belize (1981) 146,000 22,958 6 186.5) 1,208

Berauda (U.K) 72,000 33 1,350 59s" 10,8944

Cayman Yslands (U.K.) 17,035 259 66 ne 4,800%

cuba (1902) 9,771,000 113,960 86 13,300 21,3608

Dosinien (1978) 74, 100 749 99 49.7 sate

Donia. Rep. (1844) 5,762,000 48,433 a9 550088 908s

Grenada (1974) 107,000 Bue az 50.2 4398

Guadeloupe (France) 317,000 1,779 178 957m 3,040"

Guiana (France) 66,000 90,999, 1 120+ 21,9358

Guyana (1965) 793,000 214,970 4 500.788 e908

Maiti (1804) 6,000,000 27,749, 22 1,508 28,68

janaica (1962) 2,225,000 11,424 195 2,9798 1,339

Martinique (France) 312,000 1,100, 283 1,135" 3,559

Montserrat (U.K.) 12,036 102 az 20m 173088

Neth. Antéltes (Neth. 243,000 992 28 8648 3.4728

St. Kitte/Nevis (1983) 46,408 269 165 os.iee 9208

St. Lucia (1979) 122,000 oie 198 210* 1,696

Se, Vincent (3979) 115,000 288 236 sone sie

Surinase (1975) 388,000 163,758 2 22.4 237088

?Trinidad/Tobago (1962) 1,176,000 5,128, 230 53,7008 aea7®

Turks/Caicos (U.K.) 7,436 497 as 15" 2,008

Virgin Tel. (0.K.) 33 BL 28.588 _2,45eHm

721,421 35, 806.6 -

Total:

United States

Puerto Rico

U.S. Virgin tat

3,240,000,

98,307

226,306,825 9,372,623

8,897

wae

Source: Caribbean/Cent ral American Action, Car

Dept. uf Connerce, sureaw of the Consus,

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TABLE 2

1980 COMMERCIAL ENERGY PRODUCTION

In Metric Tons Coal Equivalent x 10°

Electricity (Hydro

. Total Solids Liquids Gas and Geothermal)

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Cuba a5 we 13

Dominican Republic 6 = - - 6

Halts ae - - a

Jainsica wo - - 18

Puerto Rico wo - - 10

St. Vincent and

the Grenadines 2 - - 2

Trinidad and

Tobago i932 - 159833369, -

Source: UN Statistical Yearbook, 1979/80, Tabie 180.

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TABLE 7

SECTORAL USE OF PETROLEUM

1980 IN TCE x 107

Petroleum Non Non Elect

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Antigua 6 %

Bahamas 105 nat a

Barbados 38 482 88

cuba ma 11667 89

Dominican Republic ae 1993, 82

Guadaloupe 203 85

Hatt 12 a2 85

Jamaica am 2467 8

Martinique 2 283 0

Netherlands Antilles 226 5350 96

Puerto Rico er0 10369 86

St. Kitts-Nevis ? 2 8

St. Lucia 7 a 8

US Virgin Islands 0 e407 99

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TABLE &

ENERGY USE RY SECTORS

In Percent

Residential

?and,

Others

Industrial Commercial _(inel. agr-) Losses

Dominican Republic

Baits

Jamaica

?Trinidad and Tobago

Source: UNIDO, Overview of Energy and Environme

Area.

26.1

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96.6

36.9

10.4

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30.2

1.6

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ESTIMATES OF COMMERCIAL

ENERGY DEMAND IN THE INSULAR CARIBBEAN,

IN TRE YEAR 2000

Percent Annual Level

Increase MICE x 10°

GLOBAL

Iglesias (vet. 15) 12 63.6

Hafele (ret. 13) 21 15.9

High See)

s 1s 615

World Bank (ref. 24) 24 80.5

DEVELOPING COUNT

Developing Countries

1960 =" 1970 (Actual)

(ref. 7) fa 197.5

Caribbean

1972 - 1980 (Actual) 24 60.5

Goldemberg (ref. 12) 5.2 138.1

Iglesias Cet. 16) 312 oat

Paper Scenario | va 16

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TABLE 12

ENERGY DEMAND BY PRIMARY FUEL

IN PERCENT

on 45.8 69.5 90

Coat 29.9 a

Gas x0 ana 62

fiyaro a7 63 2.8

Nietour og

Others 1s

* World Bonk (ref. 24)

* Goldener: (ref. 12)

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