

SCOPE

Bioenergy and energy security

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18/11/2013

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I. BIOMASS AS FUEL

II. BIOENERGY AND ENERGY SECURITY

II.1 Biofuels and energy security

II.2 Heat production and energy security

II.3 Electricity production and energy security

II.4 Traditional and energy security

Bioenergy encompasses a highly heterogeneous set of socio-technical systems that have in common the use of biomass as a fuel. Some of which are called *modern* (biofuels, heat and electricity, all object of commercial transactions); others, known as *traditional* (like fuelwood and residues used for cooking and heating in rural areas).

Energy security can be defined as “uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers private and industrial” (EC, 2000)

Traditional biomass refers to solid biomass—including agricultural residues, animal dung, forest products, and gathered fuelwood—that is often used unsustainably and combusted in inefficient and usually polluting open fires, stoves, or furnaces to provide heat energy for cooking, comfort, and small-scale agricultural and industrial processing, typically in rural areas of developing countries and usually is not the object of commercial transactions.

Modern bioenergy, refers to solid, liquid, and gaseous biomass fuels used for modern applications, such as space heating, electricity generation, combined heat and power, and transport (REN21, 2013, UNDP et al, 2002) and are the object of commercial transactions

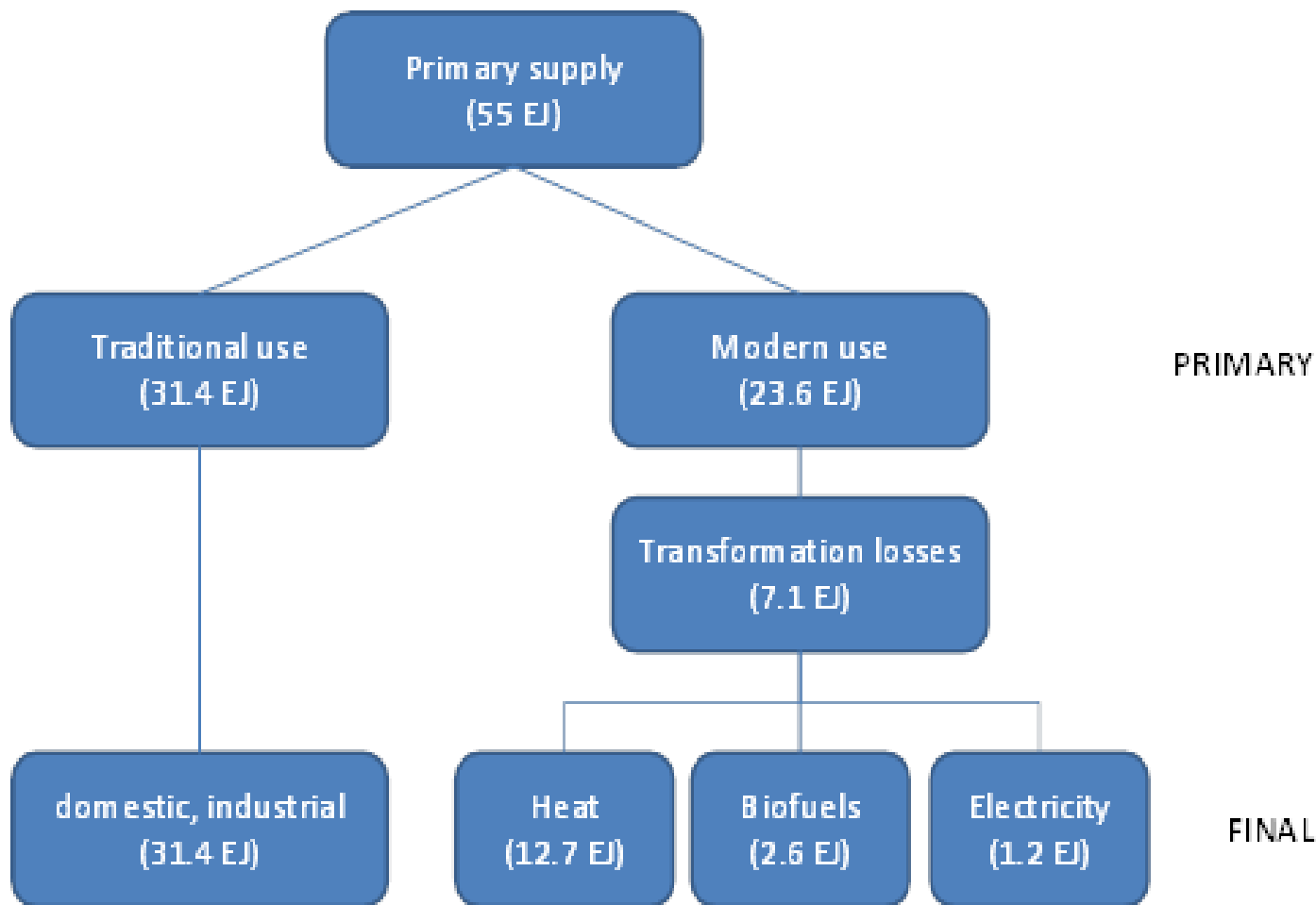


Table I

The modern biomass contribution to global energy use
(own elaboration, based on REN21 2013 and BP 2013).

| Modern biomass (A) (final energy) | | | Final Energy use (B) | | | A/B (%) |
|--------------------------------------|------|-------------------------|----------------------|-------|-------------------------|---------|
| | EJ | Growth rate (%/year) | | EJ | Growth rate (%/year) | |
| Ethanol | 1.9 | 1.7 | Gasoline | 39.6 | 0.7 | 4.8% |
| Biodiesel | 0.7 | 2.7 | Diesel oil | 33.1 | 2.6 | 2.1% |
| Biomass heat | 12.7 | 3.5 | Heat | 166.7 | 1.6 | 7.6% |
| Biomass electricity | 1.2 | 8.2 | Electricity | 64.3 | 3.4 | 1.9% |
| | | | Other transport* | 33.5 | 3.1 | - |
| | | | Non-energy use | 26.2 | 2.6 | - |
| Total | 16.5 | 9.5 | | 363.4 | 2.1 | 4.5 |

Table 2

Drivers to adoption of biofuel development (*countries with biofuel mandates). Own elaboration, based on REN21 (2013) and APEC (2010).

| Country | Energy security | Economic development | Environmental concerns |
|--------------------|-----------------|----------------------|------------------------|
| Australia* | | X | X |
| Brazil* | X | X | |
| Canada* | | | X |
| Chile | X | | |
| China* | | X | X |
| EU* | X | X | X |
| Indonesia* | X | X | X |
| Japan | | | X |
| Malaysia* | X | X | X |
| Mexico | X | X | X |
| New Zealand | X | X | X |
| Peru* | X | X | X |
| Philippines* | X | X | |
| Republic of Korea* | | X | X |
| Russia | | X | X |
| Thailand* | X | X | X |
| United States* | | X | X |

ETHANOL REQUIREMENTS IN 2021

(billion liters)

| | Ethanol production in 2015 (billion liters) | Estimated area in 2015 (Mha) | Additional ethanol amount needed in 2021 (billion liters) | Sugarcane area needed to produce the additional ethanol (Mha) |
|---------------------------|---|------------------------------|---|---|
| United States (from corn) | 57.0 ¹ | 14.5 ³ | 79.8 | |
| Brazil (from sugarcane) | 37.4 ² | 6.0 ² | 24.2 | |
| E10 for other countries | | | 34.8 ⁴ | |
| Total | | | 138.8 | |

¹ EPA (2010); ² EPE (2012); ³ baseado em USDA (2012); ⁴ baseado em REN21 (2012)

* Baseado em: 5600 litros de etanol/ha

EPA – US Environmental Protection Agency. Renewable Fuel Standard 2 – RFS2, 2010. Available at:

<http://www.epa.gov/otaq/fuels/renewablefuels/index.htm>

EPE – Empresa de Pesquisa Energética. Plano Decenal de Expansão de Energia – PDE 2021, 2012. Available at:

<http://www.mme.gov.br/mme/menu/pde2021.html>

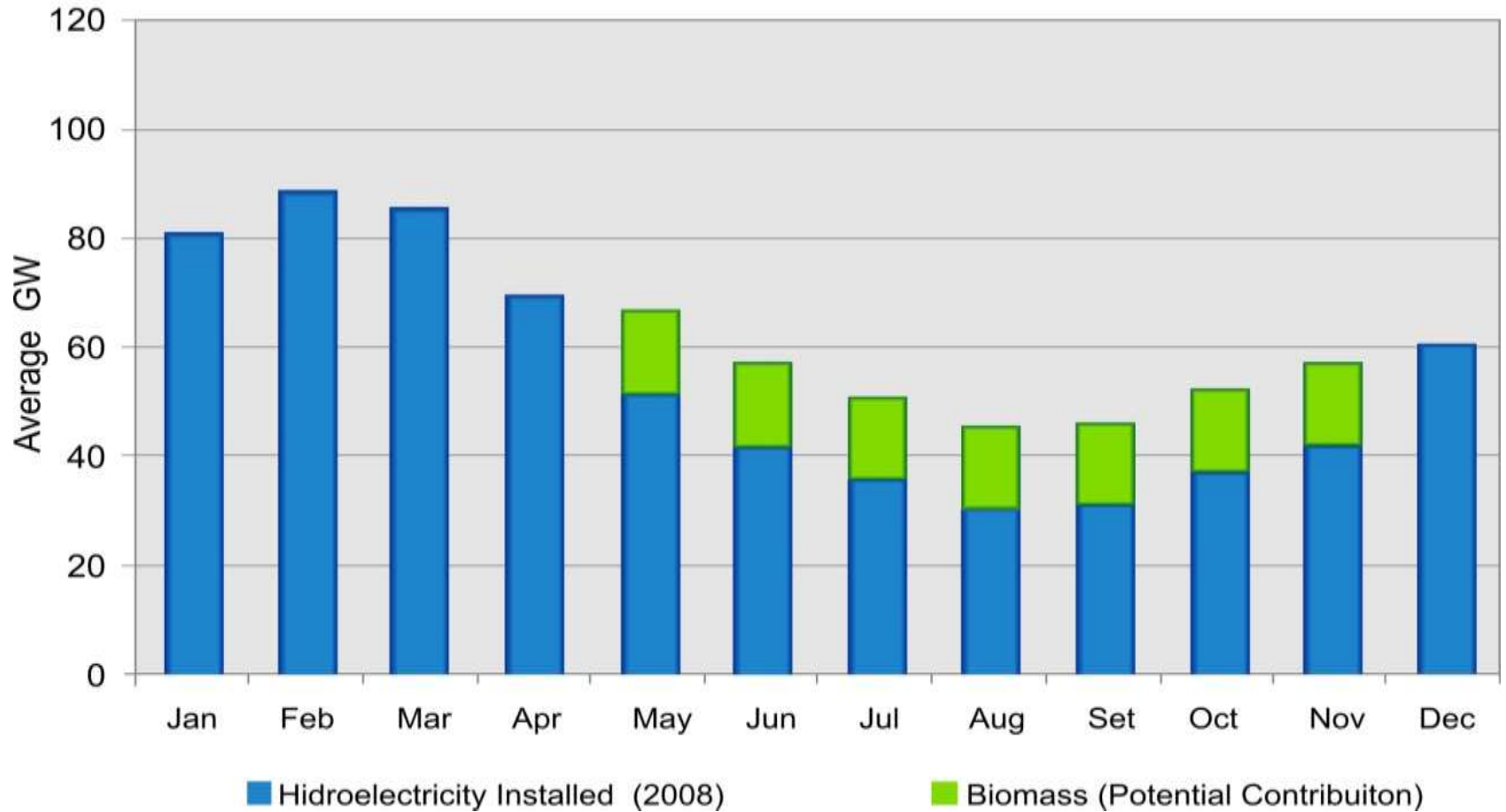
USDA – US Department of Agriculture. Economic Research Service. Biofuel Feedstock & Coproduct Market Data, 2012. Available at:

<http://www.ers.usda.gov/topics/farm-economy/bioenergy/biofuel-feedstock-coproduct-market-data.aspx>

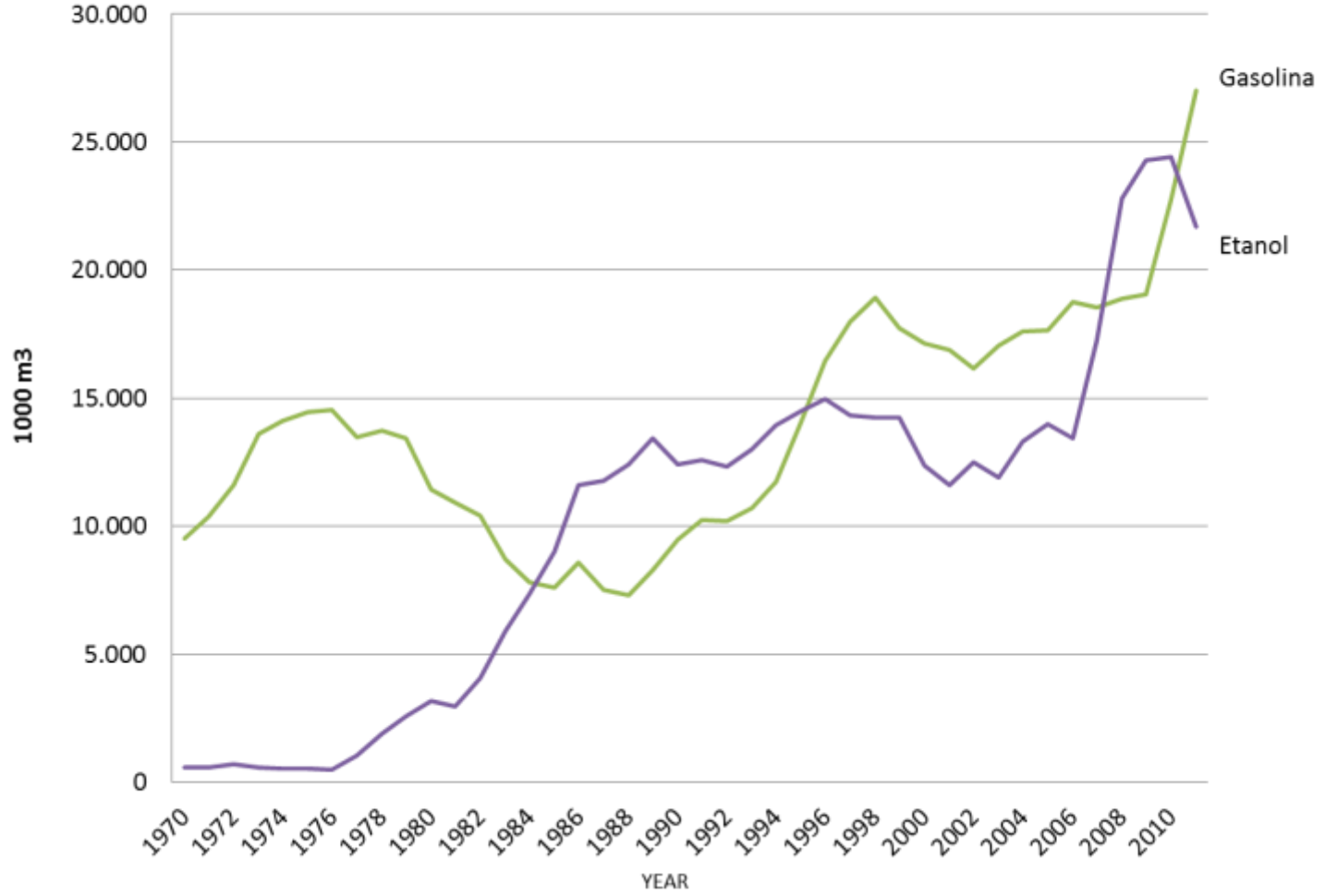
REN21 – Renewable Energy Policy Network for the 21st Century. Global Status Report, 2012. Available at:

<http://www.ren21.net/REN21Activities/GlobalStatusReport.aspx>

Electricity Generation Capacity In Brazil (2008)



Gasoline and ethanol consumption



Oil importers and sugarcane producers in 2010

| Country | Sugarcane area (ha)* | Oil self-sufficiency | Oil consumption (barrels/day) |
|------------------|----------------------|----------------------|-------------------------------|
| Australia | 405 000 | 0.5958 | 960.800 |
| Bangladesh | 121 000 | 0.0122 | 98 000 |
| China | 1,695 228 | 0.4672 | 9.400 000 |
| Cuba | 431 400 | 0.3567 | 176 000 |
| Guatemala | 234 650 | 0.2159 | 71 100 |
| India | 4,170 000 | 0.2641 | 3.185 000 |
| Indonesia | 336 000 | 0.7238 | 1.292 000 |
| Mozambique | 215 000 | 0.0424 | 17 000 |
| Myanmar | 157 000 | 0.7296 | 988 000 |
| Pakistan | 942 870 | 0.166 | 410 000 |
| Philippines | 362 834 | 0.0629 | 310 000 |
| South Africa | 267 000 | 0.067 | 533 000 |
| Vietnam | 266 500 | 0.8445 | 321 500 |
| Thailand | 977.956 | 0.3925 | 988 000 |
| Brazil (in 1973) | 1,958 780 | 0,22 | 783 000 |