Biomass Energy in Sri Lanka : Retrospective and Prospective Analysis

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International Conference on Advanced Materials for Clean Energy and Health applications (AMCEHA 2019) 6th to 8th February 2019

University of Jaffna

BIOMASS

- Organic matter derived from living, or recently living organisms
- Can be used as a source of energy
- Most often referred to plants or plant-based materials that are not used for food or feed

(wiki)

- Stored Solar Energy
- Form of first known stored energy by mankind

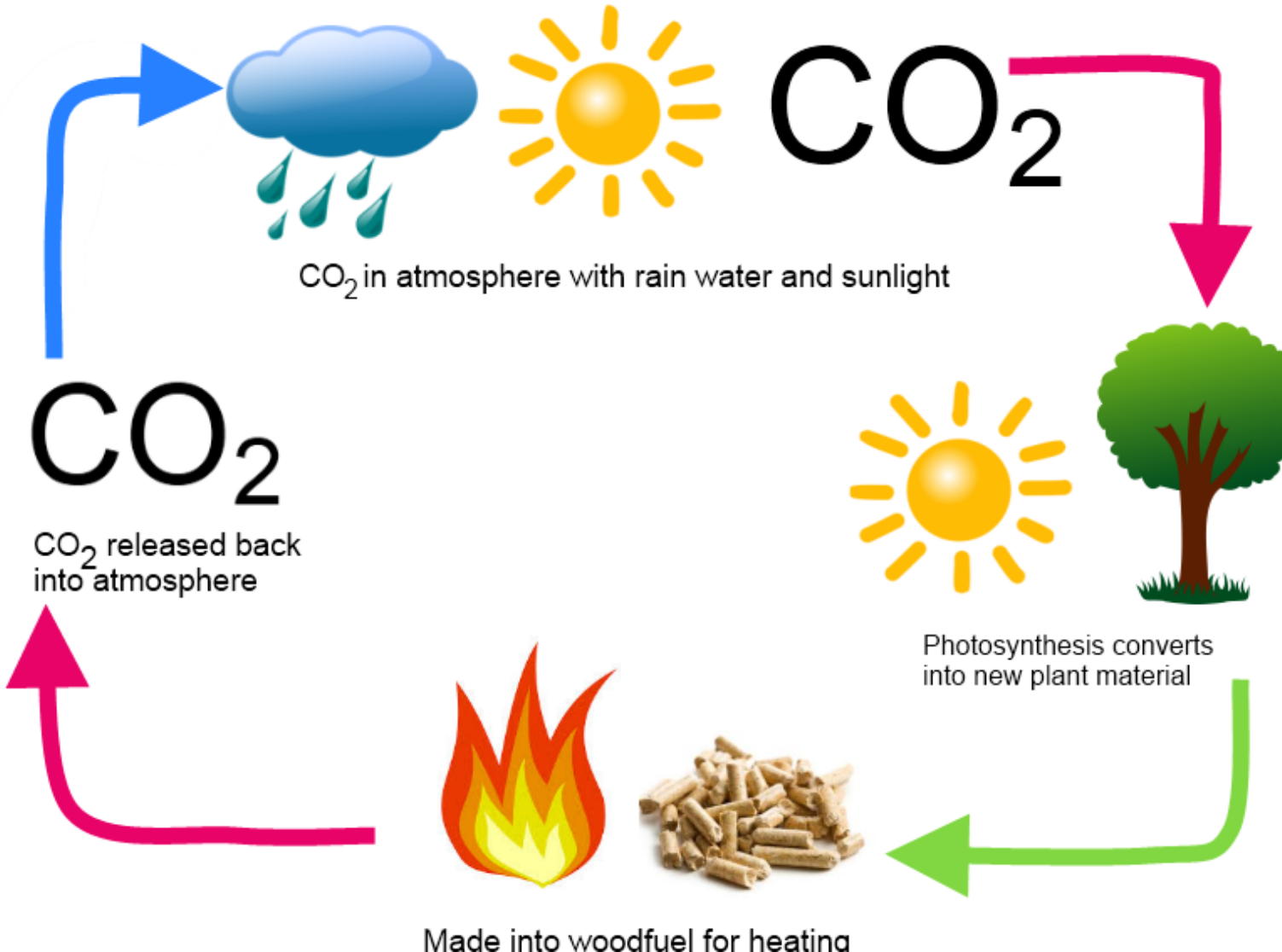
sgrlaw.com

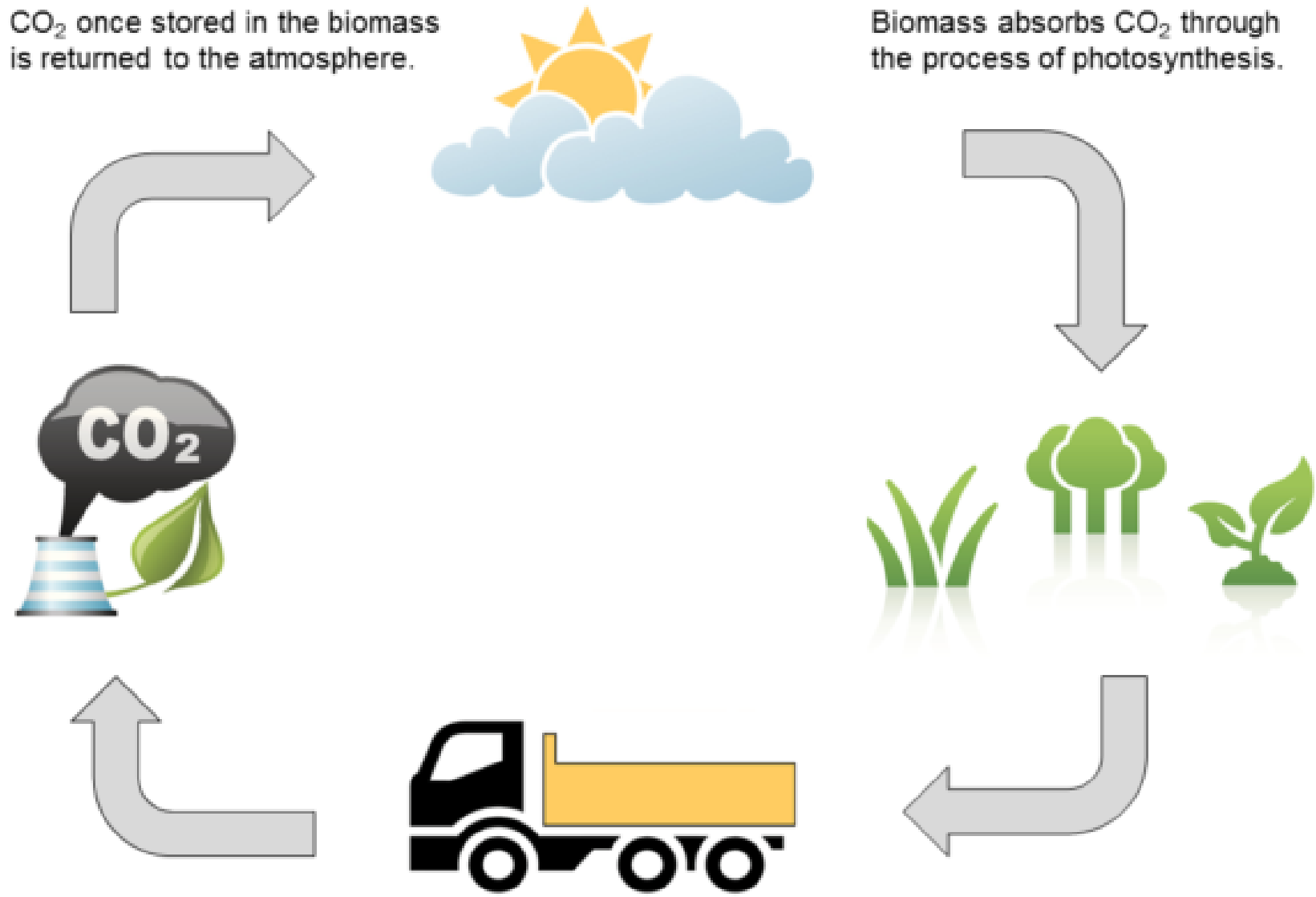
DIFFERENT FORMS

Fuelwood
Sawdust
Shavings
Chips
Pellets
Briquettes
Husk

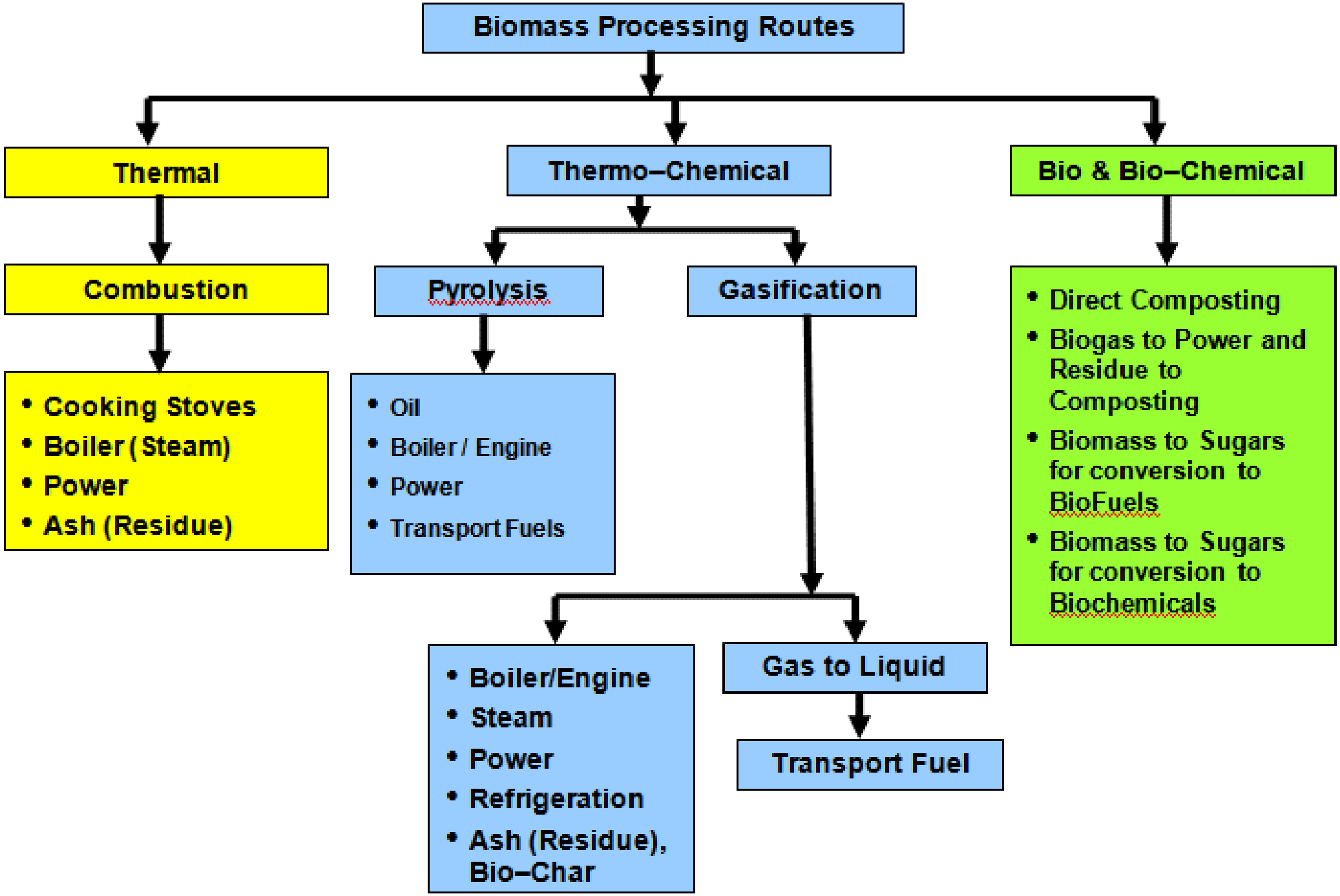
SUSTAINABLE BIOMASS

- When biomass burned, they turn back into carbon dioxide and water and release the sun's energy they contain
- Biomass functions as a sort of natural battery for storing solar energy
- As long as biomass is produced sustainably—with only as much used as is grown—the battery will last indefinitely





viaspace.com


Biomass Processing Routes
Thermal
Thermo–Chemical
Bio & Bio–Chemical
Combustion
Pyrolysis
Gasification
• Cooking Stoves
• Boiler (Steam)
• Power
• Ash (Residue)
• Oil
• Boiler / Engine
• Power
• Transport Fuels
• Direct Composting
• Biogas to Power and Residue to Composting
• Biomass to Sugars for conversion to BioFuels
• Biomass to Sugars for conversion to Biochemicals
• Boiler/Engine
• Steam
• Power
• Refrigeration
• Ash (Residue), Bio–Char
Gas to Liquid
Transport Fuel

KEY STATE INSTITUTIONS

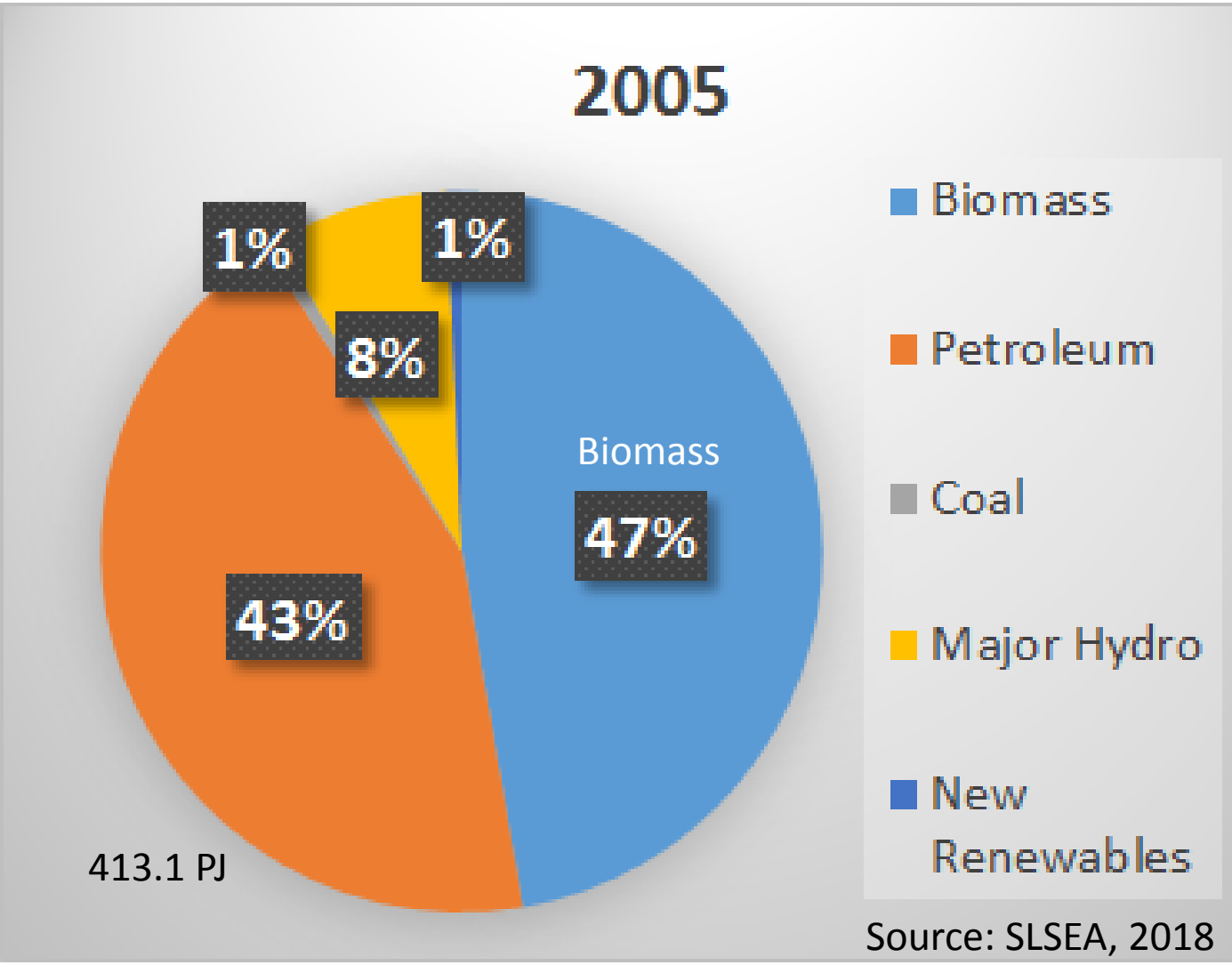
- Ministry of Power & Renewable Energy
  - Ceylon Electricity Board
  - Lanka Electricity Company
  - Sustainable Energy Authority
  - Lanka Coal Company

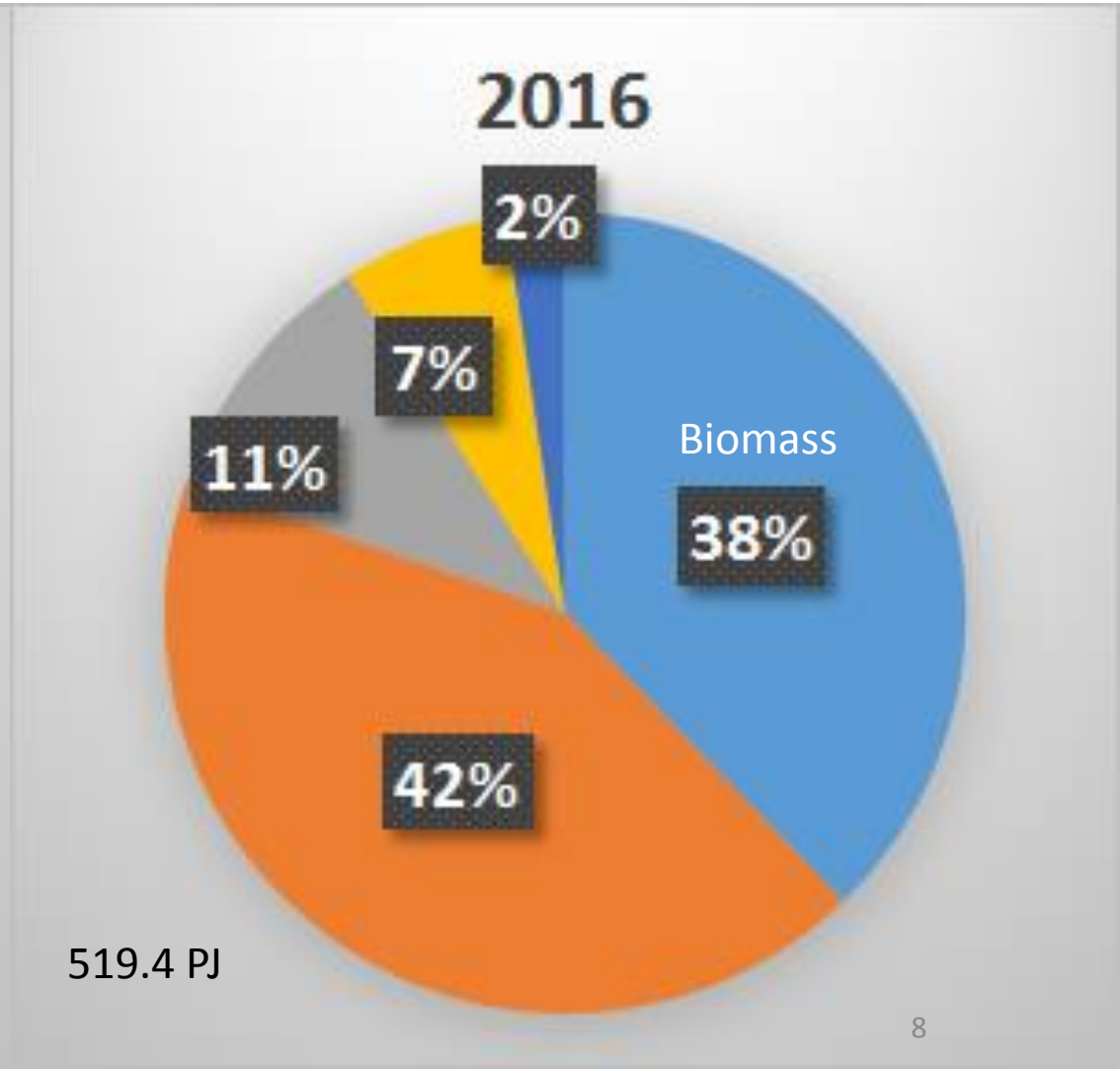
- Ministry of Petroleum Resources Development
  - Ceylon Petroleum Corporation
  - Petroleum Resources Development Secretariat
  - Ceylon Petroleum Storage Terminal Ltd

- Regulator: Public Utilities Commission

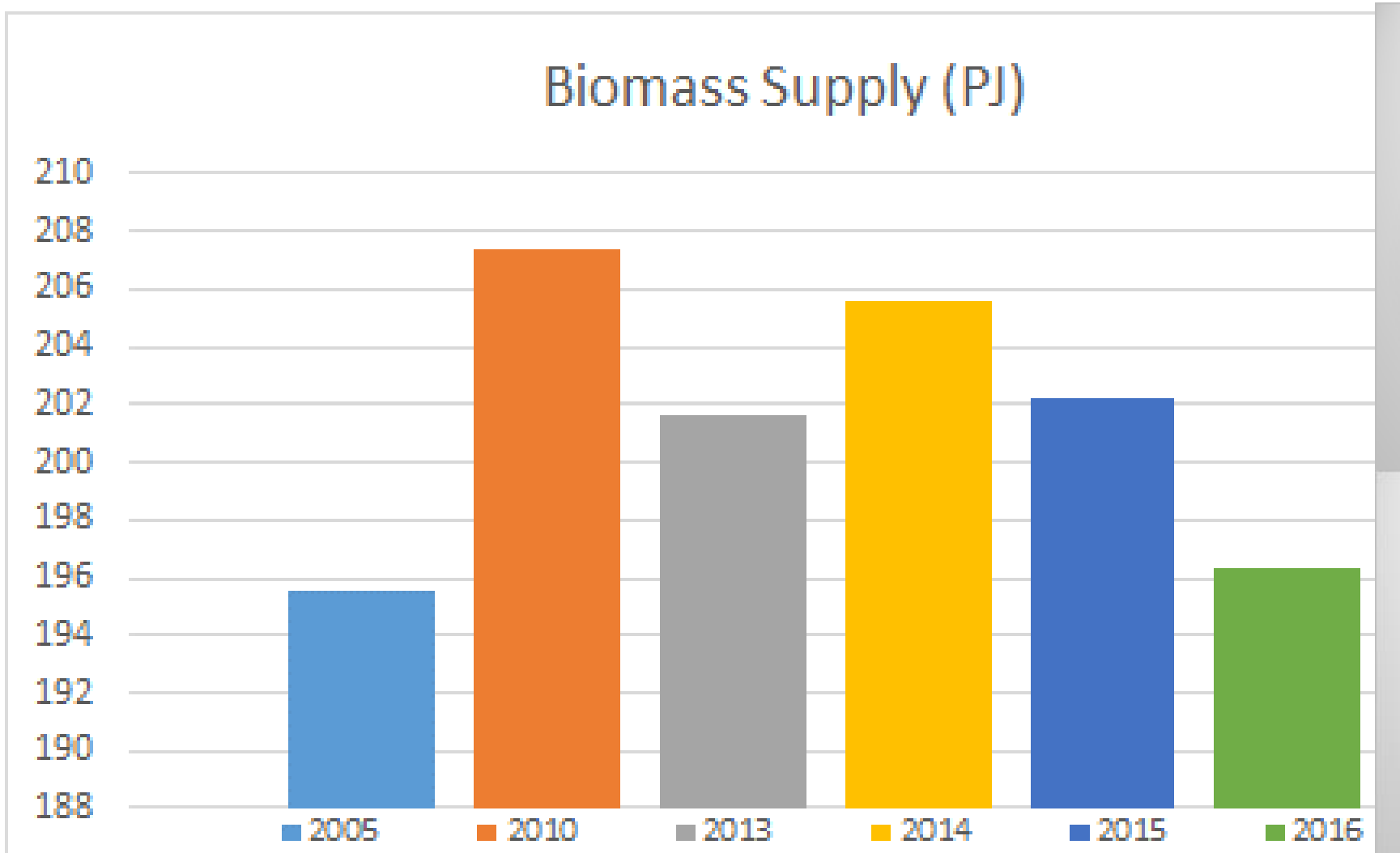
presidentsoffice.gov.lk

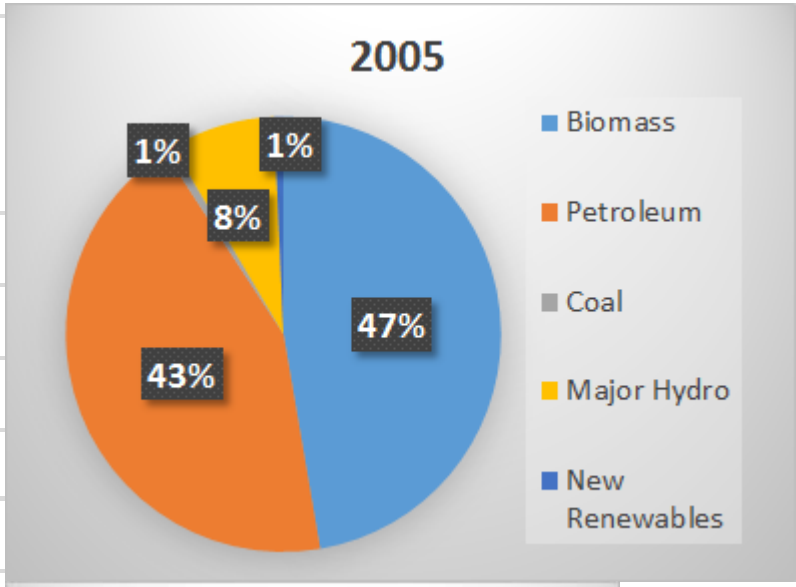
PRIMARY ENERGY SUPPLY

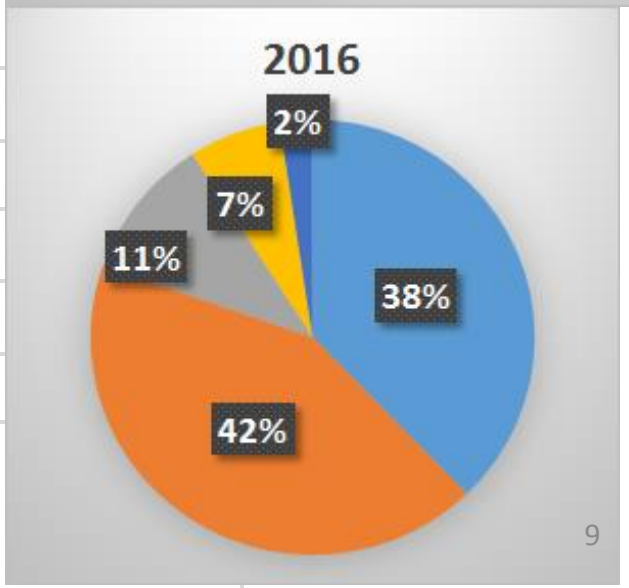




Source: SLSEA, 2018



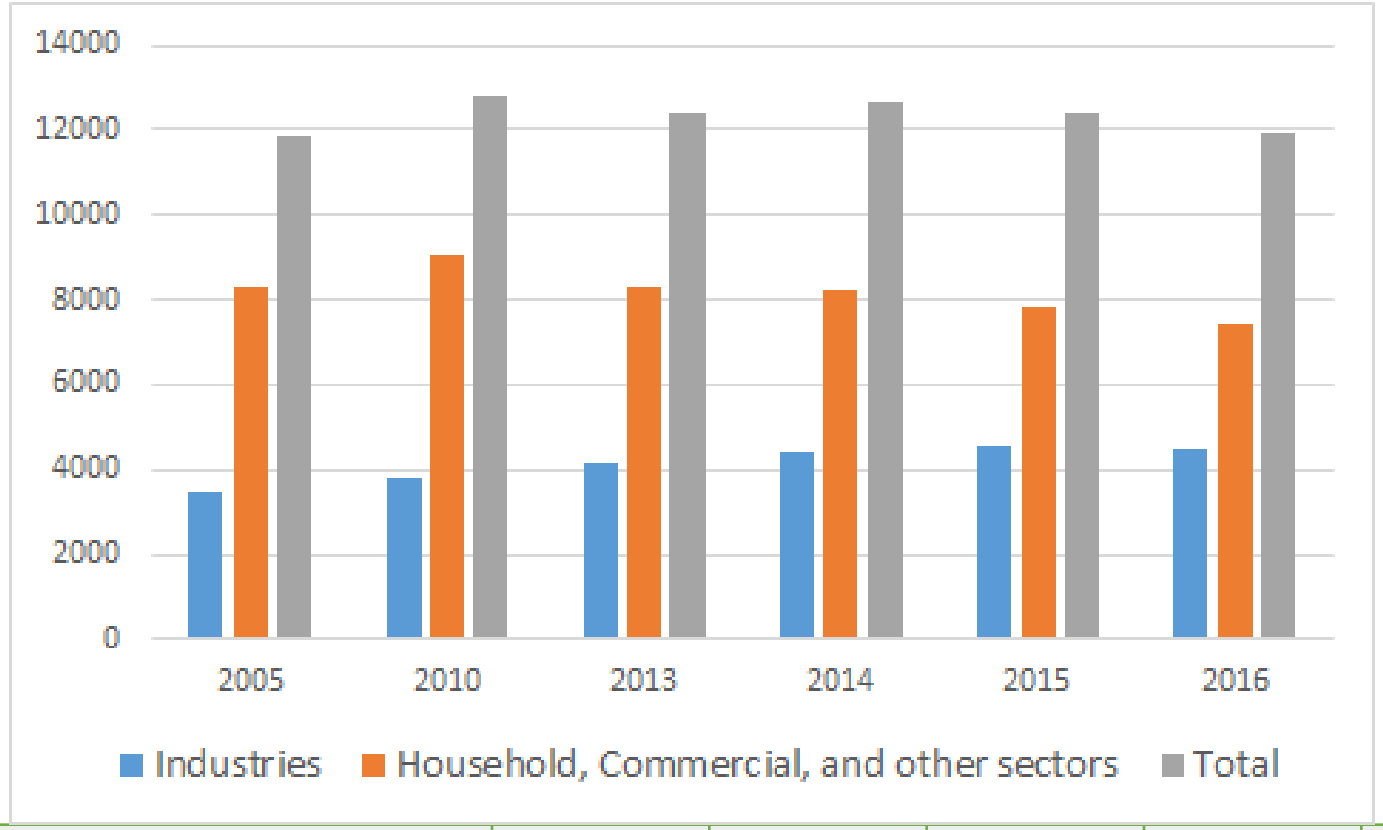




BIOMASS
48% > 38%

Source: SLSEA, 2018

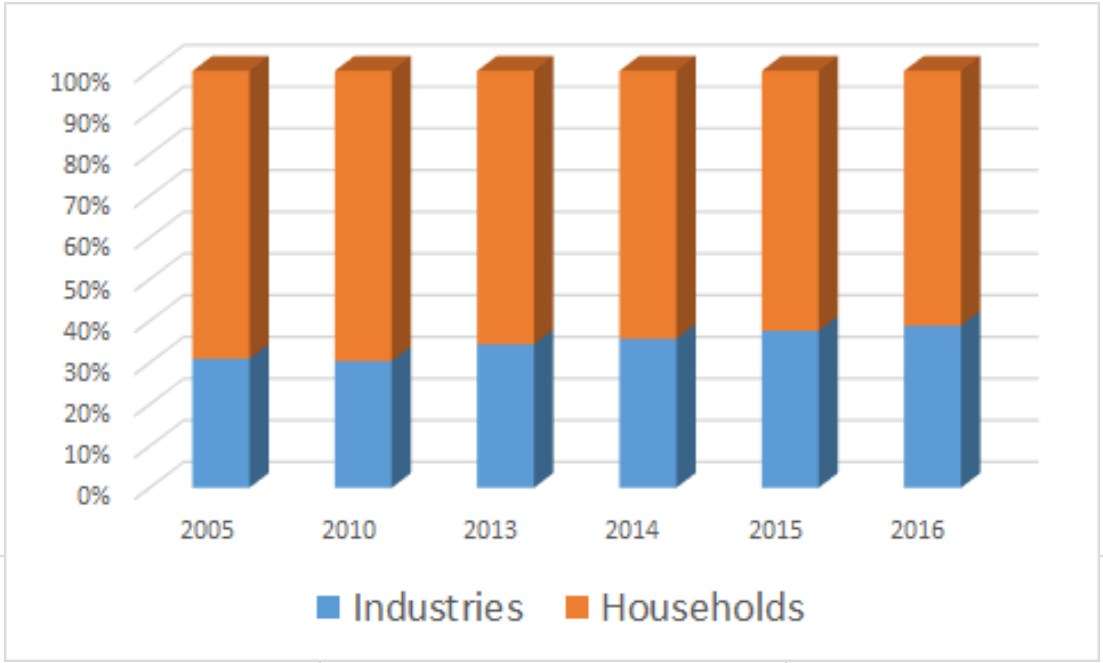
DEMAND FOR FUELWOOD (kt)

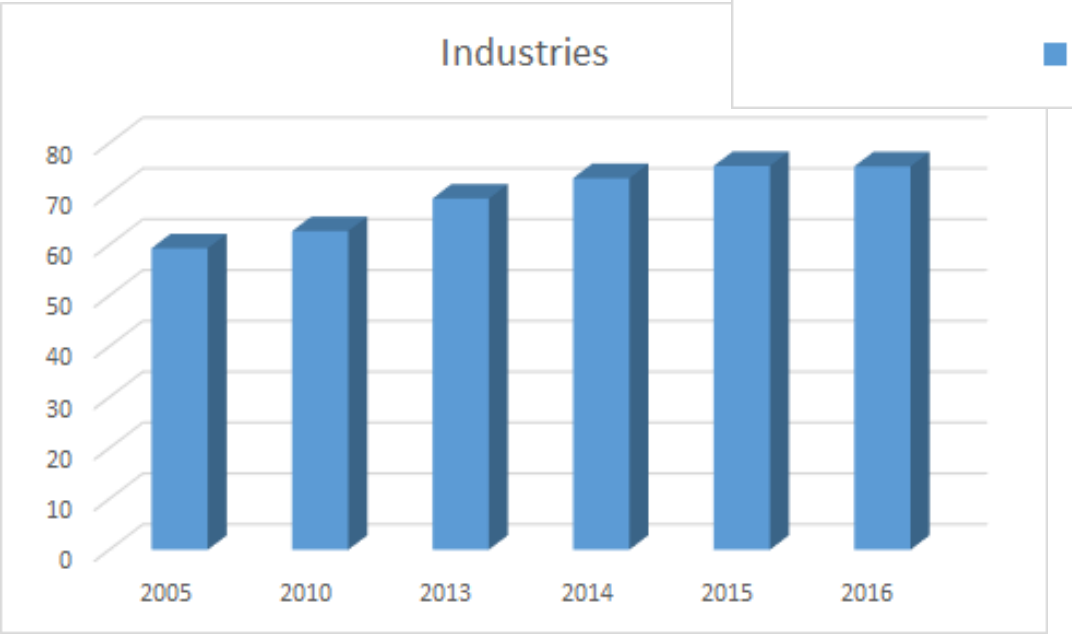


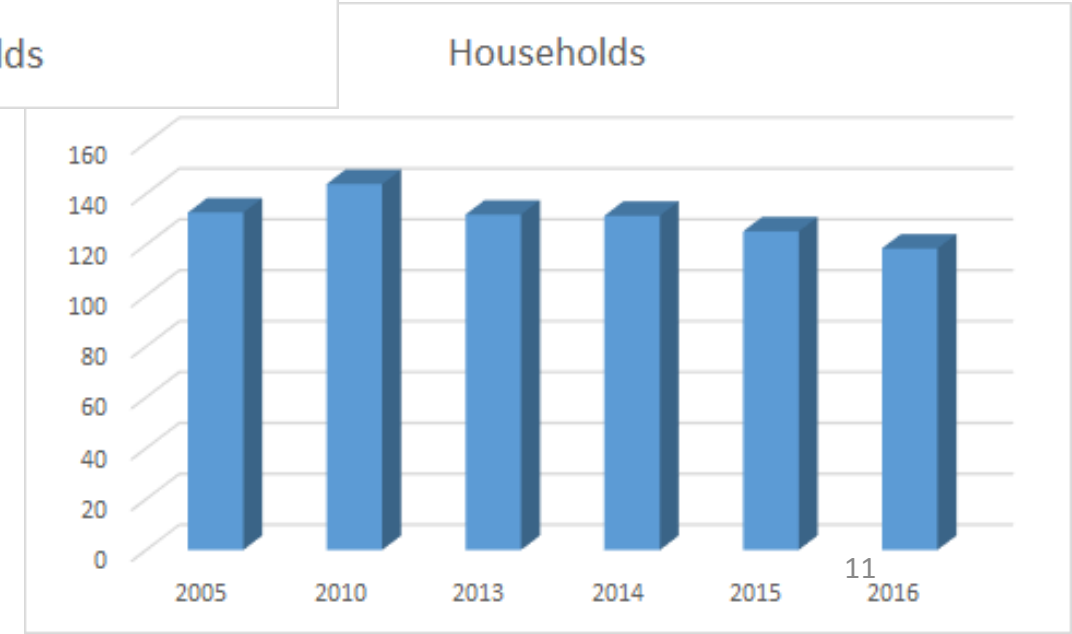
Sector / Year	2005	2010	2013	2014	2015	2016
Industries	3505	3788	4139	4436	4536	4512
Household, Commercial, and other sectors	8336	9040	8284	8260	7870	7446
Total	11841	12828	12423	12696	12406	11958

Source: SLSEA, 2018

TOTAL ENERGY DEMAND FROM BIOMASS (PJ)





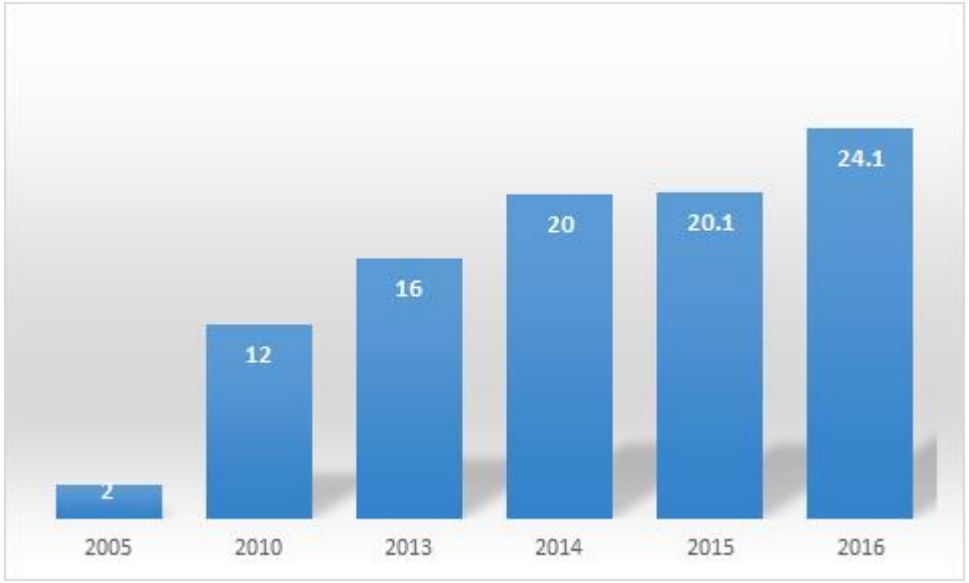


Source: SLSEA, 2018

BIOMASS – POWER GENERATION (2016)

	Biomass	New RE	Share	
Plants	9	200	4.5%	
Installed Capacity	24.1	512	4.7%	MW
Power Generation	72	1,158	6.2%	GWh (2015)

Share



National Grid (2016)

Total Installed	4,002 MW
New RE Installed	512 MW
Generation	14,343 GWh
New RE	1,158 GWh

Source: SLSEA, 2018

EMISSION & CONVERSION FACTORS

Grid Emission Factor (kg CO_2 / kWh)

Year	Factor
2005	0.3451
2010	0.3158
2013	0.3754
2014	0.5077
2015	0.4753
2016	0.5684

Energy Unit Conversion

1 toe = 10 GCal

1 toe = 41.868 GJ

Fuelwood

0.38 toe/t

15.91 GJ/t

Source: SLSEA, 2018

IMPROVED BIOMASS STOVES

unhabitat.lk

- 3-Stone and Inbuilt Stoves
- 400,000 Anagi stoves produced per year
- 200 Producers
- 5 Clusters
- 15% penetration
- Rs 400 per stove (1/3 for producer, distributor, retailer)
- National Guidelines on Indoor Air Quality (Environment Ministry)
- 30 different types of biomass, and char coal stoves in market

INDOOR AIR POLLUTION & SOLUTION

- Indoor air pollution is a major public health challenge
- WHO estimated the deaths attributable to IAP in SL to be 4200 in 2004
- Lung and eye diseases
- Soot and Carbon
- Nails and fingers
- Collection and storing burdens
- Black Carbon & Climate Change

Solution

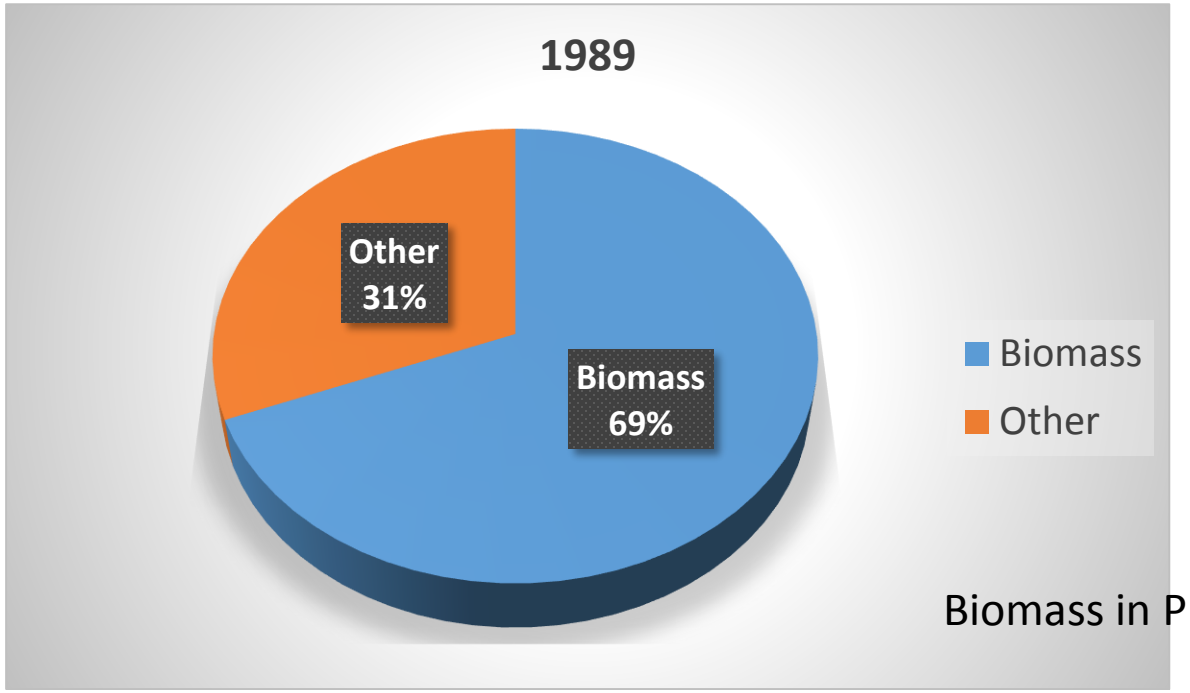
Wood Gas Stove with Features of Gas Cooker

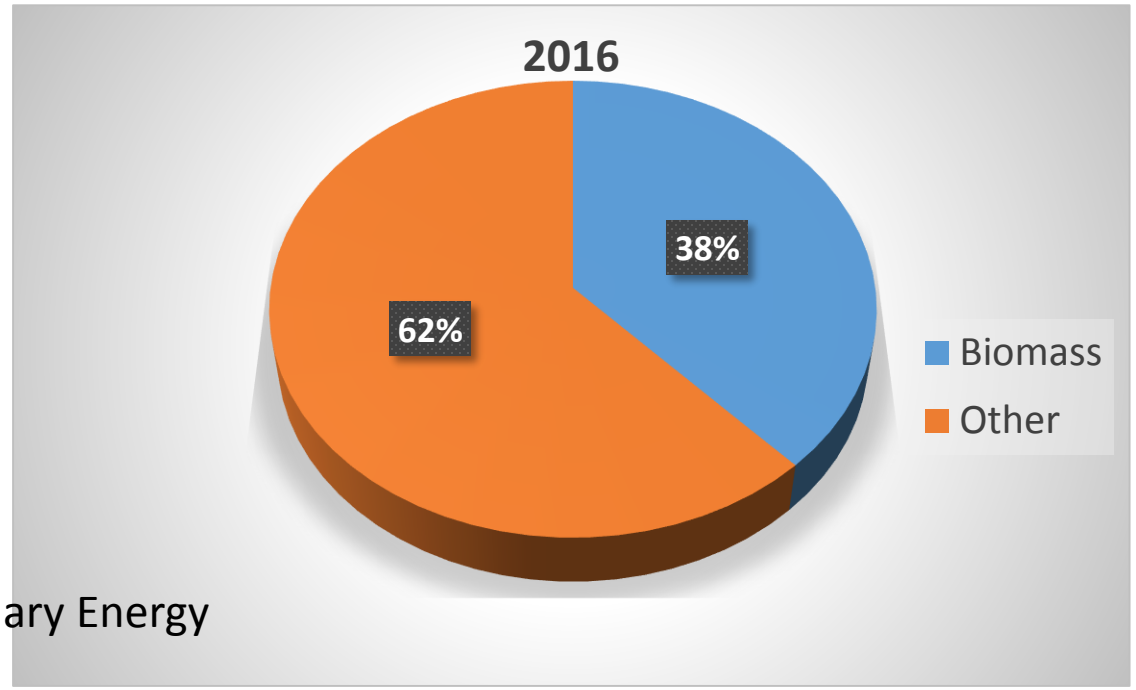
BIOMASS USER SHIFTING

- Domestic users opt out of fuelwood as main cooking fuel
- Competition from LPG with visible media campaign
- Further eroding energy security

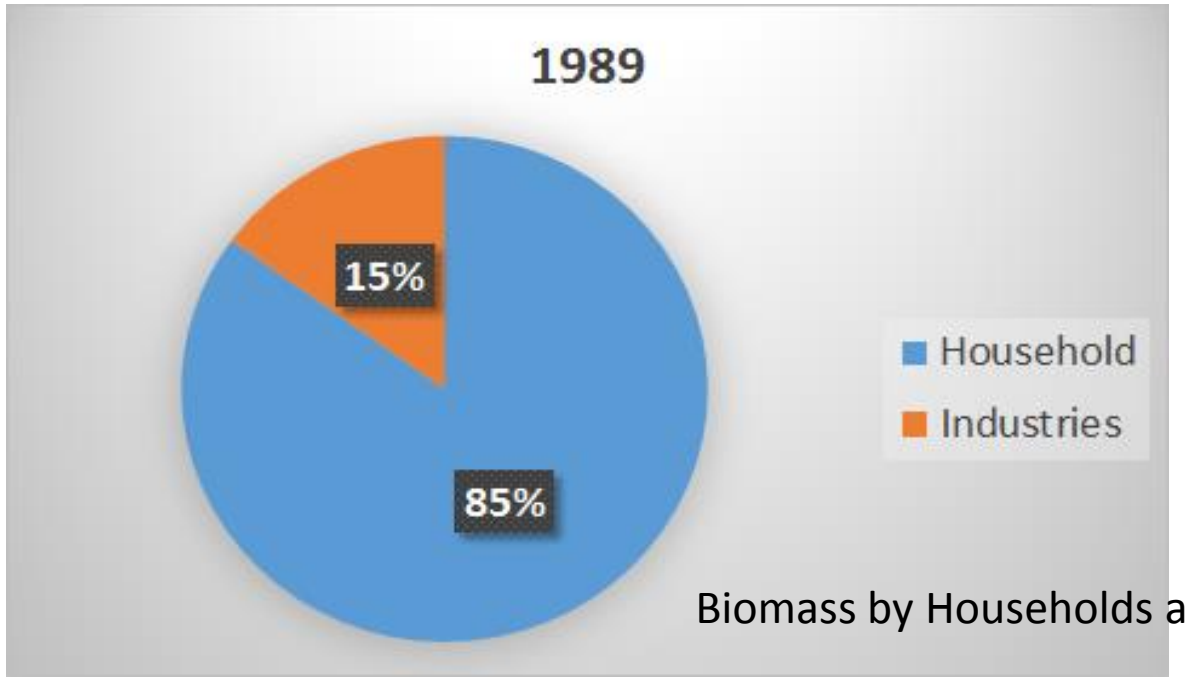
(SLSEA, 2018)

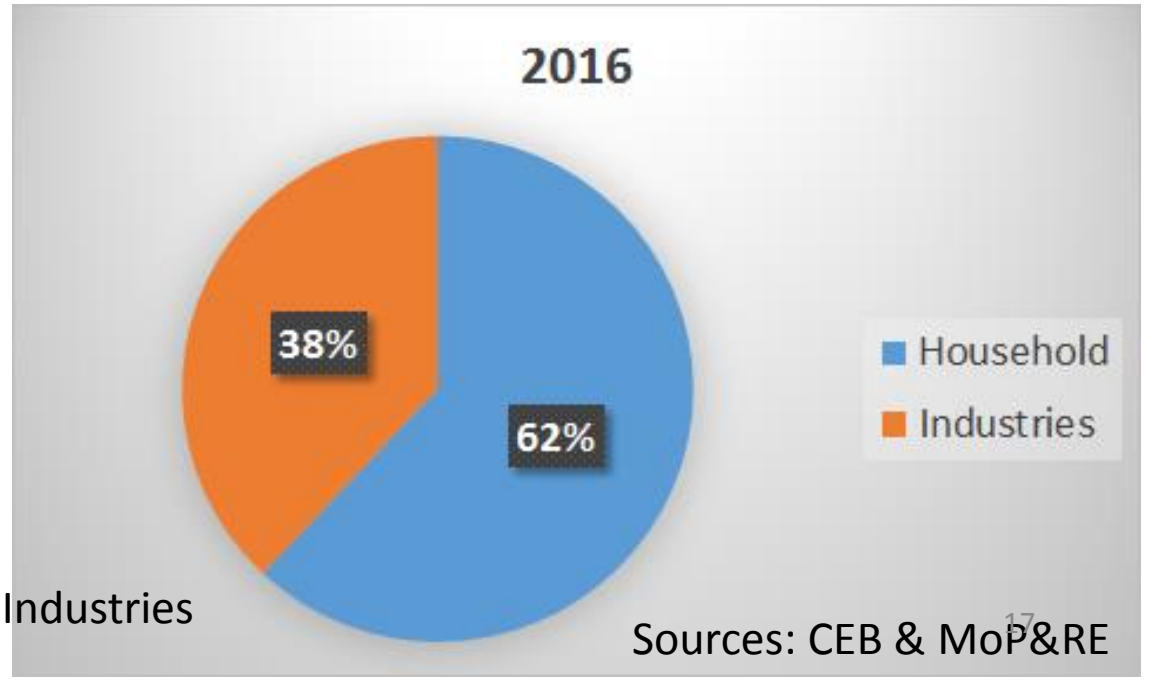
  - Clear Shift from Domestic to Industrial Sector
  - Compared to oil prices, distinct advantage to switch to Biomass





Biomass in Primary Energy



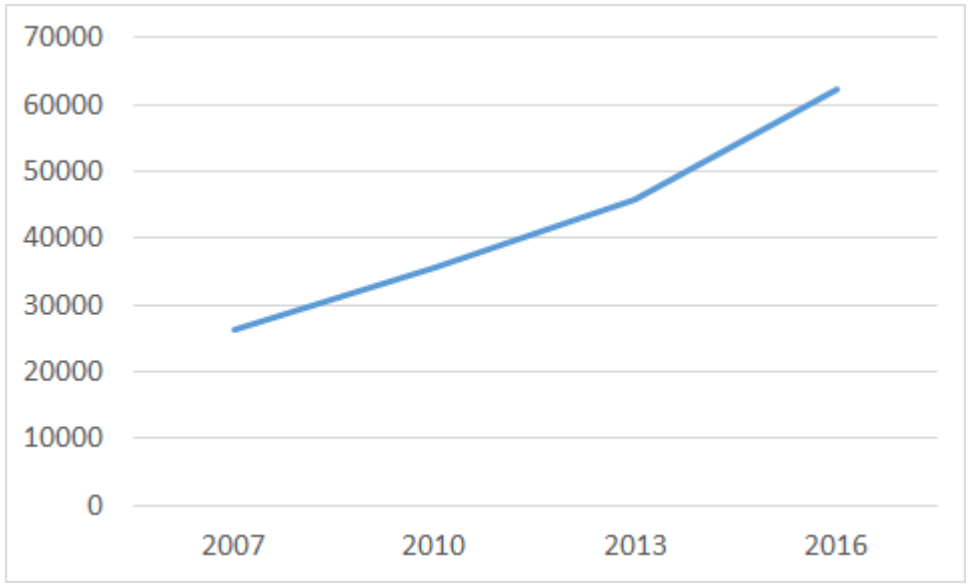


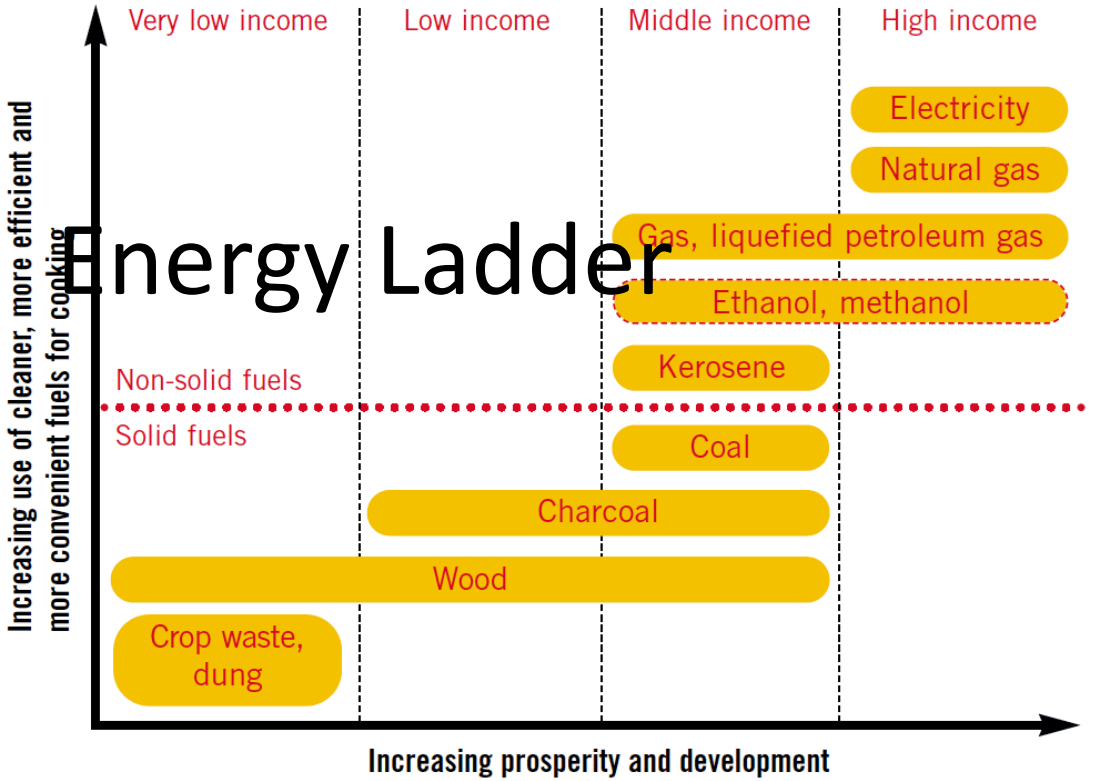
Biomass by Households and Industries

Sources: CEB & MoP&RE

No	Year	Average Annual Expenditure on Fuel & Lighting (LKR)	Average Expenditure on Fuel and Lighting (%)	Poverty Head Count (%)	Human Developmer Index (HDI)
1	1980 / 81	2,292	15.5	-	-
2	1985 / 86	3,243	13.0	-	-
3	1990 / 91	5,529	11.8	26.1	-
4	1995 / 96	7,752	9.9	28.8	0.653
5	2002	11,990	7.6	22.7	0.697
6	2005	16,087	7.0	-	0.718
7	2006/07	20,106	7.3	15.2	0.728
8	2009/10	26,694	7.1	8.9	0.744
9	2012/13	33,818	6.8	6.7	0.759

Musafer & Kularatne, 2018





Mean Monthly Household Income (LKR)	
2006/07	26,286
2009/10	35,495
2012/13	45,878
2016	62,237

CBSL-Different years

NATIONAL ENERGY POLICY - 2008

Energy for All
Energy Security
Energy Independence

- Dedicated energy plantations encouraged
- Biomass energy projects developed in areas where land resources are available
  - Enable new industrial activities
  - Emphasize creating rural income generation
- Commercial development of Biomass encouraged and facilitated
  - as a new rural industry
  - allowing rural poor to engage in fuelwool farming and
  - participate in the mainstream economic activity
  - by supplying electricity to urban load centres

Gazette of June 10, 2008

NATIONAL ENERGY POLICY (DRAFT)

2017 February Version

- SL elevated to an ‘energy empowered’ nation
- Align SL with Goal 7 of SDGs, achieve universal access to energy by 2020, a decade ahead
- 10 Principles - Energy Security, Services, Infrastructure, Self Reliance, Optimum Costs, Efficiency & Conversion, Share of RE, Environment, Governance, Innovation and Entrepreneurship

13th Amendment to Constitutions, Concurrent list (34), Alternative Energy not connected to the grid falls for Provincial Councils too

Southern Province has an Alternative Energy Statute

North-Western Province has a strong Environmental Statute

BIOMASS IN NATIONAL ENERGY POLICY (DRAFT)

- Biomass availability enhanced by dedicated energy plantations
- Commercial Biomass encouraged in industrial thermal applications and household use
- Processed biomass facilitated by efficient collection of existing resources, processing, value addition, storage and supply chains
- Promote Improved biomass conversion devices for household usage offering convenience
- Retain share of biomass for cooking preventing migration to commercial petroleum fuels

NATIONAL STANDARDS

Sustainably Produced Fuelwood - SLS 1551 : 2016

5 Principles, 11 Criterion, 42 Indicators

- Legal Compliance
- Environmental Values
- Community Benefits
- Group Support
- Chain of Custody

(Sirikumara, 2018)

2-Pot Clean Clay Cook Stoves
SLS 1475 : 2013

pinterest.com

SLS Specifications for Solid Biofuel
Logwood, Wood Chips, Saw dust (WiP)

FUELWOOD – LEGAL FRAMEWORK

Plantation

Harvesting

Transportation

Storing

villageofjustice.org

Define

- Trees
- Wood
- Fuelwood

<u>Fuelwood</u>

Type of wood is not prohibited

Less than 1m length

Diameter of either side less than 45cm

Timber Vs Fuelwood

Source: Weerasinghe, 2018

Note: Only an idea is given here. Please refer to proper legal documents for correct detailed information and interpretation

FINES AND IMPRISONMENTS

- Possessing illegally — Rs 10 k -100 k fine, upto 2 years prisonment
- Operating storage — Rs 10 k -100 k fine, upto 2 years prisonment
- Illegal transportation — Rs 20 k -200 k fine, upto 5 years prisonment
- Assisting, providing tools and vehicles — Rs 10 k – 100 k fine, upto 2 years prisonment
- Assisting — Similar to committing offence

copsplus.com

Source: Weerasinghe, 2018

Note: Only an idea is given here. Please refer to proper legal documents for correct detailed information and interpretation

LIMITATIONS AND FACILITATIONS

- Any tree not prohibited to plant can be planted for fuelwood
- Some need permits to fell / cut and to transport
- Some need environmental approval to fell / cut
- Any timber not claimed /proven assumed to be owned by state
- Transporting that require permits: 6.00 a.m. – 6.30 p.m.
- Certain types need permits in certain areas (districts, towns)

(Nilantha Kumara)

Source: Weerasinghe, 2018

Note: Only an idea is given here. Please refer to proper legal documents for correct detailed information and interpretation

PROSPECTS

- Improved Devices (Wood Gas Stoves)
- Supply Chains
- Price differentiation
- Commercial – Industry
- Labour Intensive – Mechanized
- Policy
- Climate Change
- Sustainability & SDG 7

Plenty Sunshine
Fertile Soil
Rainfall

If we want, we can make it !

REFERENCES

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- Central Bank of Sri Lanka (2018, other years)
- Musafer & Kularatne (2018)
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- Nandasena (2012)

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Photo Credits

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Thank You