Rice straw resources of Central and South America

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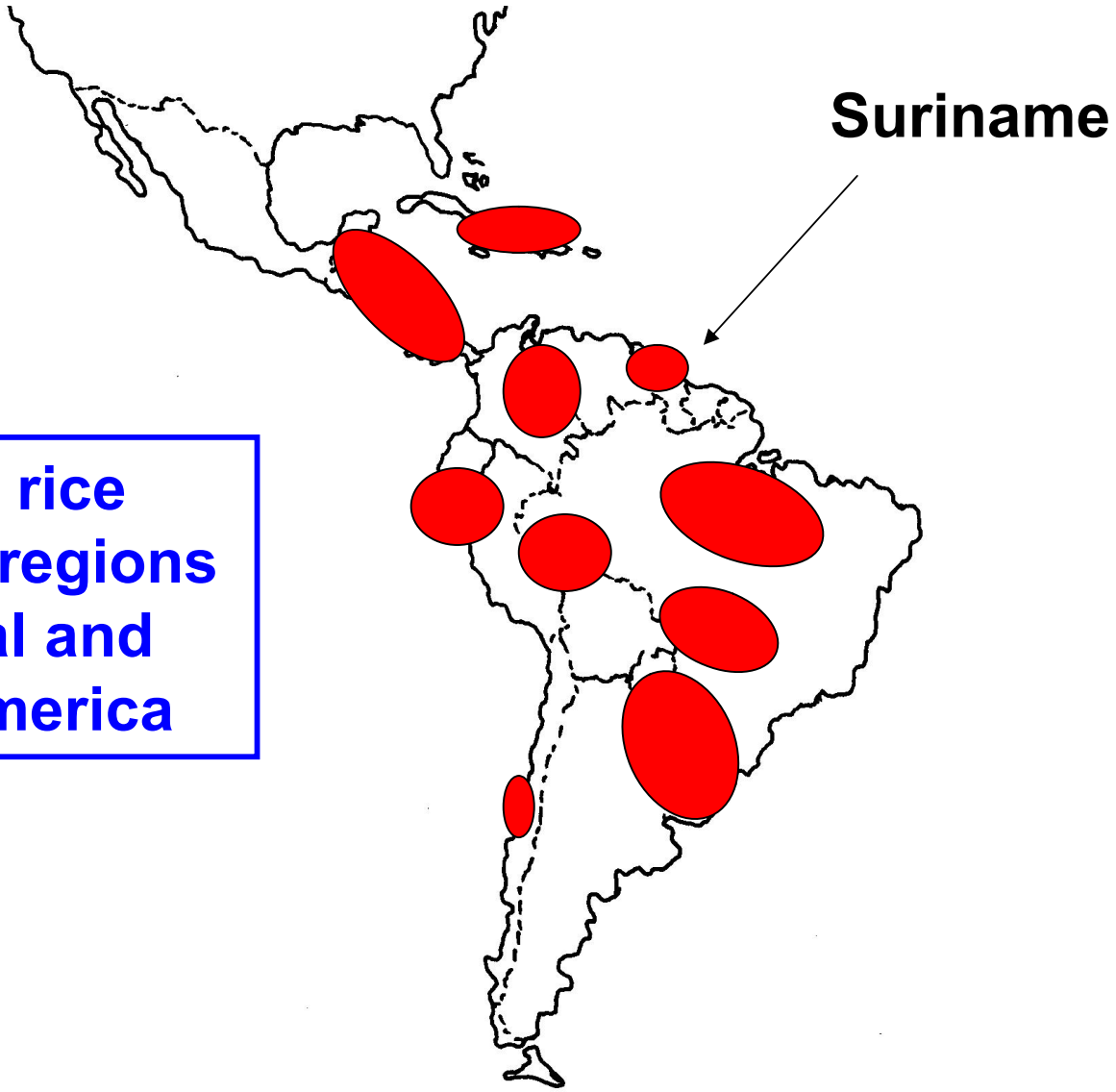
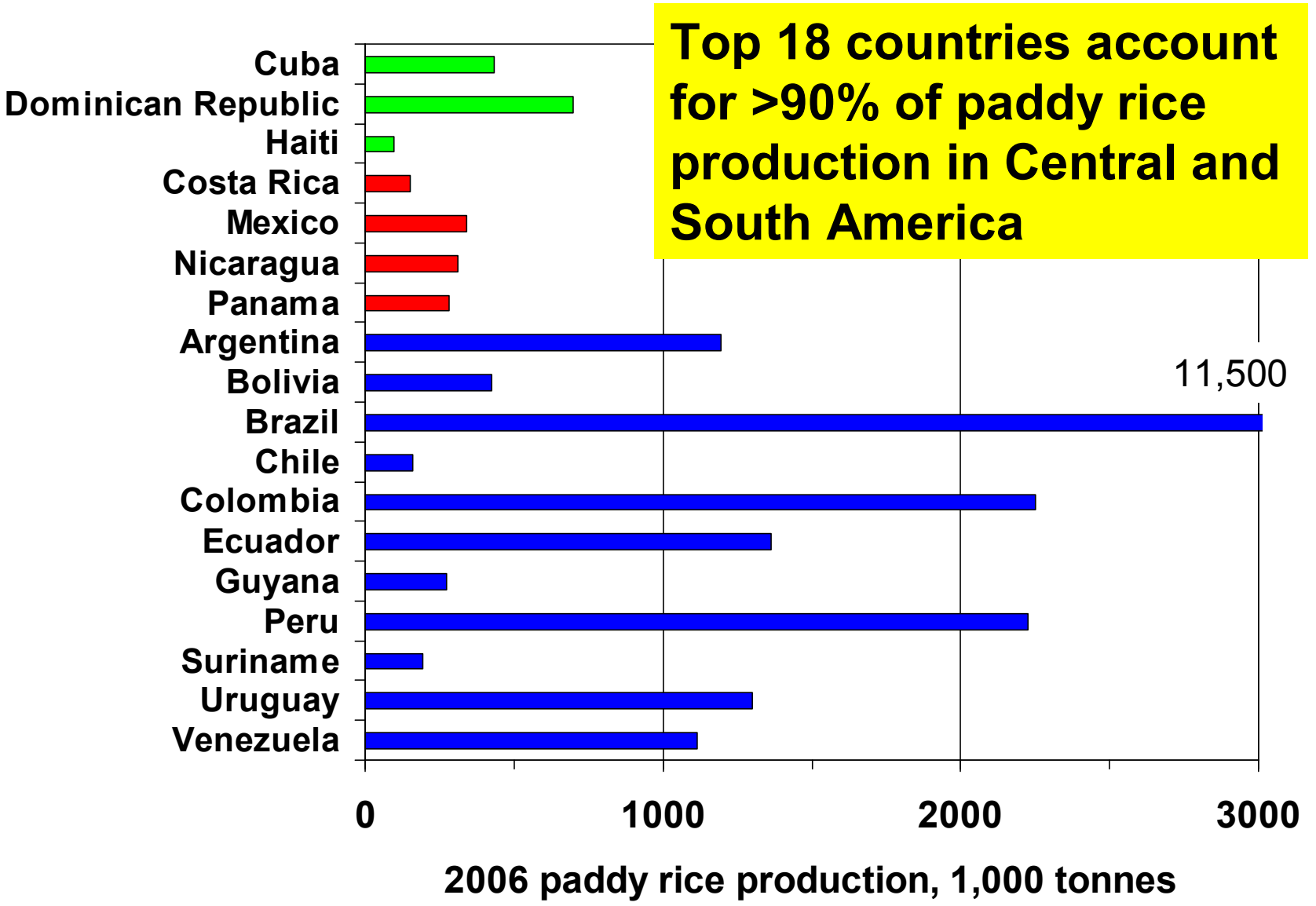
Rice is one of top cereal crops in the World today

- Staple for more than 200 million people in Central and South America.
- About 27 million tonnes produced annually in the region.
- Estimated 38 million tonnes of surplus rice straw.



Principal rice growing regions of Central and South America


Top 18 countries account for >90% of paddy rice production in Central and South America
Cuba
Dominican Republic
Haiti
Costa Rica
Mexico
Nicaragua
Panama
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
Guyana
Peru
Suriname
Uruguay
Venezuela
11,500
0
1000
2000
3000
2006 paddy rice production, 1,000 tonnes

Projected supply and value of rice straw

- **Potential straw pulp for paperboard production would be >19 million tonnes annually → *€10 billion* at ~€500 per tonne.**
- **Potential energy value of straw is nearly 600 million GJ →energy content could be valued at more than *€4 billion*, at ~€7 per GJ natural gas equivalent.**

Postharvest management of rice straw

- **Few industrial-scale economic uses of rice straw.**
- **Routine open-field burning of straw after harvest.**
- **Considerable air pollution….serious health hazard from air-borne carbon particulate matter and silica fume.**

Straw disposal is problematic everywhere

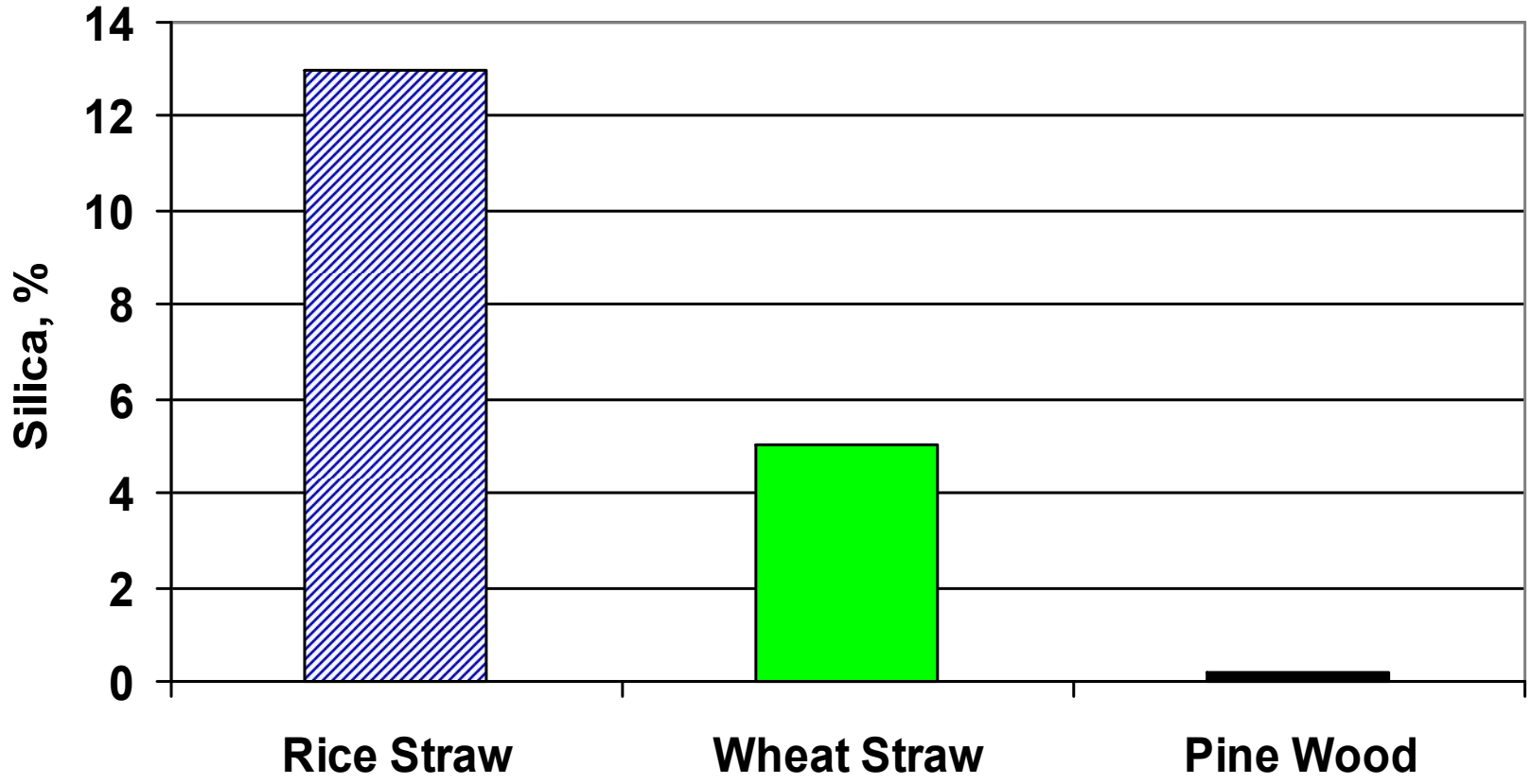
Open-field rice straw burning near Sueca (Valencia), Spain

Punjab rice straw burning

California rice straw burning

Why?

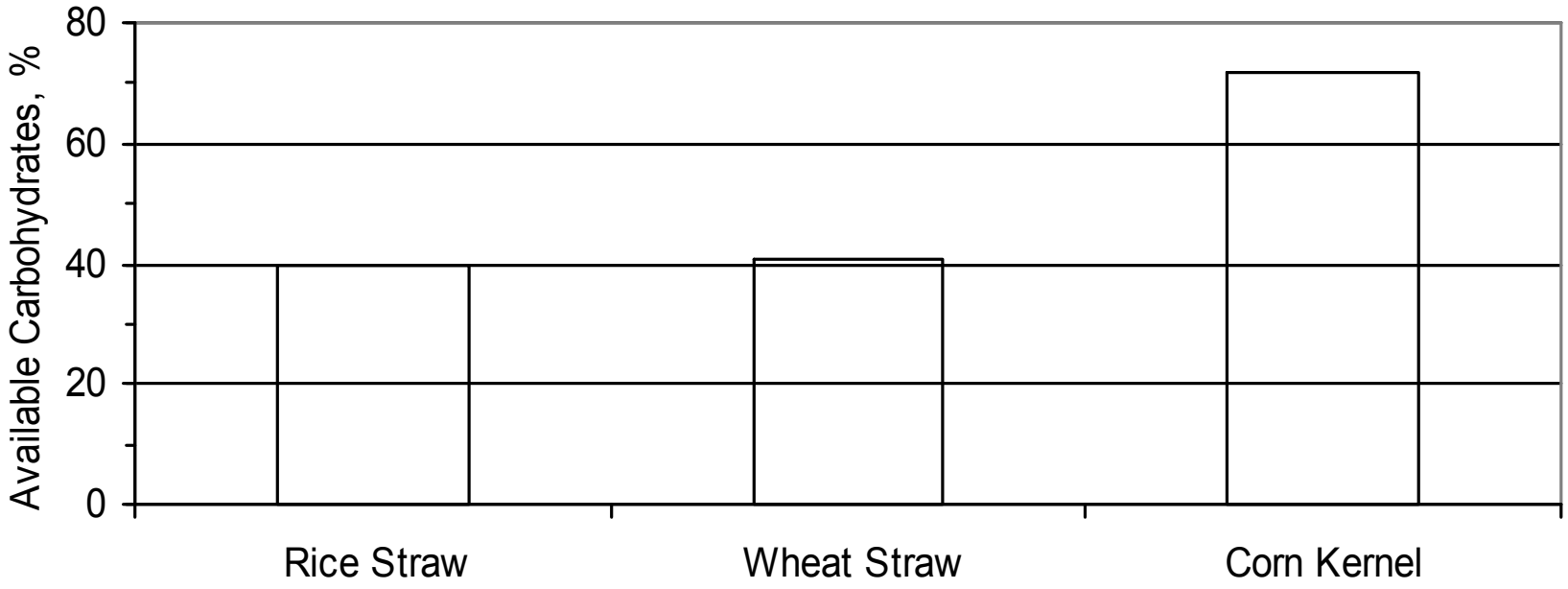
High silica (ash) content of rice straw is the most difficult problem to resolve



Rice straw is a possible fuel for industrial energy production

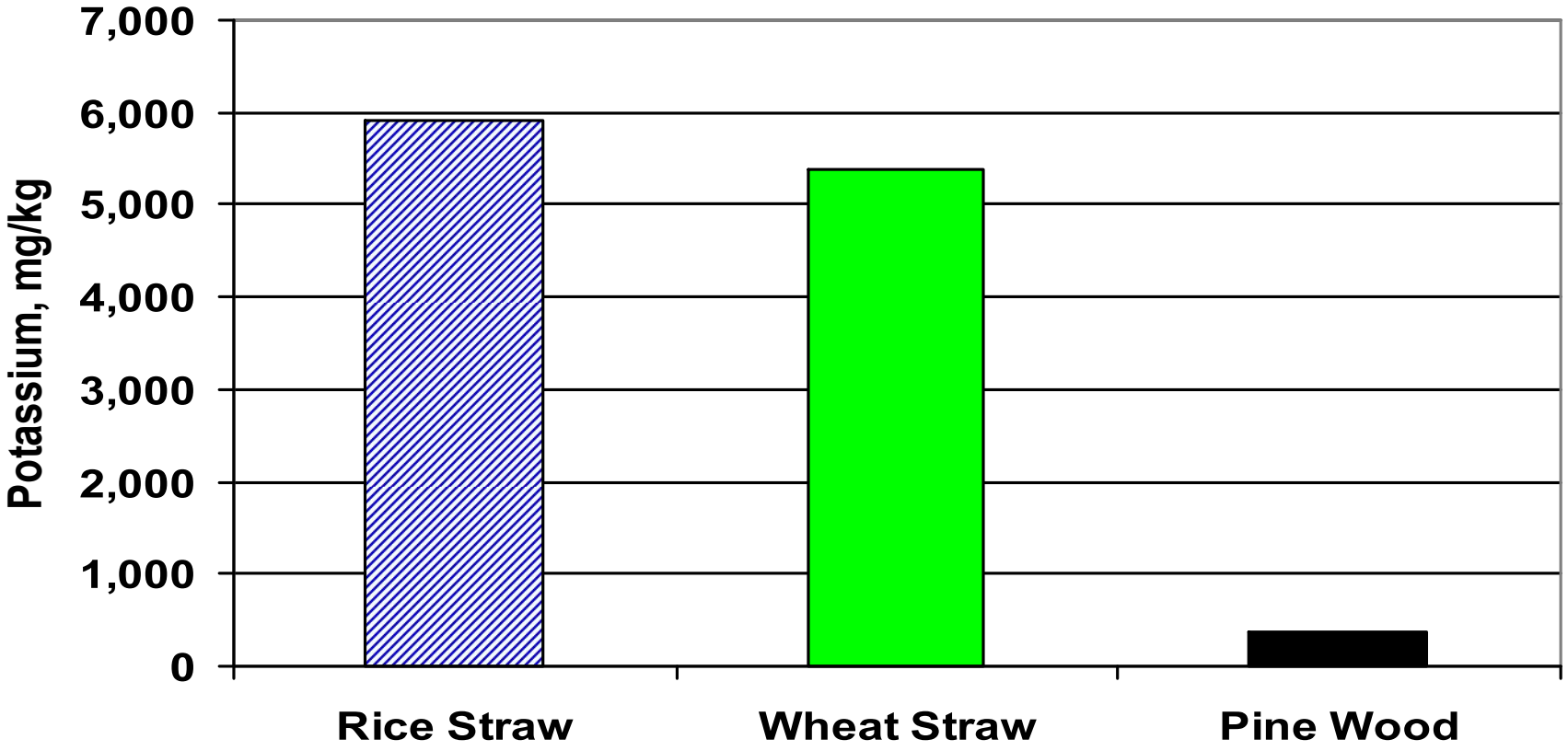
- The heating value of rice straw is 16 to 18 GJ per tonne (dry basis).
- The high ash content of rice straw may be difficult to manage efficiently……slagging in direct combustion
- Pre-conversion to anaerobic methane might be a practical means to circumvent the silica ash problem.

Rice straw is not an ideal feedstock for ethanol production



Example carbohydrate content in selected plant materials

High content of potassium in straw will cause problems in direct combustion and in conventional pulping operations!



Rice straw is not a ideal feed for livestock

Societal goals to consider in the large-scale utilization of surplus rice straw

- Export earning?
- Import substitution?
- Ecology?
- Community development?

Possible path forward

- **Deploy rice straw for the co-manufacture of energy and paper products…….Not necessarily for the export market**
- **Select technology which provides zero emission of effluent and solid wastes, and 100% energy self-sufficiency to operate a manufacturing enterprise.**

Product mix

- **Simplest…..steam de-structuring of straw fibre → molded fibre food-service containers.**
- **More complex……chemical pulping of straw and small amount of selected local vegetable fibres to produce unbleached pulp → production of paperboard for food packaging.**

Energy supply

- **Steam to power…….de-structuring of straw fibre → anaerobic digestion to form CH_4 → combustion of CH_4 to produce steam to generate power.**
- **Power to steam (where possible)… ……concentrated solar power-Stirling engine system to produce power → electrically-heated heat boiler to produce steam.**

Additional suggestions

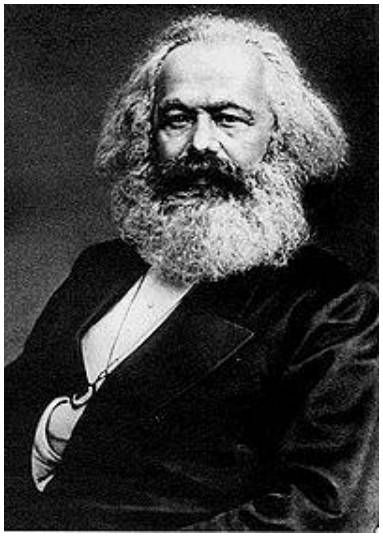
1. **Consider thoroughly *what*, *why* and *how* a new rice straw-based enterprise should be established, for benefits of the people of the communities.**
2. **Avoid the modality of colonial practice of exploiting "cheap labour and cheap land" for the export of raw materials or semi-finished goods to developed countries.**

Outlook

- **With very favourable climatic zones for agriculture, Latin America has considerable potentials for the development of natural fibre-based industries.**
- **Judicious deployment of technology for the processing of agricultural cropping residues (as well as specially cropped fibres) is a success factor.**

Suggested reading on social justice

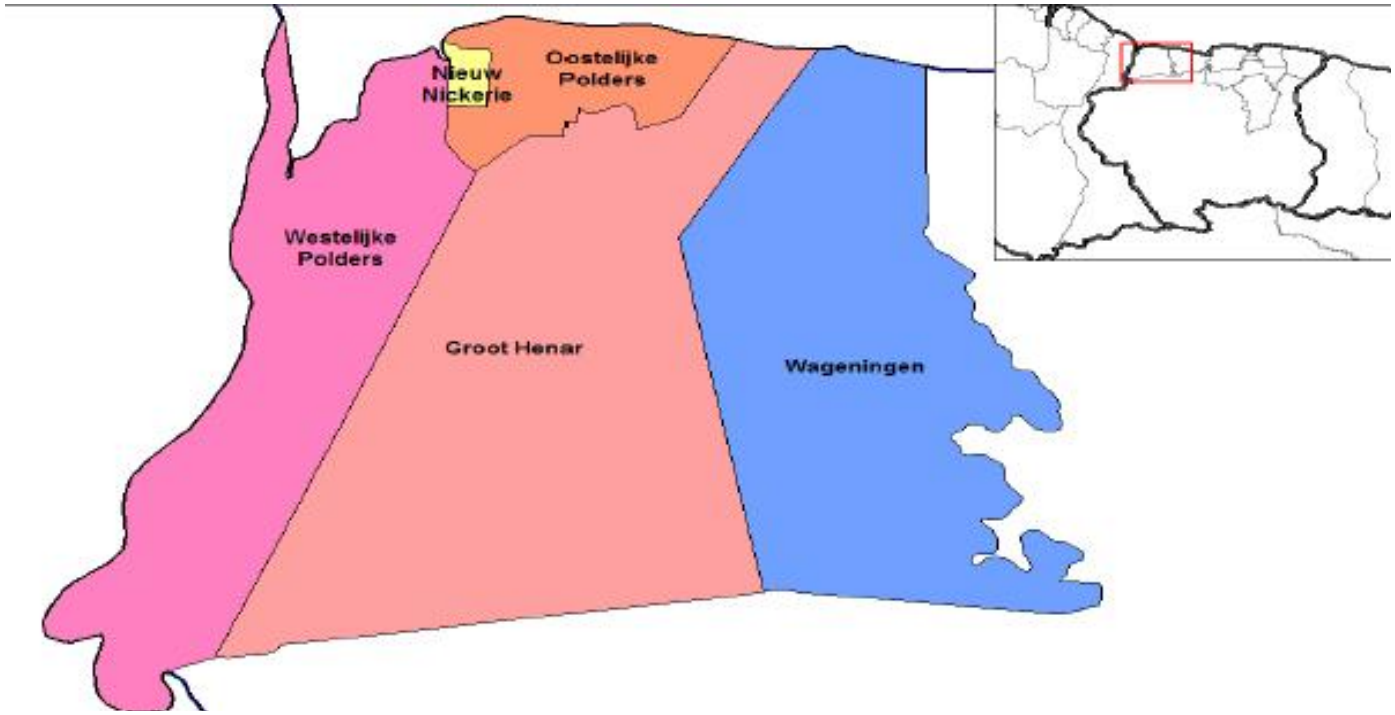
Friedrich Engels, “Die Lage der arbeitenden Klasse in England”, Leipzig,1845.



Friedrich Engels und Karl Marx, “Manifest der Kommunistischen Partei”, Leipzig,1848.

Suriname

Source: Shailesh Kisoensingh, Daood Hussainali and Sulaika Khedoe, 2011.



Source: Shailesh Kisoensingh, Daood Hussainali and Sulaika Khedoe, 2011.

Suriname rice sector

- **96% in Nickerie = 46,000 hectares (of which 27,000 hectares as "small farms").**
- **About 110,000 tonnes of rice straw at estimated 2.4 tonnes straw per hectare.**
- **75% of 37,000 Nickerie workers in the "rice sector"**

Source: Shailesh Kisoensingh, Daood Hussainali and Sulaika Khedoe, 2011.

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