What is the Best Use of Sustainable and Available Biomass in several ASEAN countries

What is Biomass?

"The biodegradable fraction of products, waste and residues of biological origin from agriculture (including vegetal and animal substances), forestry, and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste (including municipal solid waste)".

(Adapted from European Commission Agriculture and Rural Development, 2010)

"Biomass is organic material that comes from plants and animals, and it is a renewable source of energy)".

(www.eia.gov)

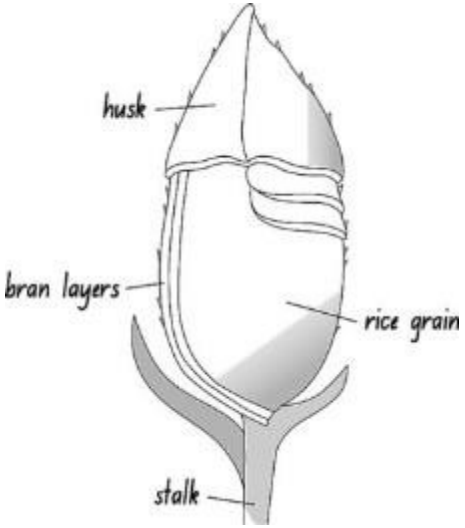
Agri-Residues and By-Products

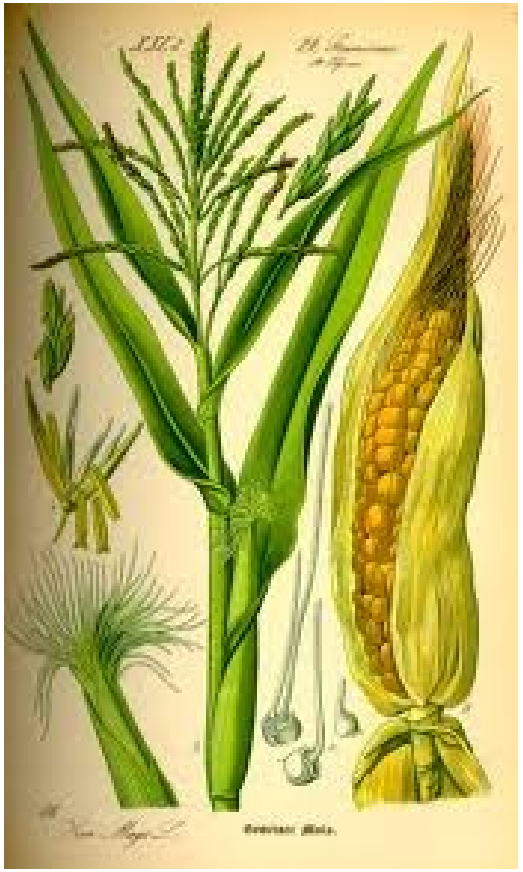
- *Agri-residues are the parts of the crop or animal that are not the main purpose of growing the plant or keeping the animal.*

- *The agricultural operation would **not** occur **only** to produce the agri-residue.*

- *Most agri-residues are by-products that have an existing use.*

Category of agri-residues






FarSide of Fifty

Residue-Product Ratio (RPR)

- The amount of residue (air dried weight) relative to the main product (grain, corn seed, tuber, sugar cane juice extract, etc.)

$$\text{RPR} = {}^{Residue\ mass}/_{product\ mass}$$

- Since many crops have more than a single residue, there is a separate RPR for each residue type.

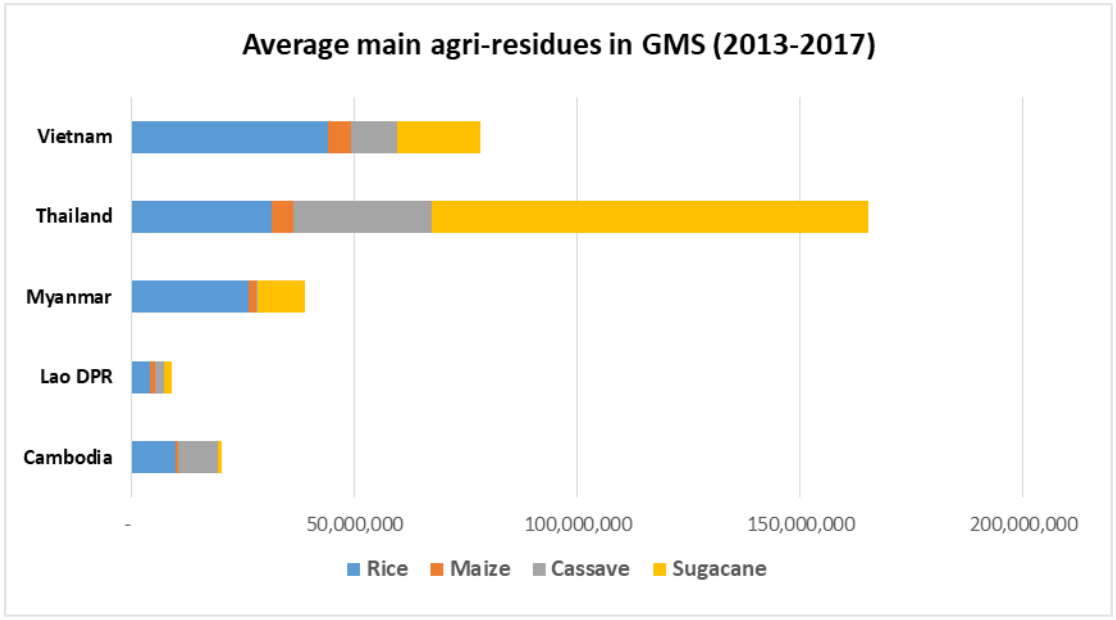
Residue-Product Ratio (RPR)

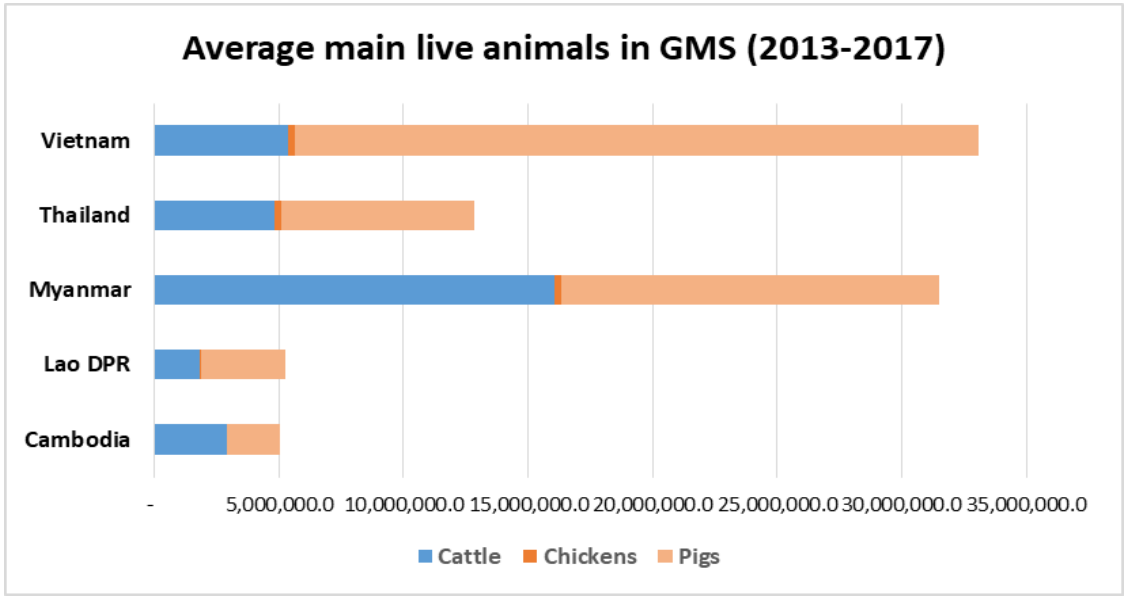
Variable	Country	Value
RPR - Husk	Cambodia	0.240
	Lao DPR	0.200
	Myanmar	0.240
	Thailand	0.230
	Vietnam	0.225
RPR - Rice Straw	Cambodia	1.222
	Lao DPR	1.000
	Myanmar	1.222
	Thailand	0.447
	Vietnam	1.000
RPR - Bran/Mash	Cambodia	0.110
	Lao DPR	0.110
	Myanmar	0.110
	Thailand	0.075
	Vietnam	0.075

Variable		Country	Value
RPR - maize	Stalks	All	2
	Cob	All	0.273
	Husks	All	0.2
RPR - Stalks		All	0.062
RPR-Sugarcane	Tops	All	0.3
	Bagasse	All	0.29

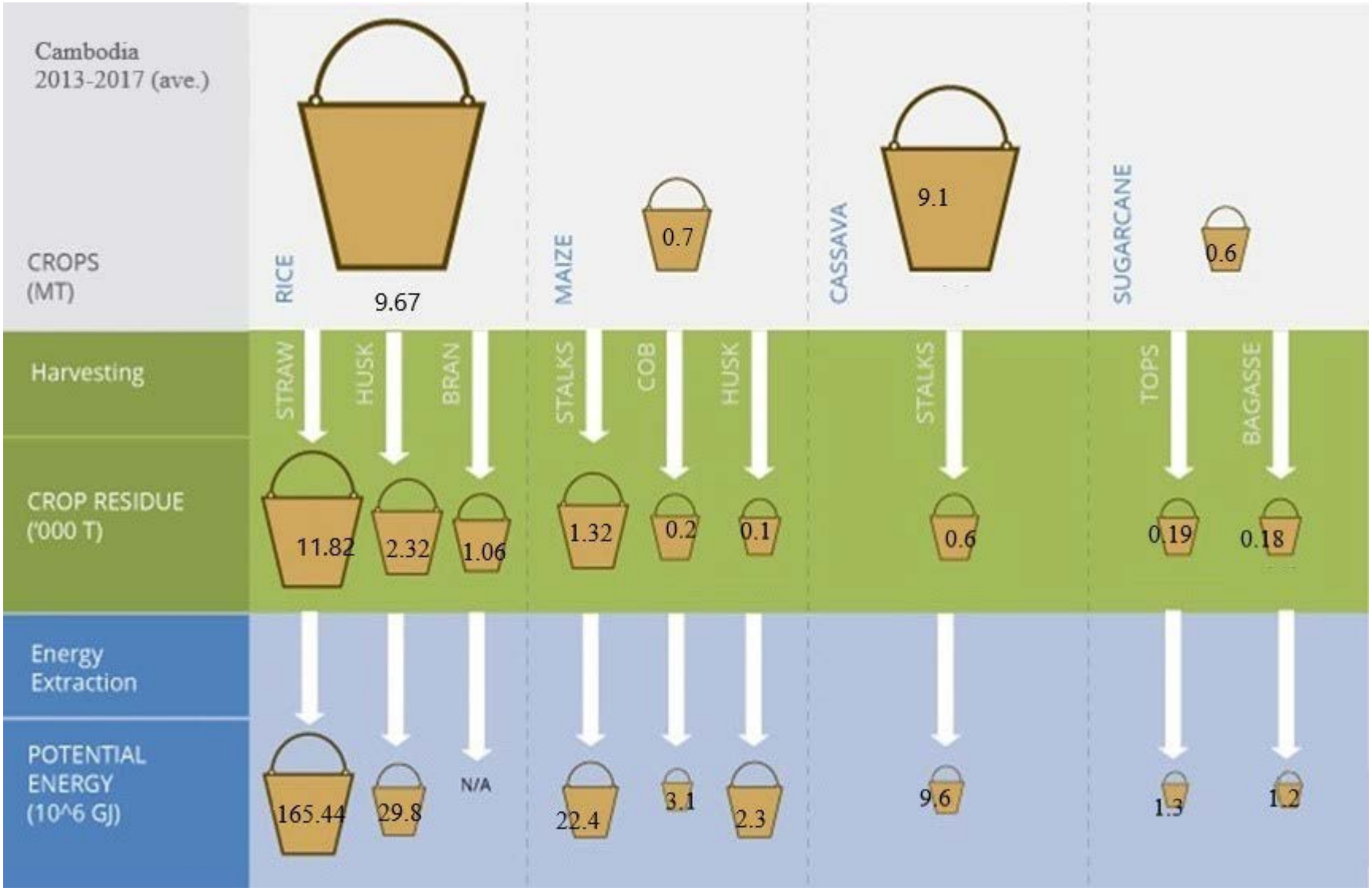
Country	Manure/head of…(kg/head/day)		
	Cattle	Pig	Chicken
Cambodia	8.0	2.0	0.08
Lao DPR	8.0	2.0	0.08
Myanmar	8.0	2.0	0.02
Thailand	5.0	2.0	0.03
Vietnam	10.0	2.5	0.2

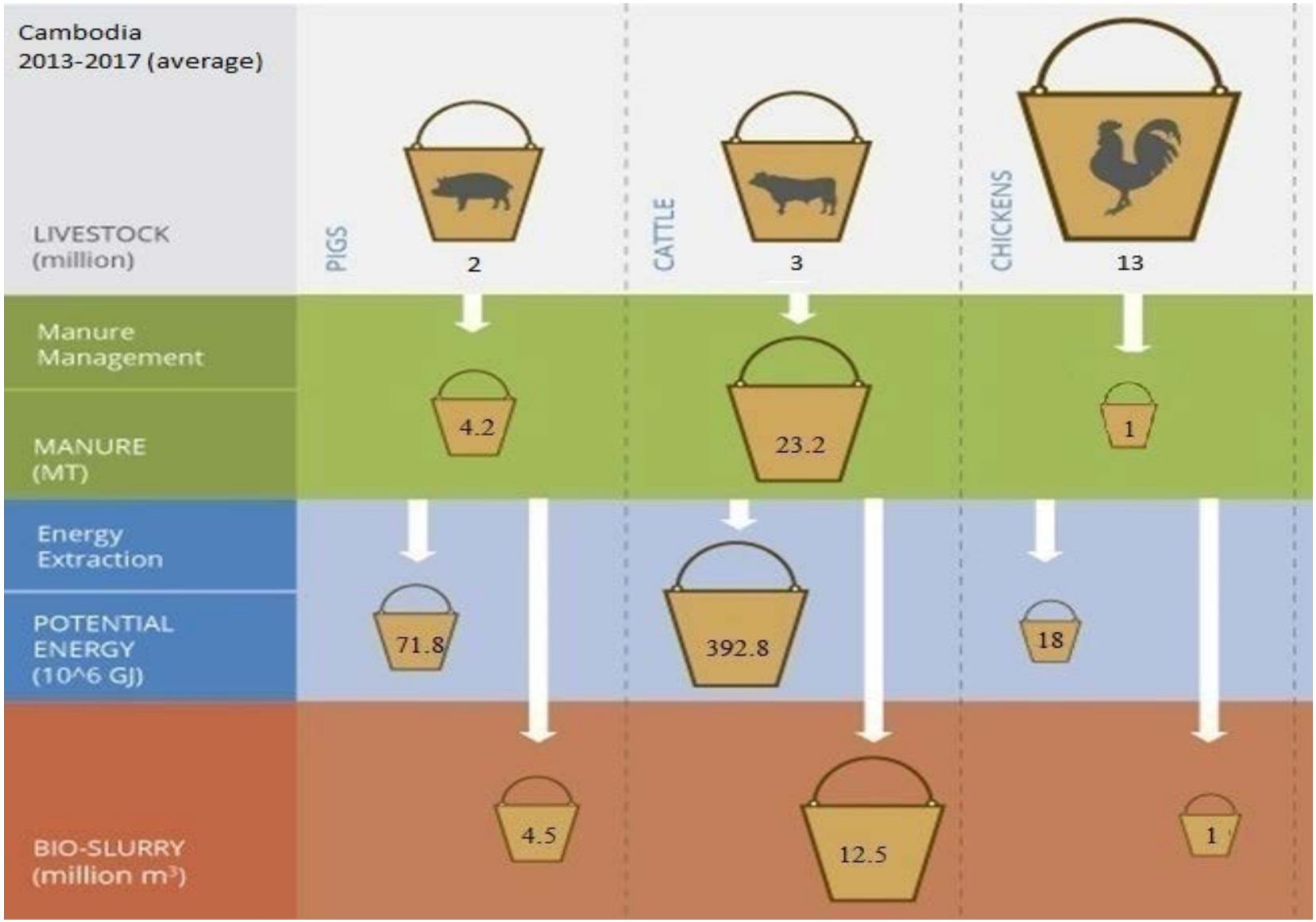
Average main agri. production (2013-2017)

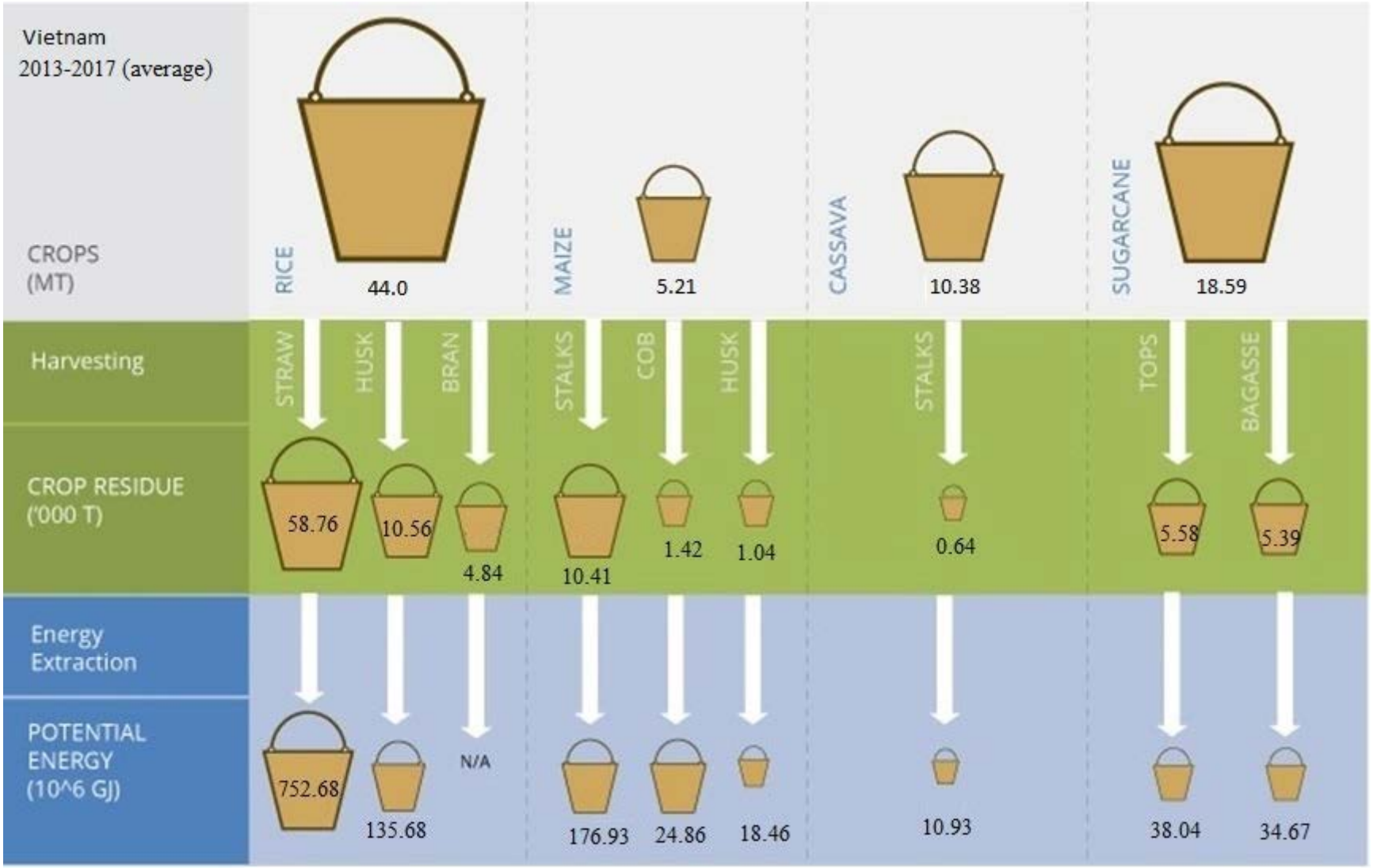


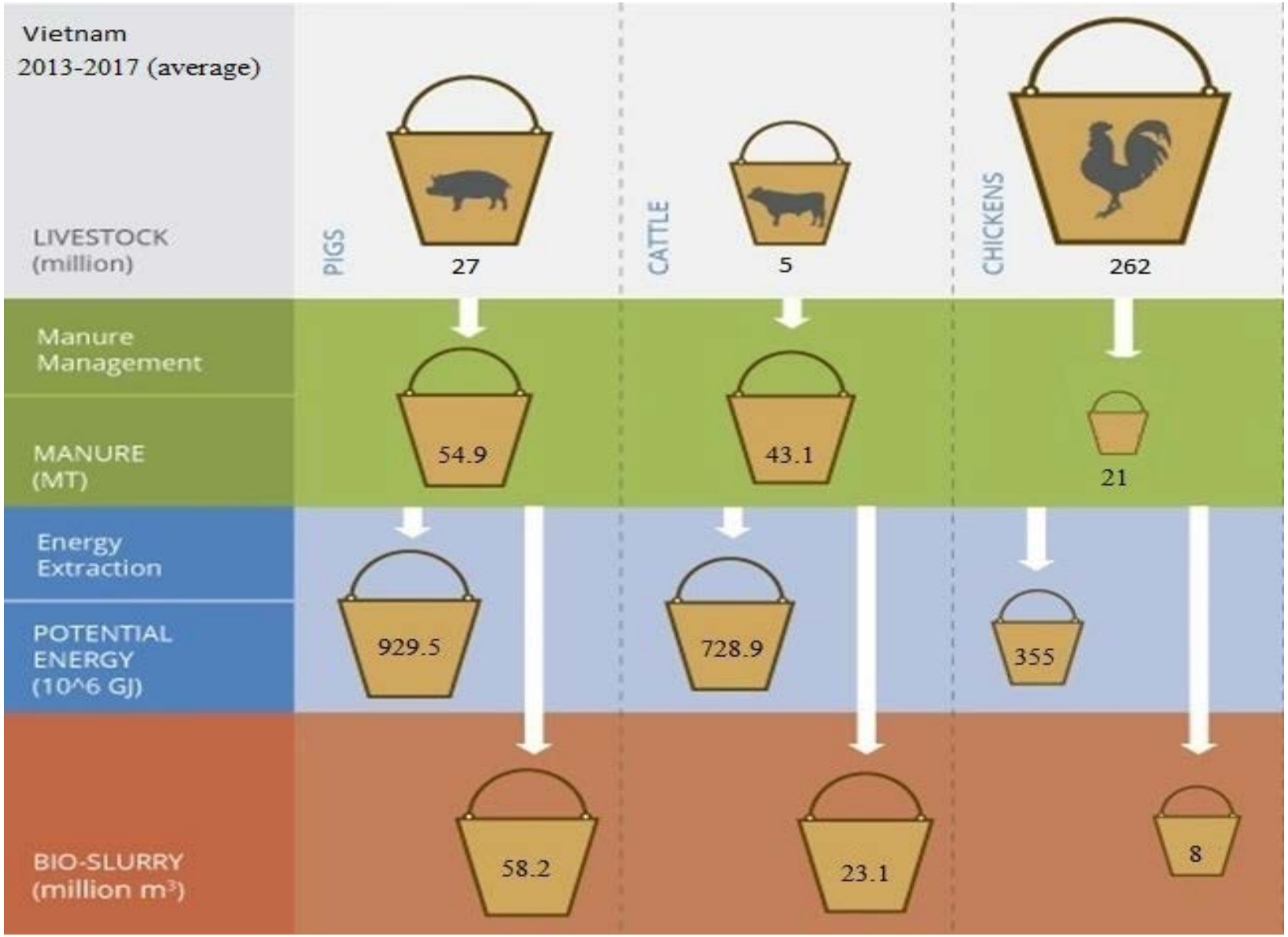


Source: http://www.fao.org/faostat/en/#data/QC


Cambodia
2013-2017 (ave.)
CROPS
(MT)
RICE
9.67
MAIZE
0.7
CASSAVA
9.1
SUGARCANE
0.6
Harvesting
STRAW
HUSK
BRAN
STALKS
COB
HUSK
STALKS
TOPS
BAGASSE
CROP RESIDUE
('000 T)
11.82
2.32
1.06
1.32
0.2
0.1
0.6
0.19
0.18
Energy
Extraction
POTENTIAL
ENERGY
(10^6 GJ)
165.44
29.8
N/A
22.4
3.1
2.3
9.6
1.3
1.2


Cambodia
2013-2017 (average)
LIVESTOCK
(million)
PIGS
2
CATTLE
3
CHICKENS
13
Manure
Management
MANURE
(MT)
4.2
23.2
1
Energy
Extraction
POTENTIAL
ENERGY
(10^6 GJ)
71.8
392.8
18
BIO-SLURRY
(million m3)
4.5
12.5
1

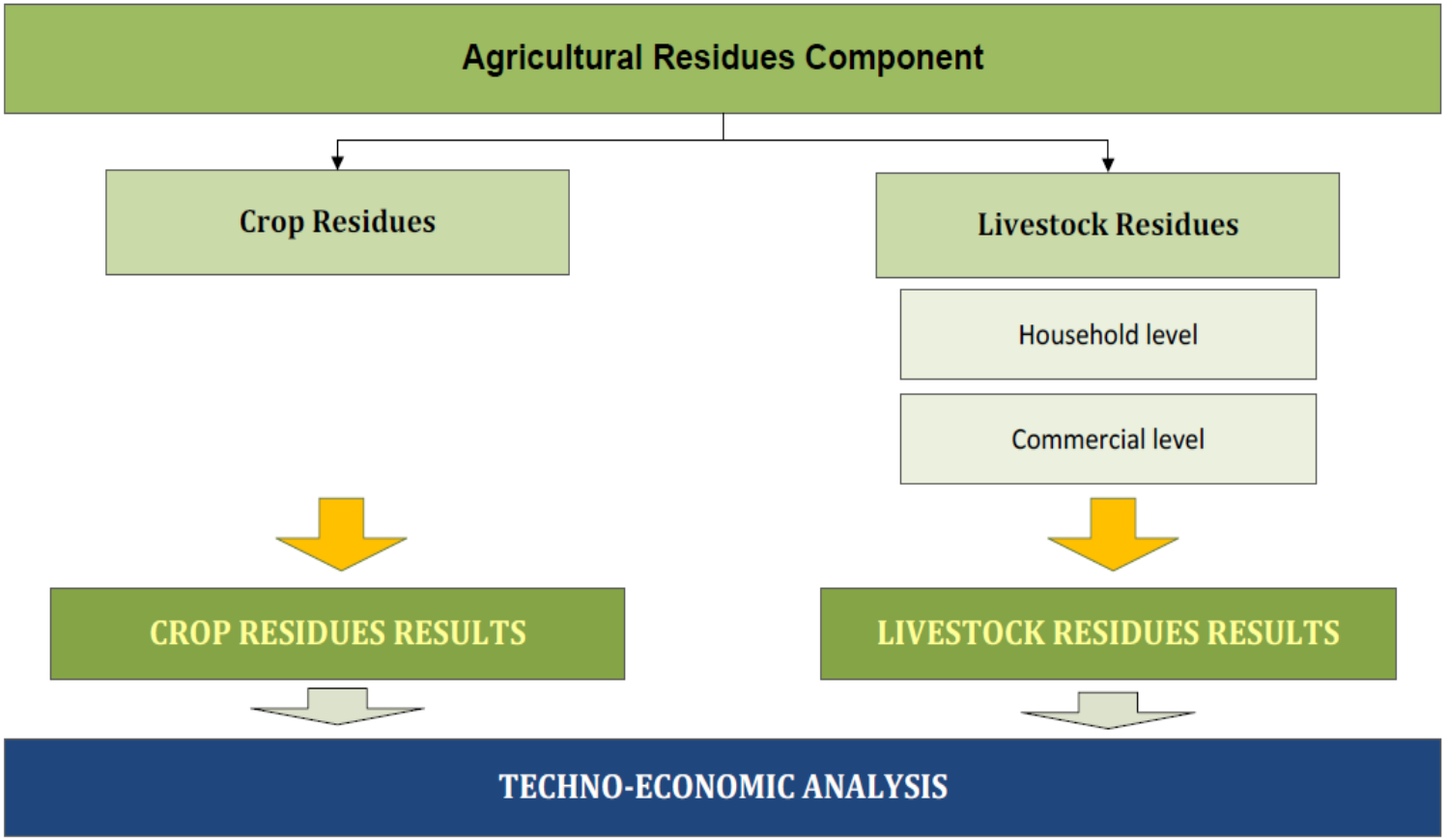

Vietnam
2013-2017 (average)
CROPS
(MT)
RICE
44.0
MAIZE
5.21
CASSAVA
10.38
SUGARCANE
18.59
Harvesting
STRAW
HUSK
BRAN
STALKS
COB
HUSK
STALKS
TOPS
BAGASSE
CROP RESIDUE
('000 T)
58.76
10.56
4.84
10.41
1.42
1.04
0.64
5.58
5.39
Energy
Extraction
POTENTIAL
ENERGY
(10^6 GJ)
752.68
135.68
N/A
176.93
24.86
18.46
10.93
38.04
34.67


Vietnam
2013-2017 (average)
LIVESTOCK (million)
PIGS
27
CATTLE
5
CHICKENS
262
Manure Management
MANURE (MT)
54.9
43.1
21
Energy Extraction
POTENTIAL ENERGY (10^6 GJ)
929.5
728.9
355
BIO-SLURRY (million m³)
58.2
23.1
8

Existing Uses of Agri-Residues

- Animal feed (husks, straw, cobs, stalks, bran)
- Human food supply chain (e.g. rice bran)
- Animal bedding (straws and husks)
- Fuel (straw, cobs, husk, bagasse, manure)
- Soil fertilizer (manure, compost, char)
- Soil conditioner (fumigated rice husks)
- Specialized uses (insulator, building materials, water treatment, absorbent)

Defining ‘Best Use’



Defining 'Best Use'

Topics to consider	Indicators	Analytical and Data Needs
Economics	Cost-benefit analysis; internal rates of return; return on investment	Capex, opex, risk contingency; discount rate; private v. public investment
Climate change & carbon emissions	Life-Cycle Assessment (LCA); adaptive capacity	Cradle-to-grave data needs
Energy - heat, power (electricity)	Demand analysis; energy balance (> LCA)	Energy inputs, outputs, energy ratio
Soil health	pH, erosion rates, SOC/SOM, nutrients, leaching, microbiology	Multiple
Other environmental, health & safety issues	Clean-burn, Particulates, Standard Operating Procedures, hydrology	As required
Acceptability	Feedback from targeted users	Surveys, interviews, focus groups

Conclusion: Integrated Assessment

- Trade-offs inevitable between objectives (because of different definitions of ‘best use of biomass’ and ‘best for who?’)
- Climate change / carbon, versus other ecosystems services, versus sustainable soils and agricultural livelihoods, versus private return on investment, versus the public good …….
- Good quality data allows trade-offs to be made clear between intended users, investors and policy makers
- Semi-quantitative methods like multi-criteria decision mapping useful to show and compare different options

What are we trying to achieve?

- Policy intervention to find right balance between competing public and private interests
- Policy ‘sticks’ (regulation) and ‘carrots’ (incentives)
- But also ‘nudging along’ – reducing compliance and transaction costs
- Making it easier for private sector and individuals to comply
- Requires creative and courageous thinking on the part of policy makers to design instruments for promoting ecosystem service and public good benefits

THANK YOU FOR YOUR ATTENTION