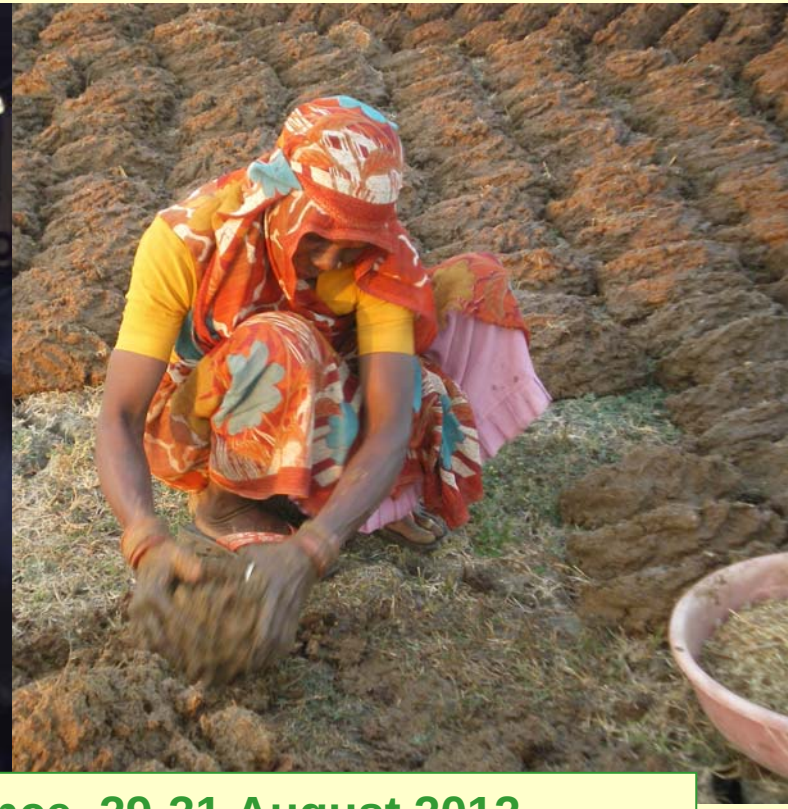
Economics of Cow Dung

a commercialized VC with a huge Green Jobs potential



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Presentation structure

1. Why the number matters
2. Why creating 2 million GJs is possible
3. How the analysis was conducted
4. Why energy policy is an employment policy
5. Why 2 million GJs are not yet there
6. What's next

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Highlights of the ILO study (forthcoming)

The dung economy in India supports

- Presently: Approx. 1.5 million jobs

  Many not decent jobs

- Potentially: **2.0 million additional Green (and decent) Jobs** can be created

  – if right policy choices are made
  – if transformation is managed with care

… larger than total RE jobs of any single country/union

TECHNOLOGIES	Global	China	India	Brazil	USA	EU[7]	Germany	Spain	Others
	Thousand jobs								
Biomass[1]	750	266	58		152	273	51	14	2[8]
Biofuels	1,500			889[6]	47–160	151	23	2	194[9]
Biogas	230	90	85			53	51	1.4	
Geothermal[1]	90				10	53	14	0.6	
Hydropower (Small[2])	40		12		8	16	7	1.6	1[8]
Solar PV	820[4]	300[5]	112		82	268	111	28	60[10]
CSP	40				9		2	24	
Solar Heating/ Cooling	900	800	41		9	50	12	10	1[8]
Wind Power	670[4]	150	42	14	75	253	101	55	33[11]
Total[3]	**5,000**	**1,606**	**350**	**889**	**392–505**	**1,117**	**372**	**137**	**291**

Source) REN21 (2012) with inputs from the IRENA and the ILO Green Jobs Programme

… comparable to the size of large public employment prog

- South Africa's Expanded Public Works Programme (EPWP) has created one million work opportunities over five years. EPWP Phase II (2009-2014) sought to create two million full time equivalent jobs.
- To respond to the financial crisis of early 2000, Argentina implemented the Plan Jefes y Jefas de Hogar (Jefes), providing job opportunities to 2 million unemployed heads of household in 2003.

→ But jobs created are temporal.

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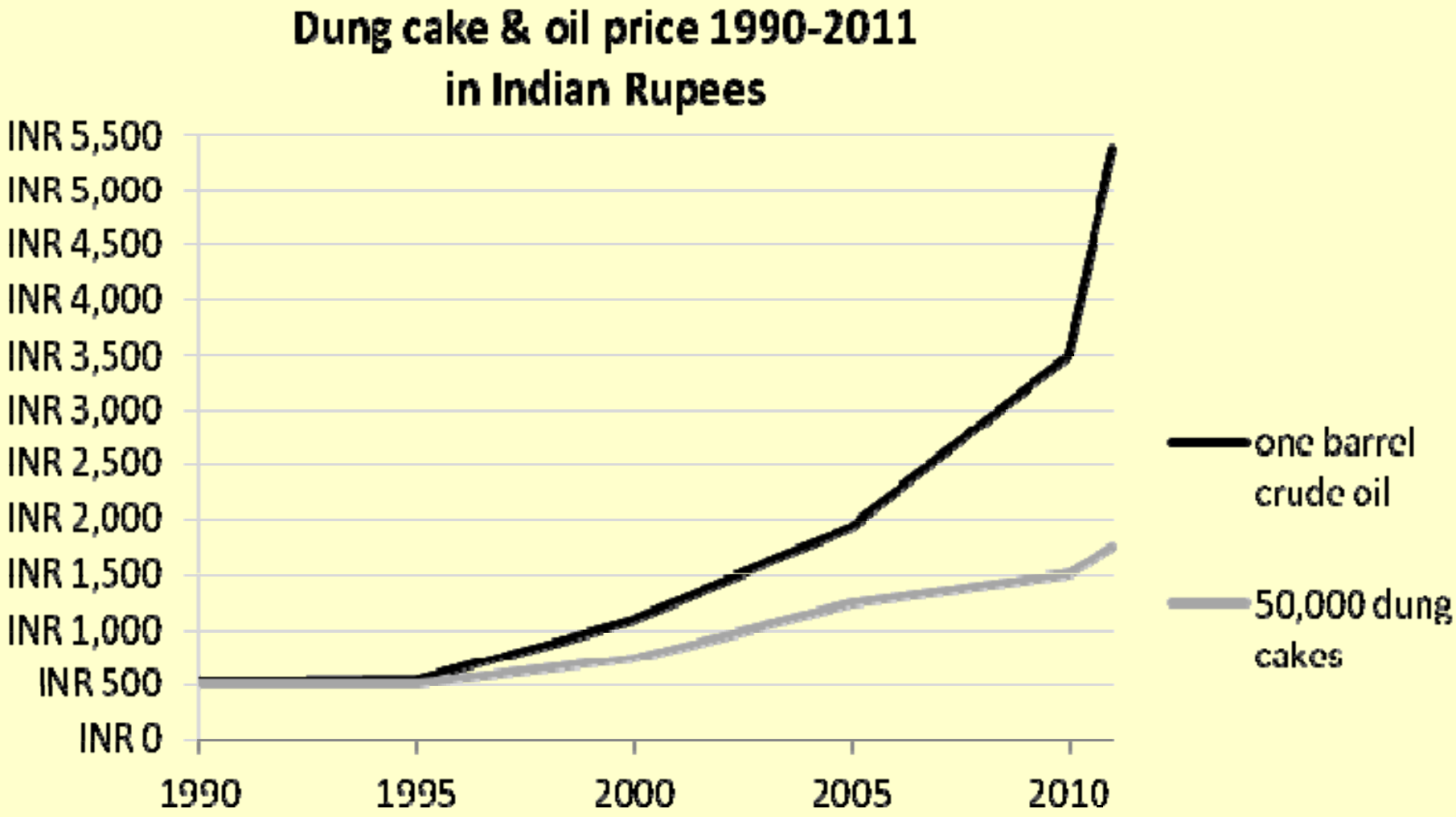
A buffalo produces 3 ℓ oil/day

15 ℓ milk

30 kg dung
= 3 ℓ oil

Rising oil price reveals dung value



Source) ILO (forthcoming) Economics of Cow Dung

Commercialized Dung Value Chain

Dung cake making

Dung clearn up and collection

Lease his land to a middleman

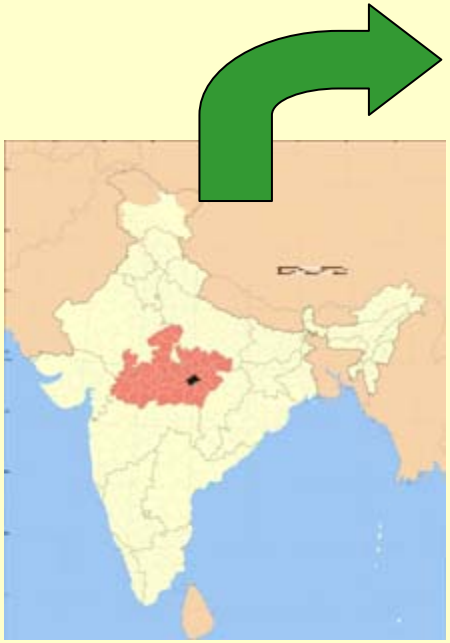
Hire labour

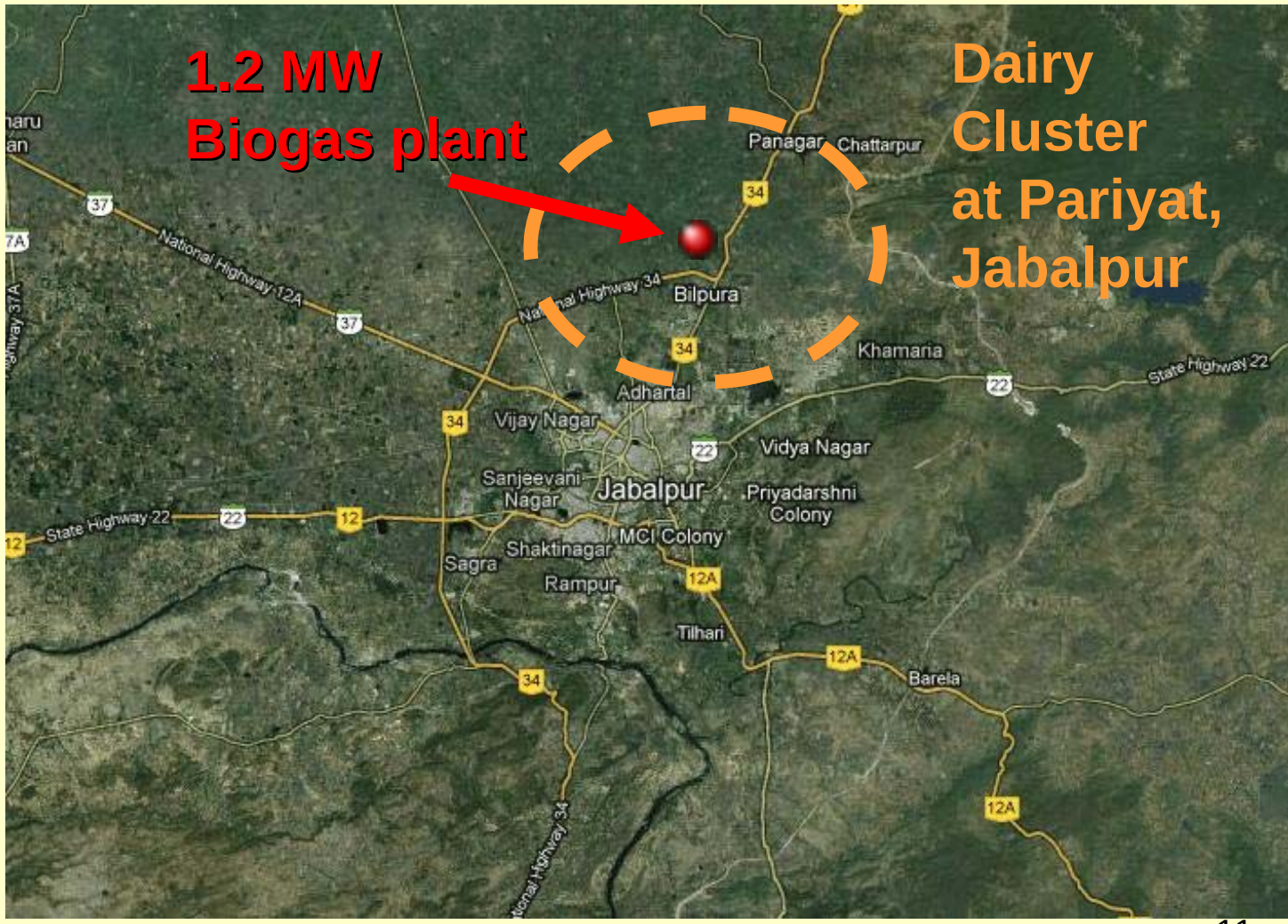
Contract with dairy farms

Dung Contractor

Sell to brick kilns

Jabalpur urban dairy cluster location



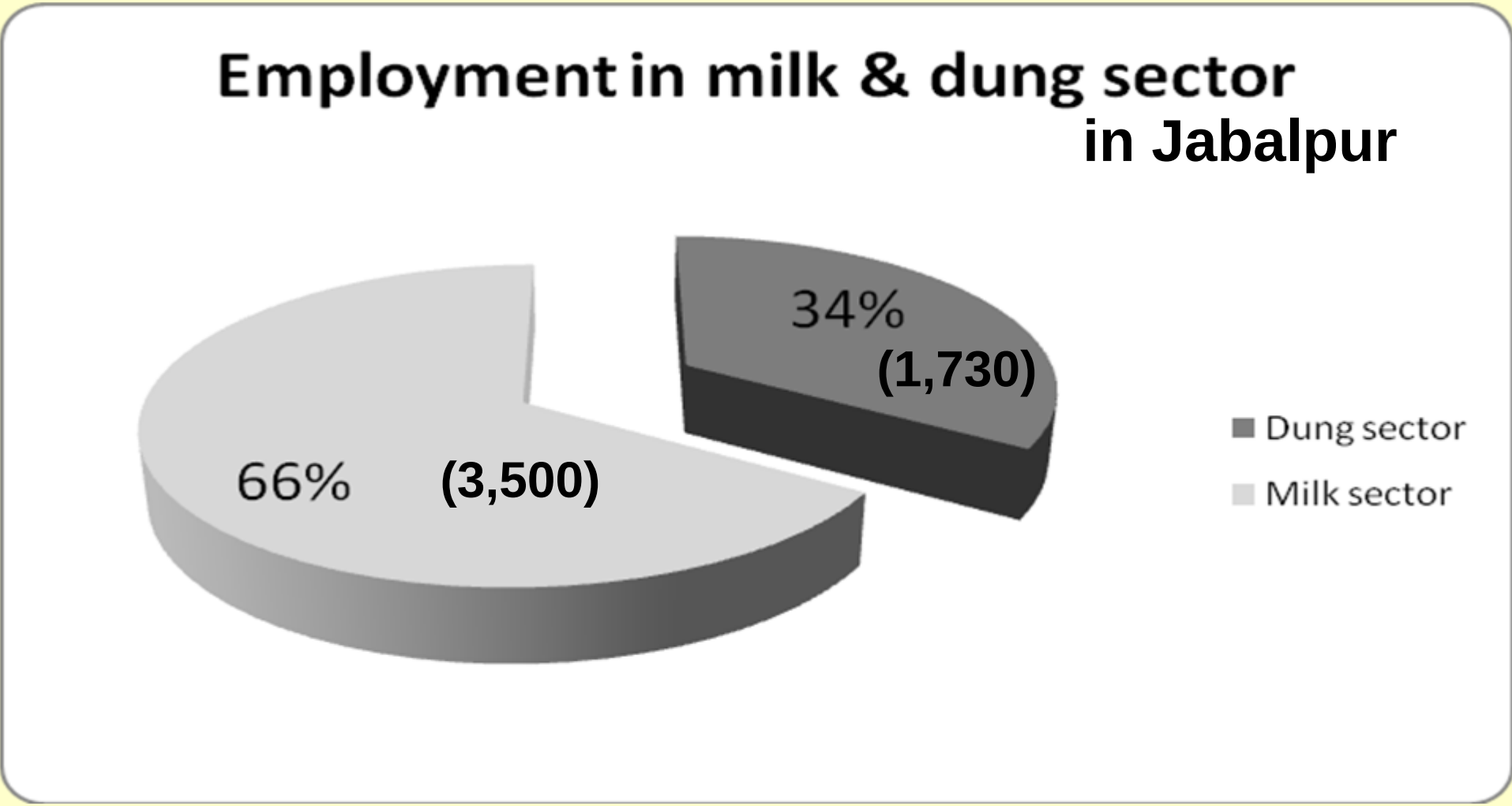


Individual vs. contractor model

Contractors lease their own land
or get a plot of dairy farm for dung cake making

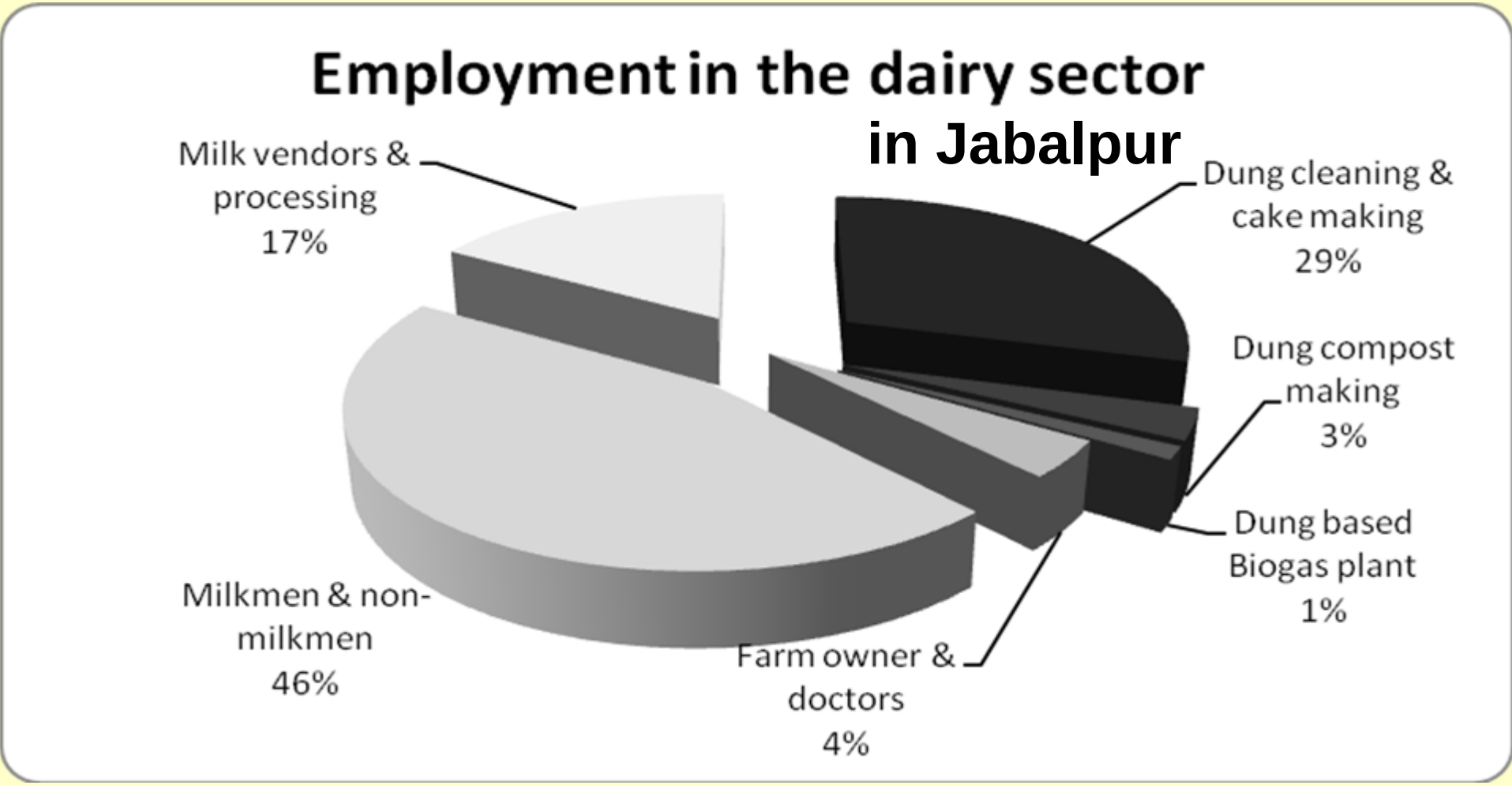
Individuals without extra plots of land use road side for dung cake making

1/3 of dairy jobs are in the dung sector



Source) ILO estimates

Composition of jobs in the dairy sector



Source) ILO estimates

Important facts & assumptions in calculating current employment

- Commercially usable dung comes from (confined) animal feeding operations (AFO and CFAO) in the urban/peri-urban dairy clusters. 100% of buffalo population and 25% of cattle and mixed breed fall under this category.
- Dung of a Cow is 10 kg/day, a Calf 5 kg/day and a Buffalo 15 kg/day.
- 50 % of dung not used in a productive way.

National dimension of present employment in the dung sector

Type of Jobs in dung sector	Estimation based on Jabalpur cluster
Cleaners and collectors	950,000 (1.9 m half time jobs)
Dung cake makers	400,000
Compost makers	41,000
Transport & management	37,000
Small biogas construction	85,000
Total	**1,513 million**

Suggested changes in the dung VC

X Dung cake making

→ Biogas electricity generator

100% dung clean up and collection

Milk processing & chilling

Sell electricity to grid

Vermin compost making

Growing market of organic farming

Analysis & dialogue to adjust energy pricing policies

Formalization of workers; OSH guidelines

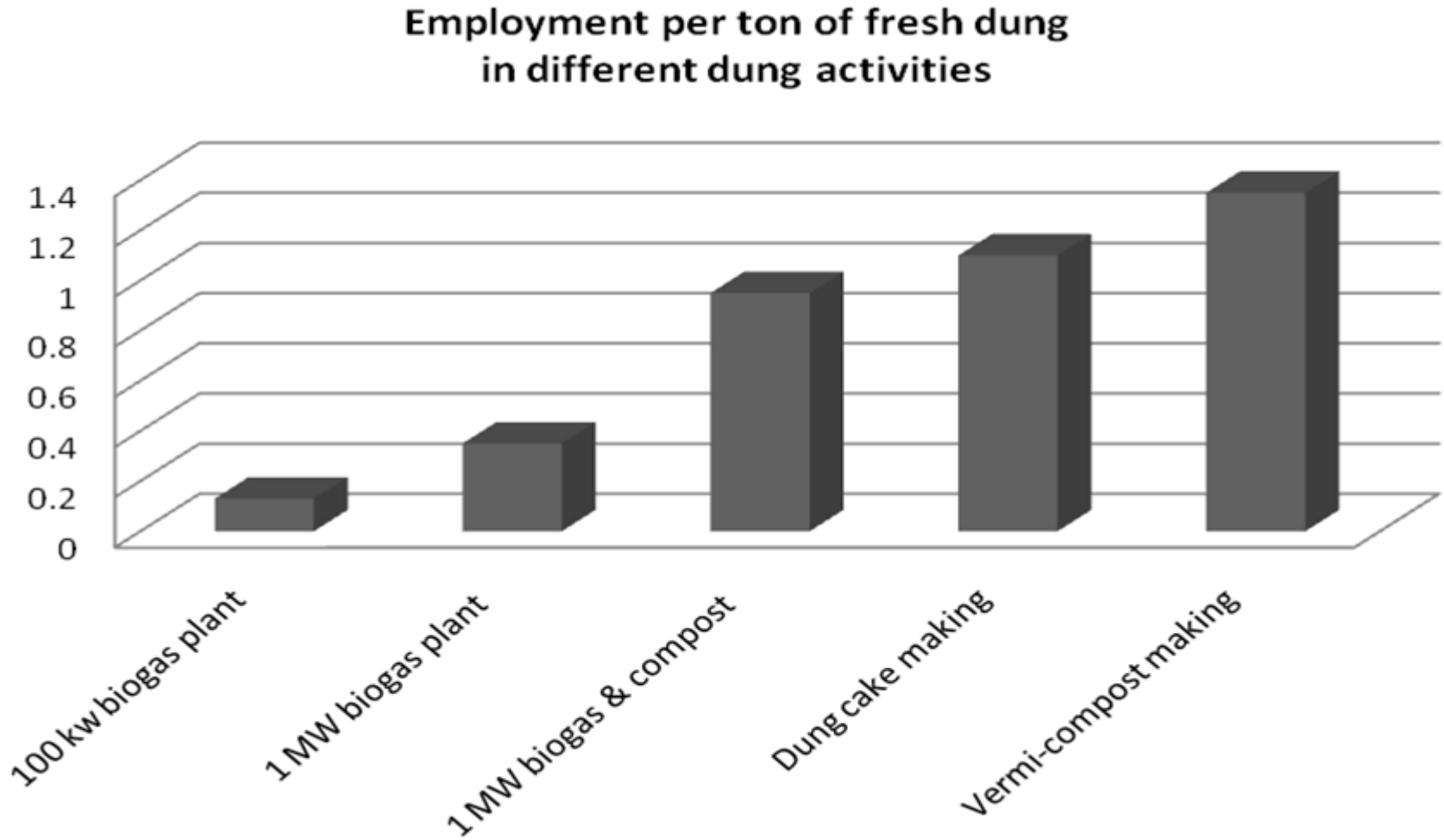
ALMP

Interventions

Employment impact of full productive use of dung

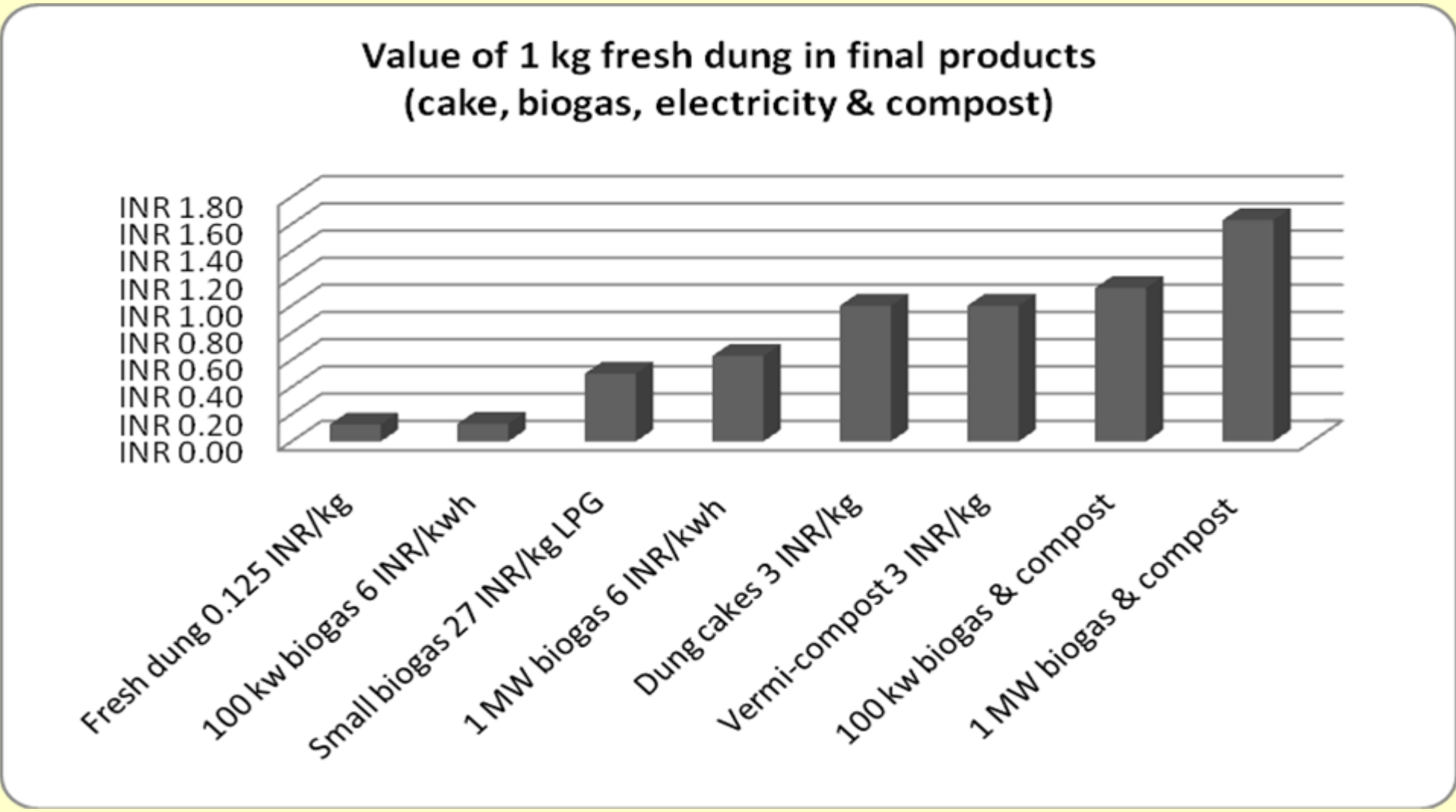
Potential Green Jobs creation	Estimation
Dung collectors and cleaners for additional 660,000 tons	1.24 million
Transport & dung management in urban clusters for additional 660,000 tons	55,000
Electricity plants of 1MW x 5000 incl. fertilizer production from slurry	950,000
Construction and maintenance of additional 10 million small biogas plants	140,000
Total	2.385 million
Jobs lost in dung cake making	-400,000
Total net employment gain	**1.985 million**

RE may not be labour intensive but part of the VC can be



Source) ILO calculation

Biogas + compost will make more value than dung cake



Source) ILO calculation

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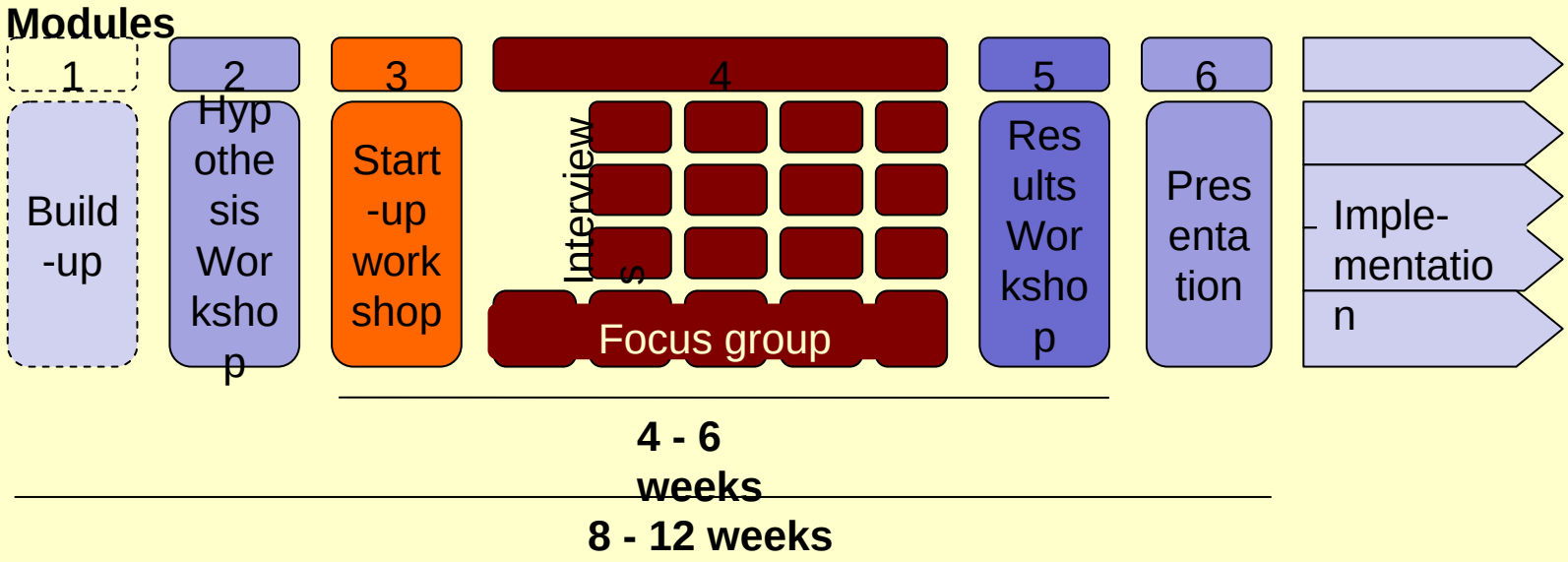
Summary of how we did it

1. Map VC and system
2. Count jobs and extrapolate
3. Identify bottlenecks and ways to address them

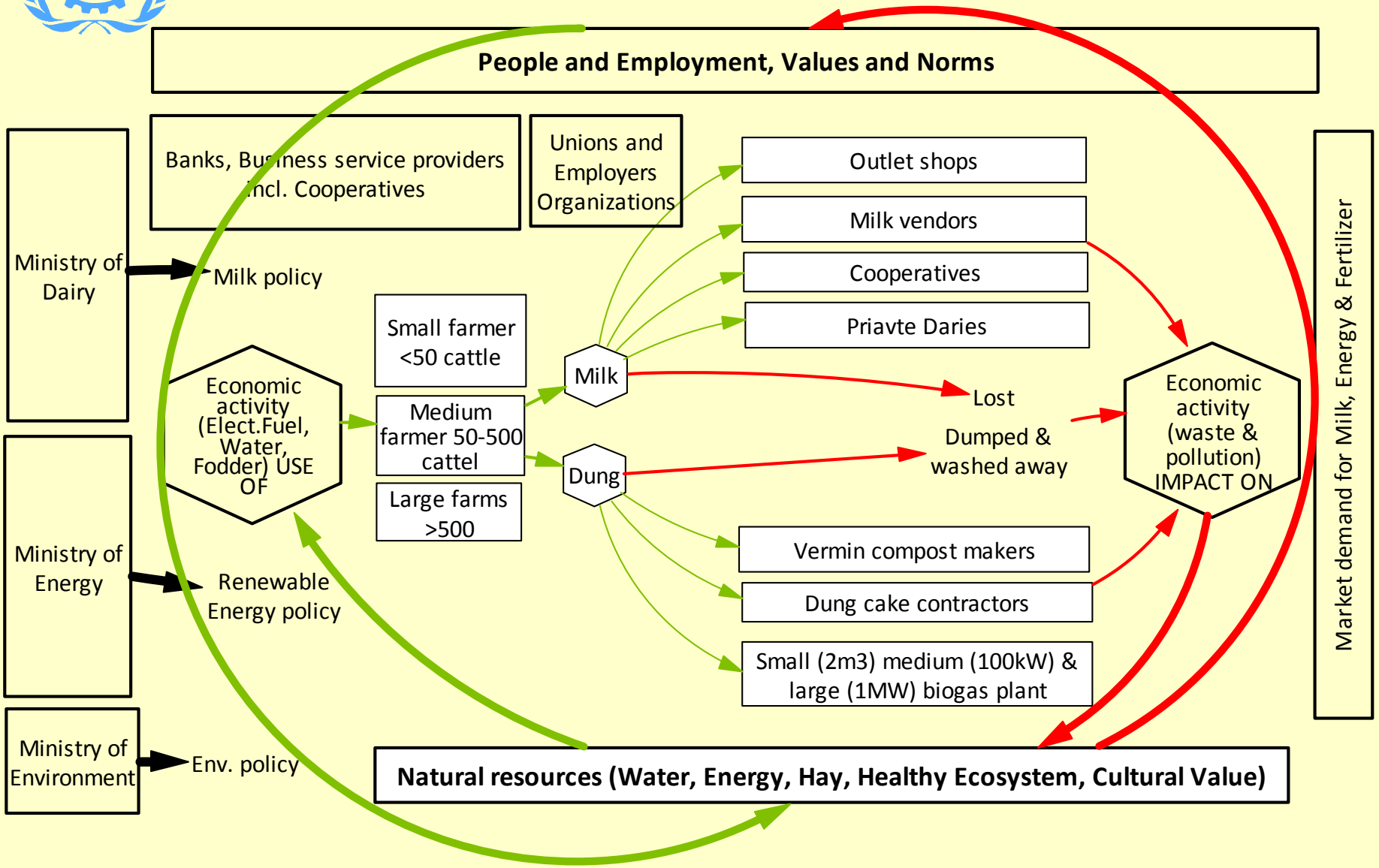
IMPORTANT: RE market is policy- and subsidy-driven. "Commercialization" approach for massive replication of key technologies (to boost GJs) would rely on the level playing field and political decisions.

ILO's VCD process made green

- Structured participatory diagnosis and action planning
- VC steering committee by local stakeholders
- Put the circular/recycling channel and policy elements as part of the analysis



Value chain map w/ feedback loops



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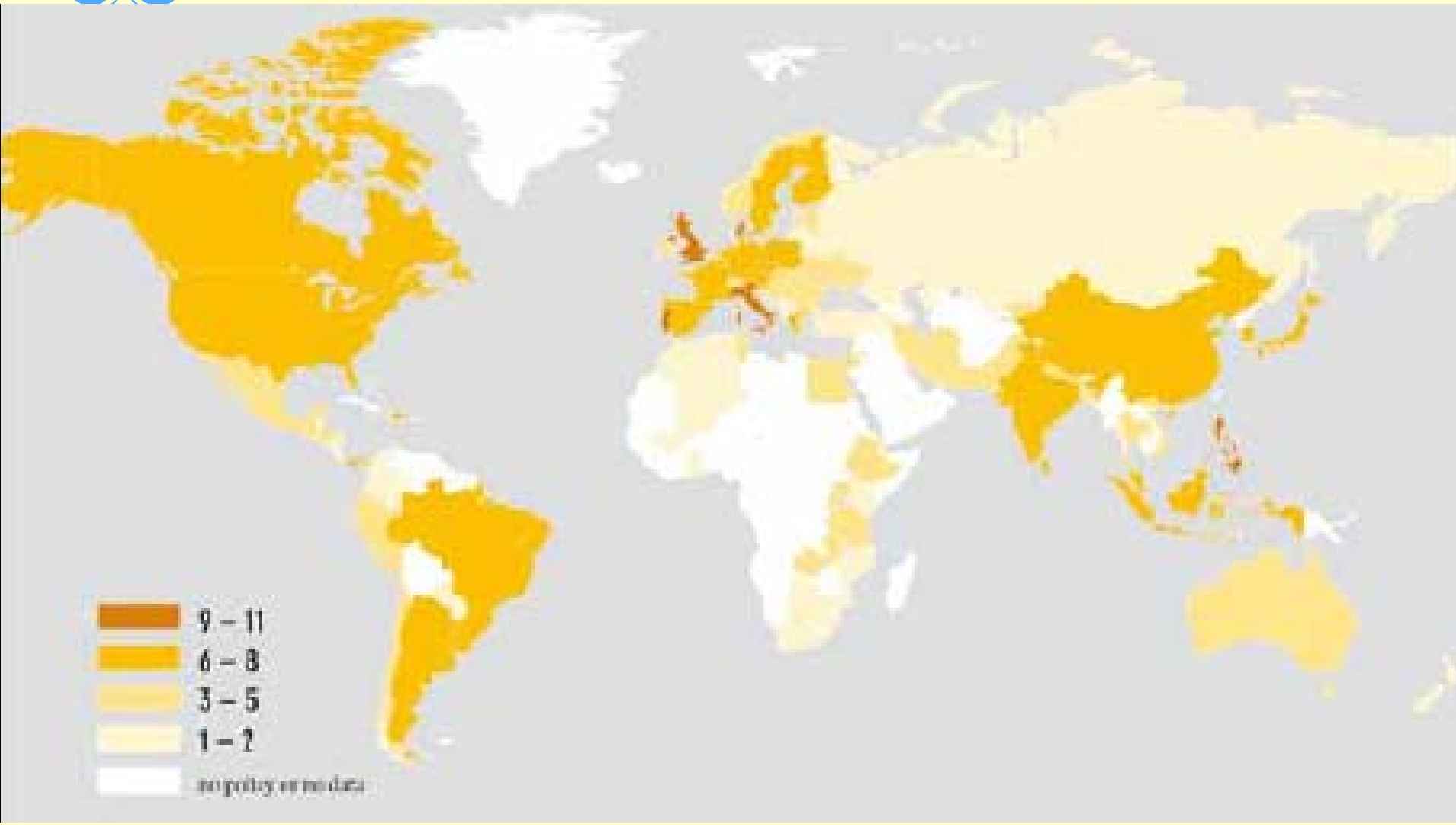
The Large-scale biogas digesters

- Expected to absorb 53% of the dung in the peri-urban area (1,500 MT per day)
  - Contributes to reducing pollution, but not completely
  - Other measures (dung capture from river, dairy zoning)
- Slurry from the biogas digester can be used for vermin compost
- Not commercially feasible even with the subsidy
  - PPA rate is temporarily set low (Rs.3.36/kwh) while PPA rate for the solar technology is 5-6 times higher (Rs.14-17/kwh).
  - Power shed prevents from meeting the CDM target

118 countries have RE policy targets



Source) REN21 (2012)

92 countries enacted feed-in policies

Year	Cumulative #	Countries/States/Provinces Added That Year
1978	1	United States
1990	2	Germany
1991	3	Switzerland
1992	4	Italy
1993	6	Denmark; India
1994	9	Luxembourg; Spain; Greece
1997	10	Sri Lanka
1998	11	Sweden
1999	14	Portugal; Norway; Slovenia
2000	14	—
2001	17	Armenia; France; Latvia
2002	23	Algeria; Austria; Brazil; Czech Republic; Indonesia; Lithuania
2003	29	Cyprus; Estonia; Hungary; South Korea; Slovak Republic; Maharashtra (India)
2004	34	Israel; Nicaragua; Prince Edward Island (Canada); Andhra Pradesh and Madhya Pradesh (India)
2005	41	Karnataka, Uttaranchal, and Uttar Pradesh (India); China; Turkey; Ecuador; Ireland
2006	46	Ontario (Canada); Kerala (India); Argentina; Pakistan; Thailand
2007	56	South Australia (Australia); Albania; Bulgaria; Croatia; Dominican Republic; Finland; Macedonia; Moldova; Mongolia; Uganda
2008	69	Queensland (Australia); California (USA); Chhattisgarh, Gujarat, Haryana, Punjab, Rajasthan, Tamil Nadu, and West Bengal (India); Kenya; the Philippines; Tanzania; Ukraine
2009	80	Australian Capital Territory, New South Wales, and Victoria (Australia); Hawaii, Oregon, and Vermont (USA); Japan; Kazakhstan; Serbia; South Africa; Taiwan
2010	84	Bosnia and Herzegovina; Malaysia; Malta; United Kingdom
2011	88	Rhode Island (USA); Nova Scotia (Canada); Netherlands; Syria
2012 (early)	90	Palestinian Territories; Rwanda
	92	Total Existing

Source) REN21 (2012)

Electrification advancing but unevenly

COUNTRY	Electrification Rate (rural, urban and/or national)
All Developing Countries	75.0%
Africa	42.0%
North Africa	99.0%
Sub-Saharan Africa	30.0%
Developing Asia[1]	81.0%
China and East Asia	91.0%
South Asia	68.0%
Latin America	93.0%
Middle East	90.0%

- China >99.5%
- Philippines 84%
- Sri Lanka 76.6%
- India 75%
- Indonesia 65.1%
- Rural Bangladesh 63.4%
- Pakistan 62%

- Afghanistan 16%
- Myanmar 13%
- Nepal 10%
- Rural Micronesia 4%

Source) REN21 (2012)

Policy feedback

- Provides feedback for the discussion at the GJ task force
  - Promote commercial replication of biogas plants
    - PPA rate comparing total benefits and mapping the commercialization scenario
    - Balancing jobs and subsidized energy for the poor
  - ALMP to help dung workers to move to the biogas and compost sector
  - Formalize workers and make jobs decent

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Brazil – biogas feasible

- Biogas generated electricity is cheaper than the grid price (less subsidized), so large farms generate electricity for self-use.
  - Grid price (USD 18 cents /kwh) + demand charge for transformer + taxes +fees = up to USD 40 cents /kwh
  - Biogas generation cost: USD 17 cents /kwh

Nepal & Pakistan – biogas feasible

- Grid is unreliable. Power availability hour is low (up to 16 hours per day power cut in dry season), which forces many people to use diesel generators.
- Biogas generated electricity is cheaper than the diesel.
  - Diesel generation cost: USD 0.35 / kwh
    Biogas generation cost: USD 0.10 / kwh

India (Jabalpur case) – large biogas plant not feasible?

- Grid reliability is improving. Presently 22 hours per day in urban Jabalpur.
- Biogas generated electricity is cheaper than diesel but costlier than the grid.
  - Grid price is INR 5 / kwh. (USD 0.10 / kwh)
  - Diesel generation cost: USD 0.32/kWh
  - Biogas: INR 10 / kwh. (USD 0.18 / kwh)

Population relying on traditional biomass for cooking

REGIONS AND SELECTED COUNTRIES	Population	
	Millions	Percent
Africa	657	65%
Nigeria	104	67%
Ethiopia	77	93%
Democratic Republic of the Congo	62	94%
Tanzania	41	94%
Kenya	33	83%
Other Sub-Saharan Africa	335	74%
North Africa	4	3%
Developing Asia[1]	1,921	54%
India	836	72%
Bangladesh	143	88%
Indonesia	124	54%
Pakistan	122	72%
Myanmar	48	95%
Rest of Developing Asia	648	36%
Latin America	85	19%
Middle East	n.a.	n.a.
All Developing Countries	2,662	51%
World[2]	**2,662**	**39%**

Source) REN21 (2012)

India (Jabalpur case) – small biogas plants f/ cook stove

- High rate of non-functional plants
  - Competing energies: firewood, propane gas
  - Premature start of use

→ Diagnosed process bottlenecks and generated a problem solving guide

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Implications to further research

1. Diesel dependency area map of India
   - Crossing this with major dairy clusters in urban centres, we will get a rough number of target farms for commercially viable electricity generation from the biogas digesters
2. Detailed review of the subsidized price of grid electricity vis-à-vis RE PPA on-grid and off-grid.
   - International comparison among Brazil, Nepal and Pakistan could be part of the study.

Way forward

1. Explore policy and implementation space within the RE, energy and daily policies in India.
2. Explore dairy sector opportunities in other countries through research and pilot.
3. Explore other sectors with great GJ potential.