



Dark Rooms, but not the Dark Ages

Relevance of LVDC for Microgrids for Electricity Access

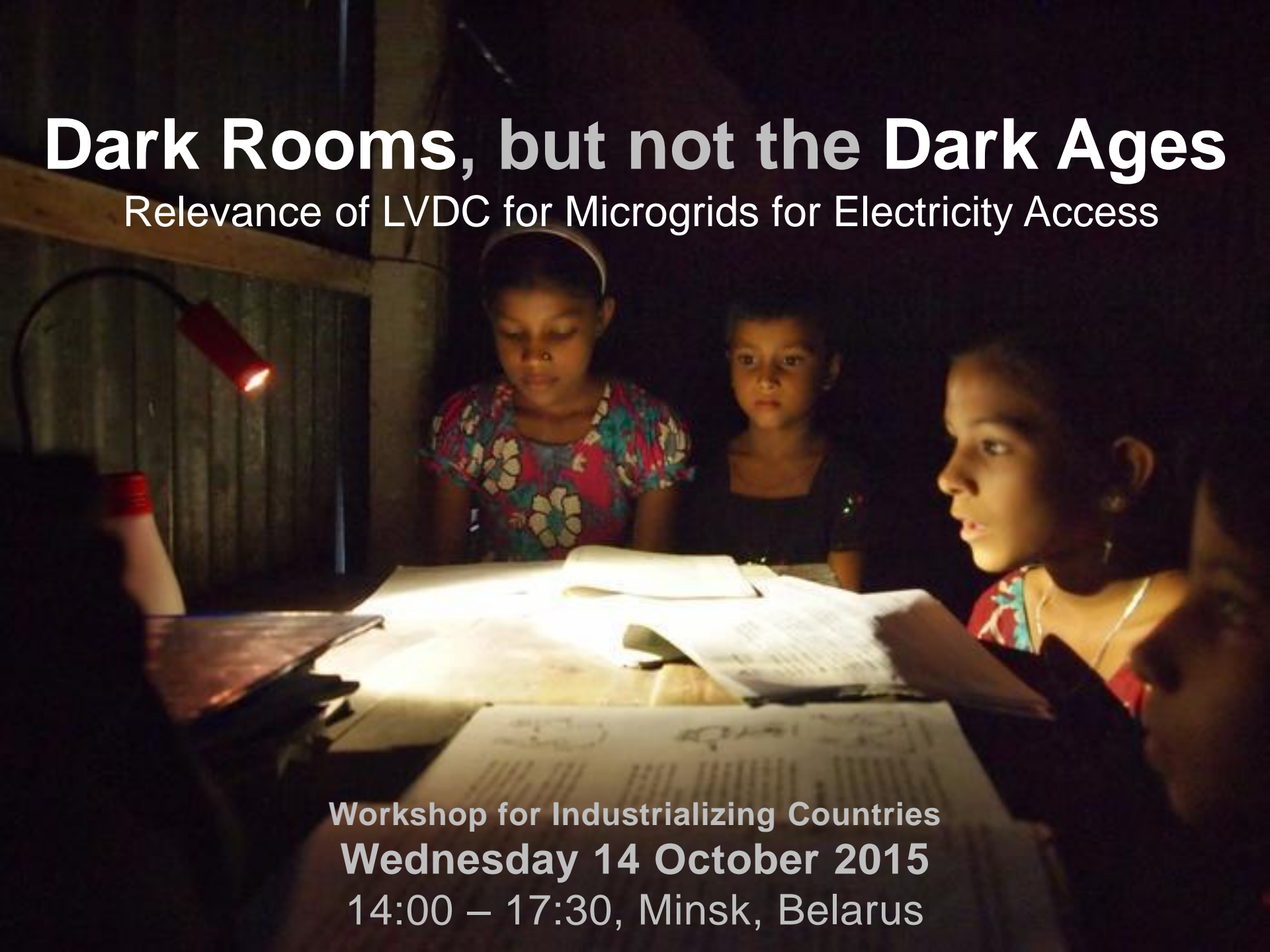


Vimal Mahendru
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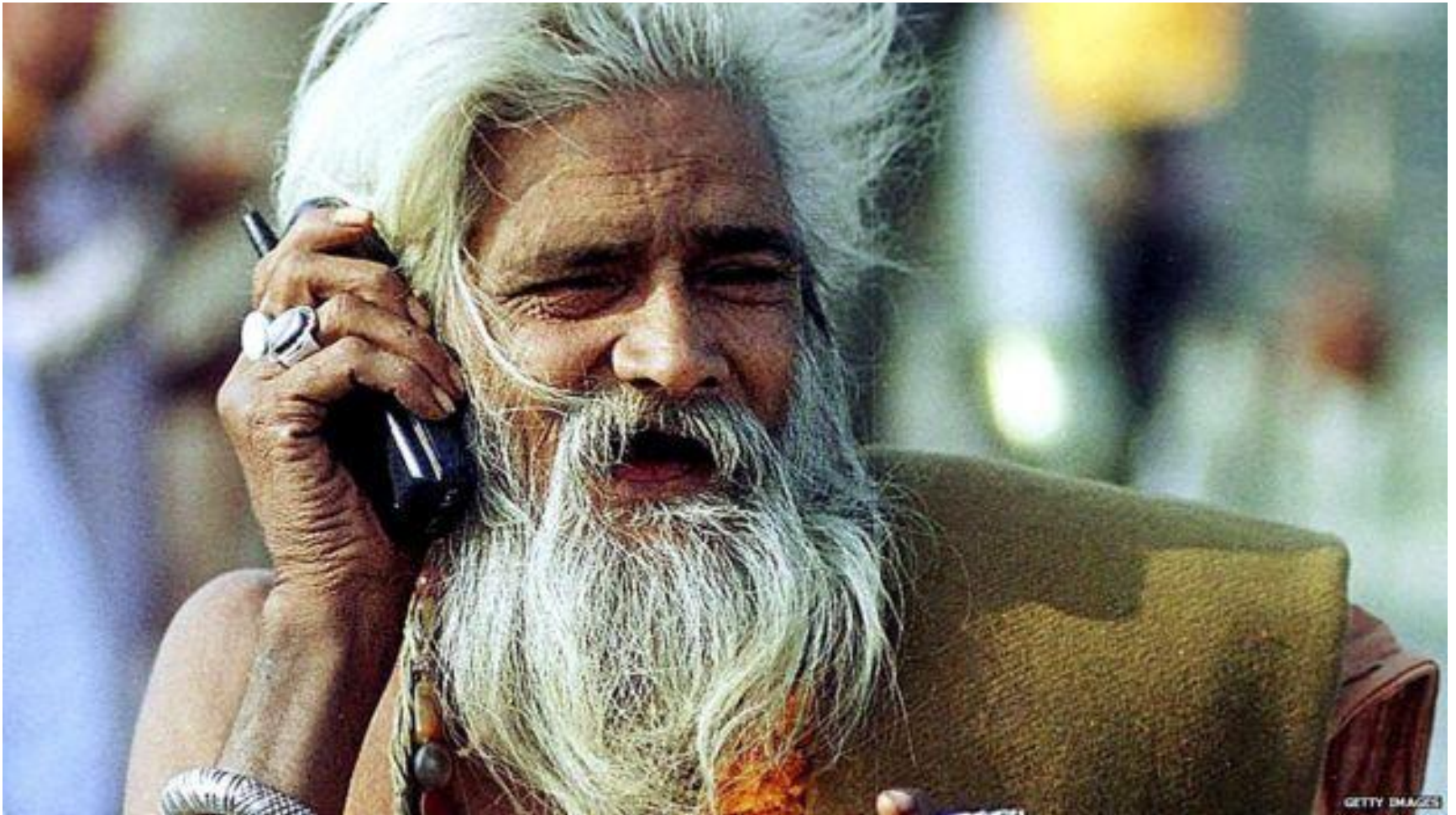


Dark Rooms, but not the Dark Ages

Relevance of LVDC for Microgrids for Electricity Access

A photograph of three children in a dark room, illuminated by a red desk lamp. They are gathered around a table, looking at papers and books. The child on the left is wearing a colorful patterned shirt, the child in the middle is wearing a dark shirt, and the child on the right is wearing a red and white patterned shirt. The lamp is a small, red, cylindrical desk lamp with a black cord.

Workshop for Industrializing Countries
Wednesday 14 October 2015
14:00 – 17:30, Minsk, Belarus



All the things we



run on LVDC

We already live in
a DC World!



LVDC Use-Cases

- **Data Centers**
 - Large
 - Medium
 - Small
- **Housing**
 - Rural
 - Off Grid
 - Grid Connected
 - Suburban or semi-urban – grid connected
 - Urban – grid connected
 - Home Appliances
 - Lighting and elevators
 - Air-conditioning
- **Transportation, E-Mobility**
 - Automotive
 - Marine vessels – propulsion
 - Avionics
 - Railways; inter-city
 - Railways; metro
- systems – intra-city
- **Electric Vehicle Charging**
 - Public
 - Residential
 - Commercial
- **Street Fixtures**
 - Street lighting
 - Signage
 - Traffic Controls
 - Toll and toll plaza
- **Mining, Manufacturing and Warehousing**
 - Robotics and industry automation
 - Winches, Cranes and material transportation
 - Logistics and warehouse functions
- **Commercial Buildings**
 - Office and office equipment
- Healthcare
- Hospitality
- Educational
- Retail
- Lighting and elevators
- **Agriculture, Fish Farming**
 - Greenhouse
 - Farm and farm equipment
 - Water pumping
- **Military**
 - Housing
 - Supply Base
 - Forward Base
 - Portable power
- **Appliances for convenience, hygiene, productivity and lifestyle**
 - Domestic
 - Commercial
 - Personal

Electricity; then and now

Then

- GLS Bulbs (hot)
- Hardly any consumer electronics
- Electricity seen as luxury
- Generated elsewhere, consumed all over
- Cheaper to transport coal than power
- Large monolithic utilities
- Theme: unlimited resources and natural abundance

Now

- LED Lighting
- Electronics, electronics, electronics
- Electricity is a basic need and necessity
- Generate and consume locally
- Nimble customer-focused partnerships
- Theme: limited resources and responsible technologies

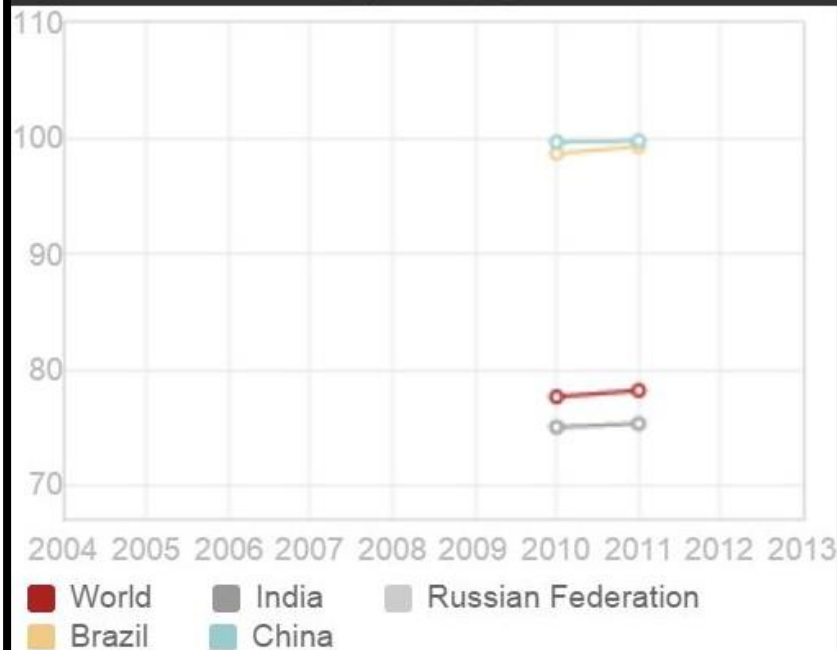
Electricity access in 2012

Region	Population without electricity millions	Electrification rate %	Urban electrification rate %	Rural electrification rate %
Developing countries	1,283	77%	91%	64%
Africa	622	47%	68%	26%
North Africa	1	99%	100%	99%
Sub-Saharan Africa	621	38%	59%	16%
Developing Asia	620	84%	95%	74%
China	3	100%	100%	100%
India	304	80%	94%	67%
Latin America	23	90%	99%	82%
Middle East	18	88%	98%	78%
Transition economies & member countries of OECD	1	100%	100%	100%
WORLD	1,285	82%	94%	68%

[SOURCE: IEA, World Energy Outlook 2014](#)

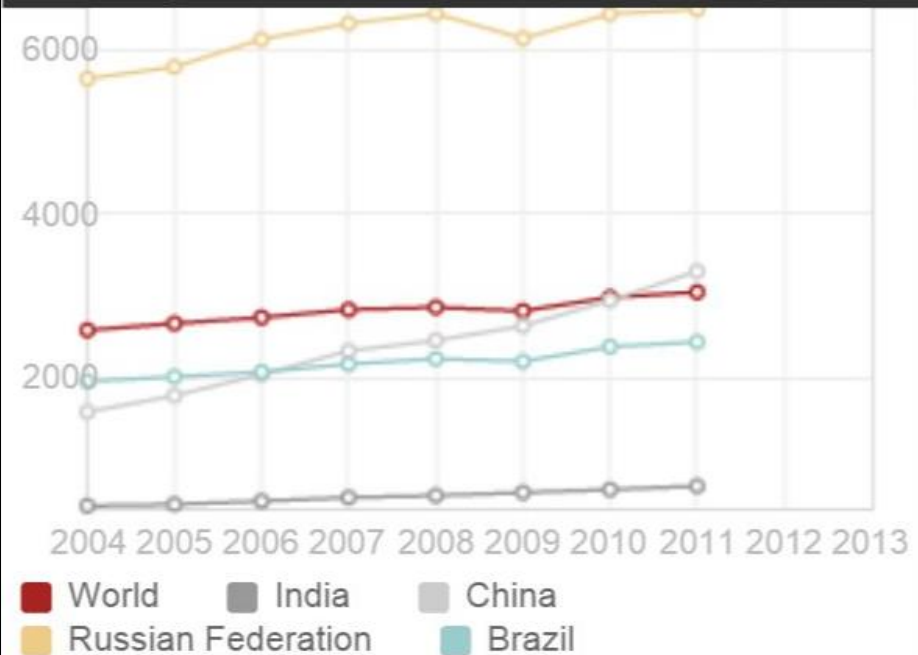
The urgency to provide Electricity Access

Access to electricity (% of population)



Data from World Bank

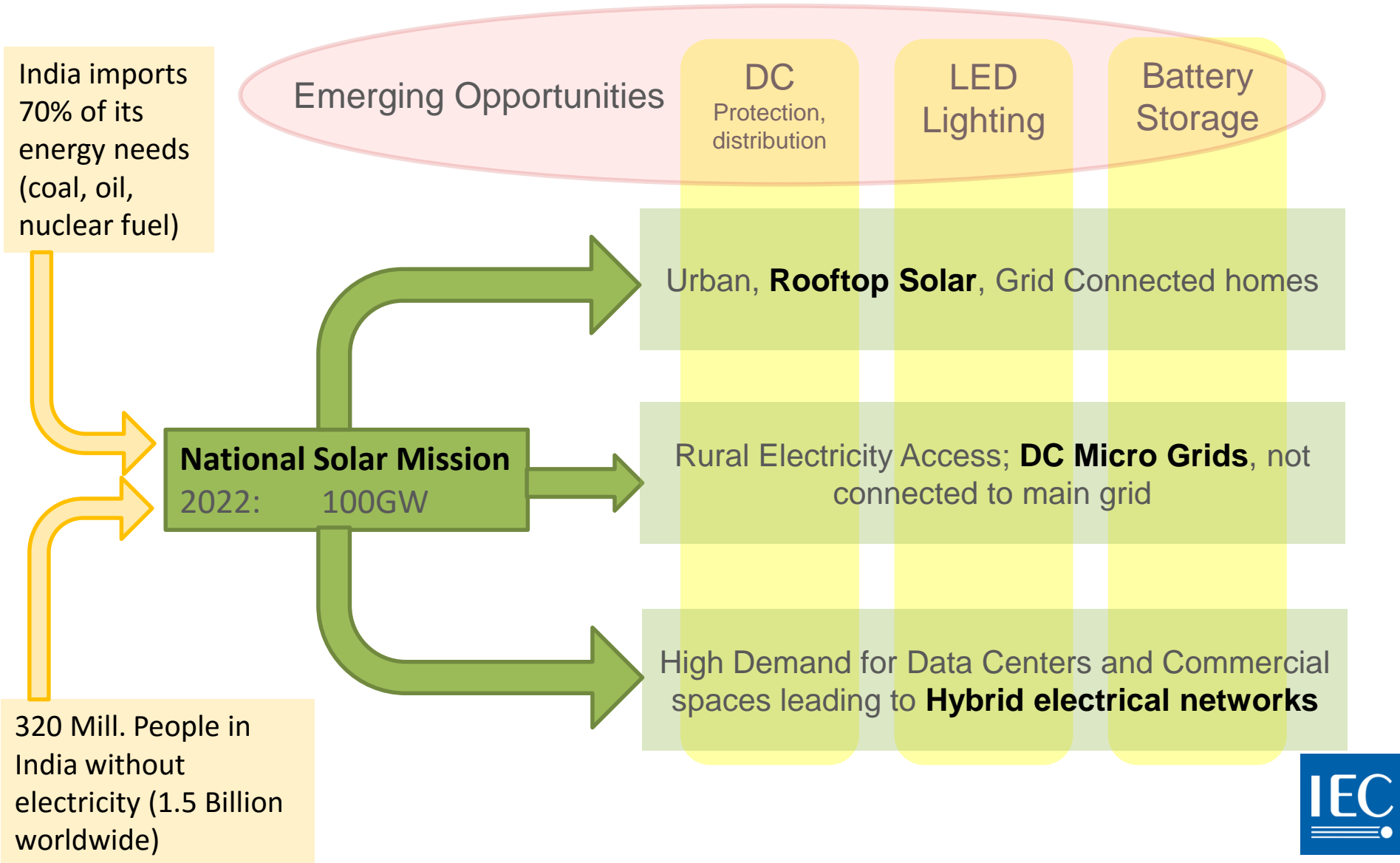
Electric power consumption (kWh per capita)



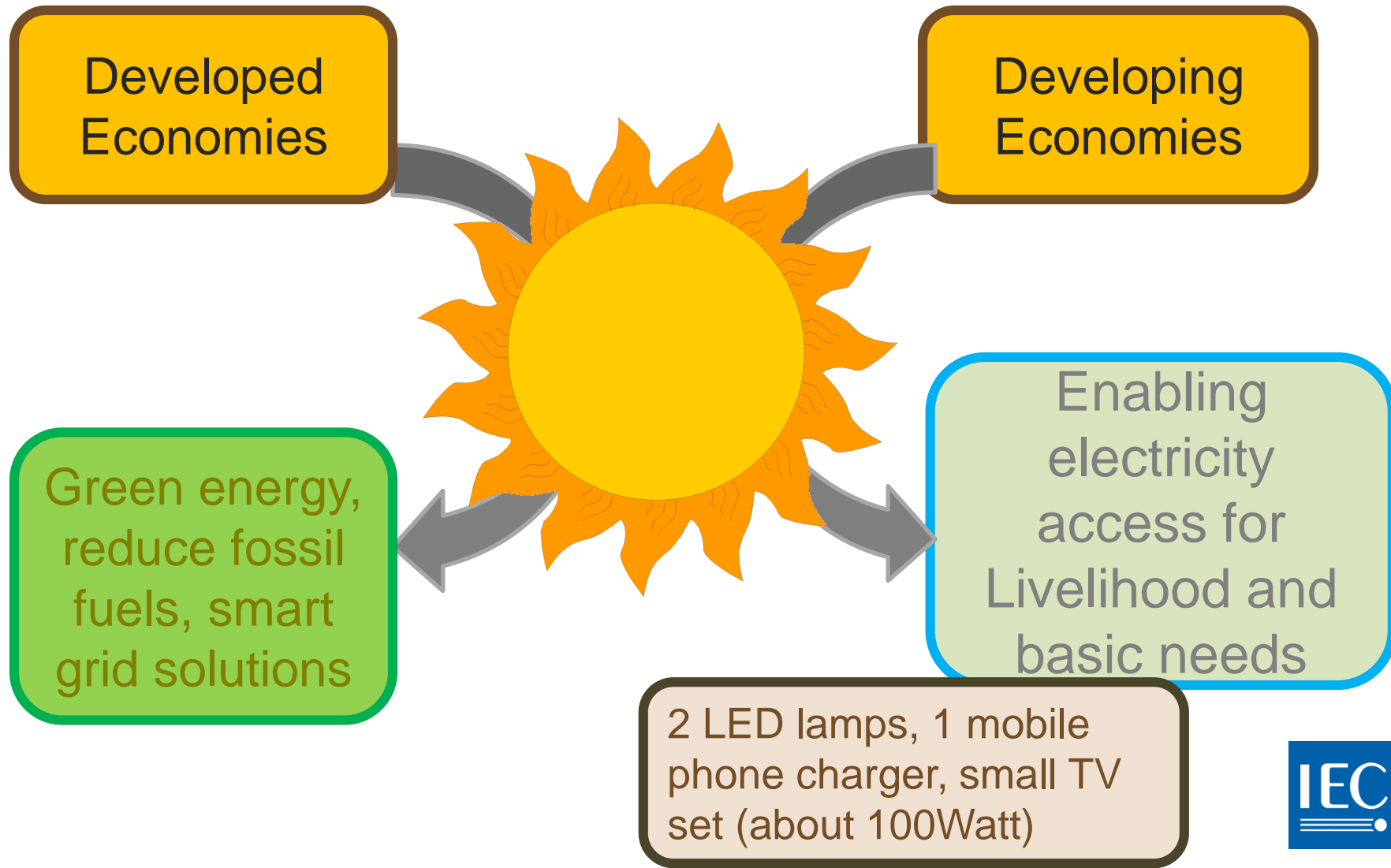
India

- Population, 1.25 Billion (46% below age of 24)
- Land, 3.288 million km² (7th largest in the world)
- Economy, US\$4.99 Trillion, (4th Largest after USA, China, EU)
- Economy: Agriculture: 17.4%, Industry: 25.8%, Services: 56.9%
- Mobile Phone Users, 893 Million (2nd largest) (over 70% of population)
- Electricity production 871 Billion kWH (4th largest)
- Installed Generation Capacity 240 GW (4th largest, 2/3rd from fossil fuels)
- Per Capita Electricity Consumption, 700 kWH (158 of 217 countries)
- People without electricity, 320 Million (about 25% of total population)
- Villages without electricity 650,000 (challenge of definition)

Why Microgrids makes Sense in India

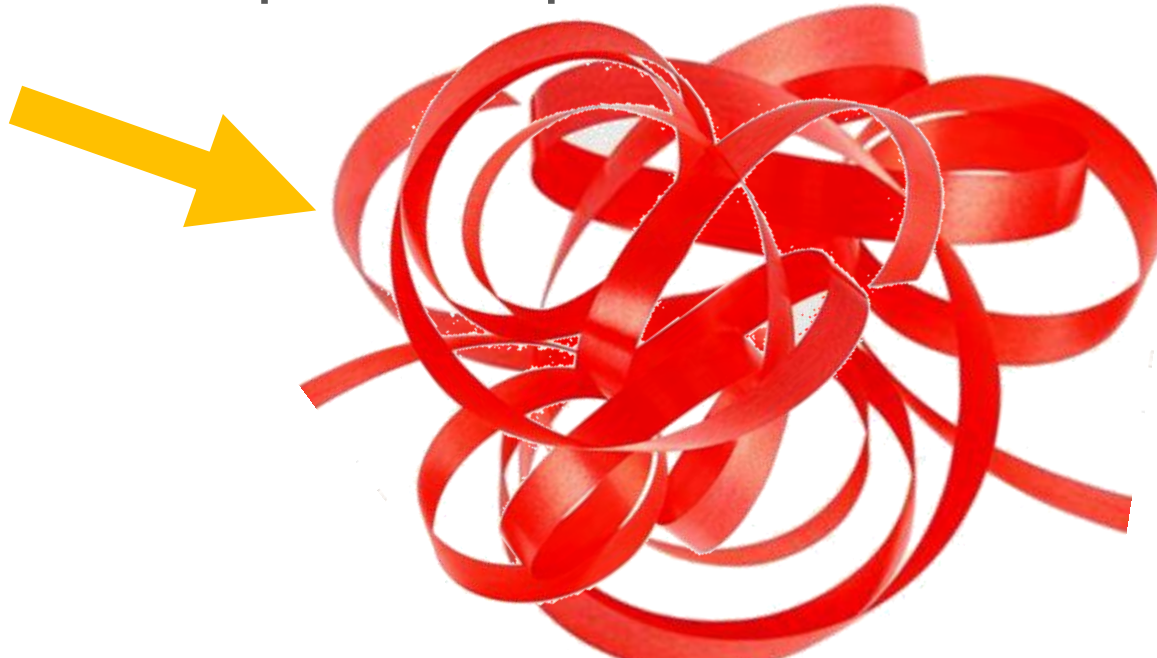


Why Solar makes sense



LVDC ➡ Microgrids ➡ Electricity Access

- With Solar, LED Lighting and LVDC; perfect solution for Microgrids
- Speed of roll-out
- Enabling Public-Private Partnerships
- Local Ownership and implementation
- And No





This is meaningful work...
Thankyou



Thank you!

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International
Electrotechnical
Commission

References and Readings

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