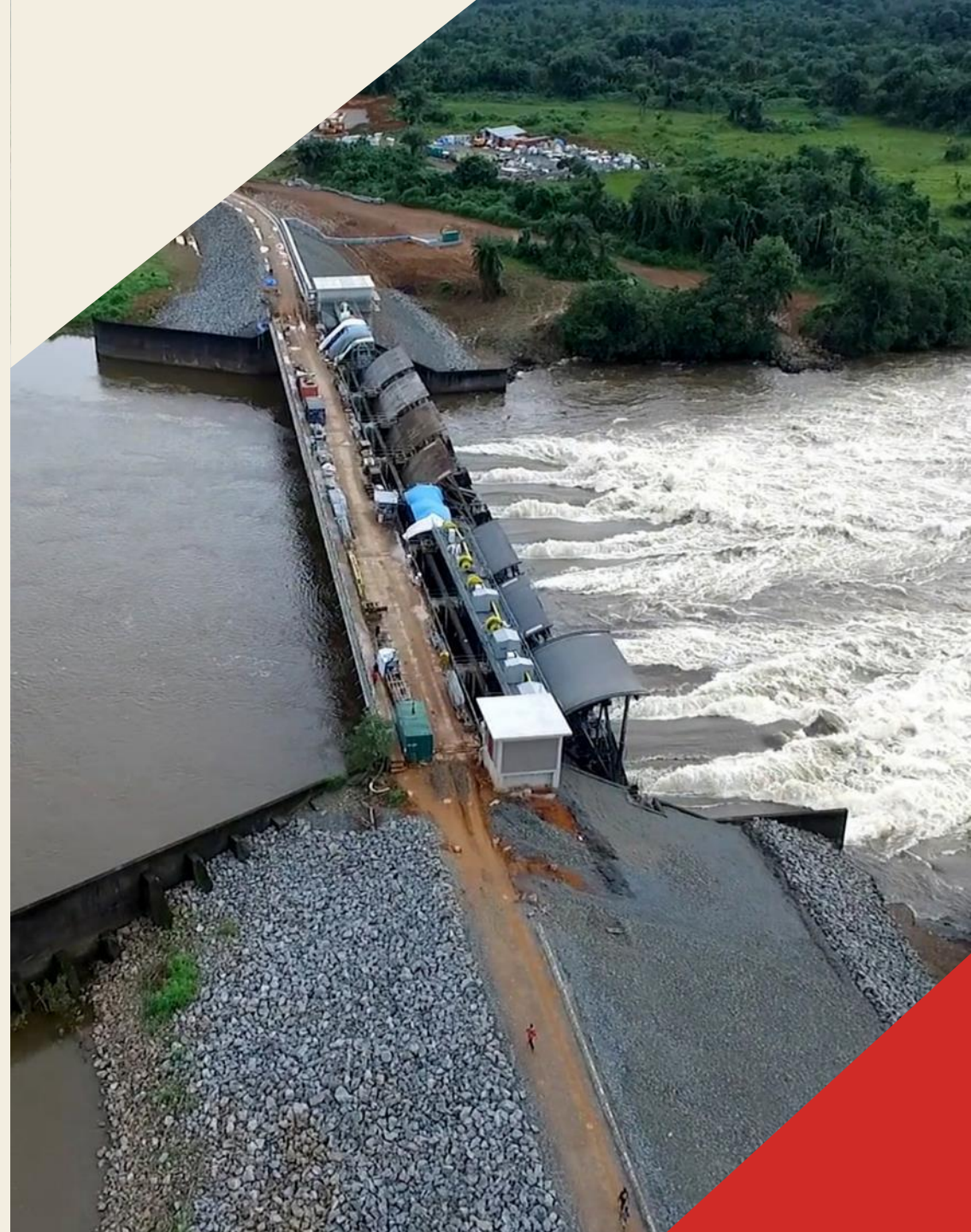


# Liberia Energy Evaluation

**Evaluation of the Liberia Power Compact:  
Interim Findings**

*November 2020*

*“Electricity is Life”.*



# Investing in the energy sector in a challenging context: Liberia as a case study

- Only small-scale thermal generation
- Destitute utility company
- Dilapidated T&D infrastructure
- Regulatory environment: undeveloped, unfamiliar
- Post-conflict and pandemic (Ebola) affected
- Uncertain political economy
  - Weak governance, institutional capacity, and public sector management
  - Loss of a generation of personnel with energy sector skills and experience
  - New administration lacking experience
  - Worsening financial crisis and unfavorable macroeconomic outlook

*Rapidly growing demand for energy*

# Liberia Compact (2016-2021)

## MCC's Energy Project (\$202 million):

- Aims to improve access to reliable and affordable electricity by
  - Increasing production and distribution of lower cost, quality electricity
  - Reducing tariffs and user costs



## Activities



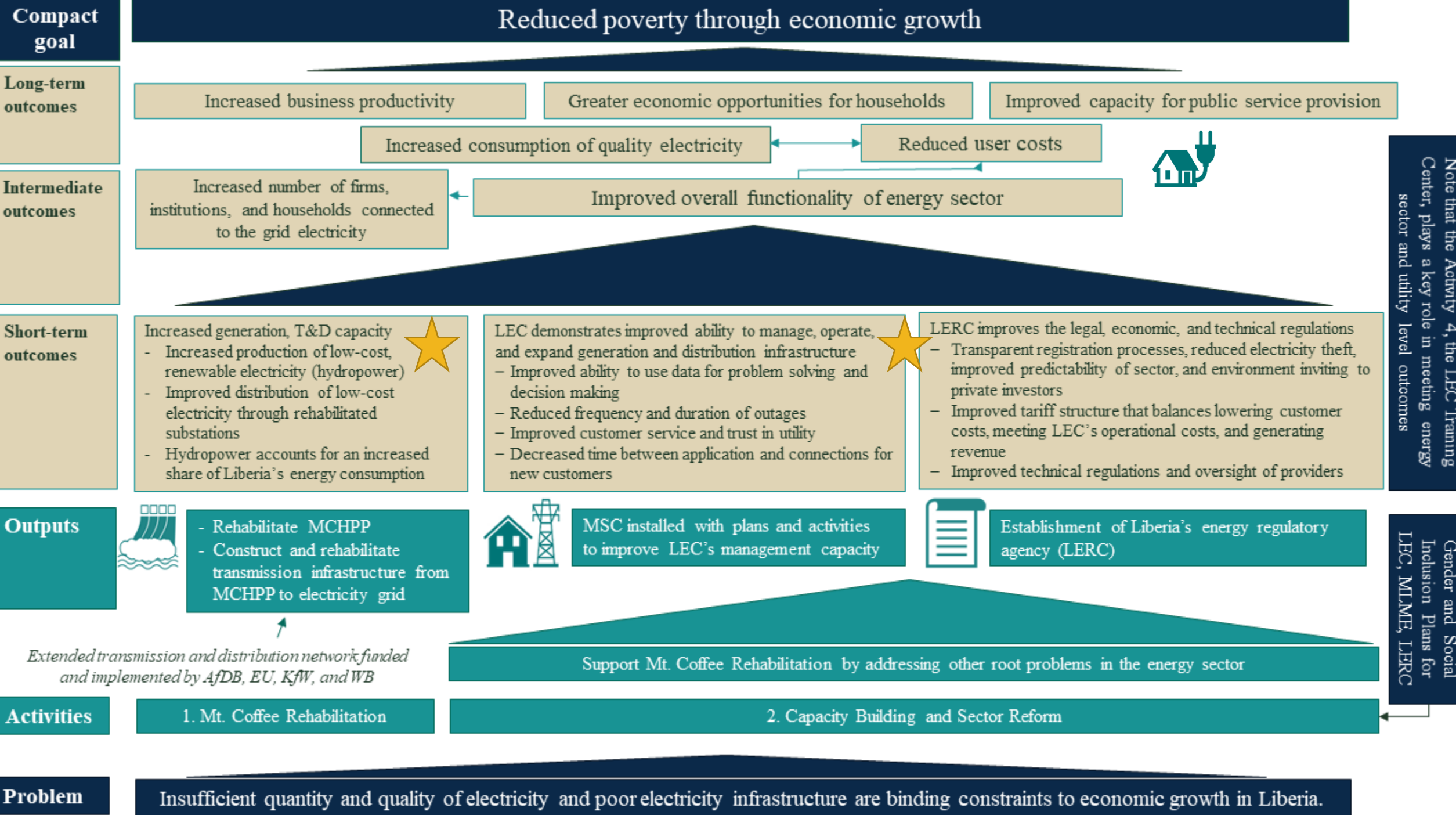
- Rehabilitate the Mount Coffee Hydropower Plant (MCHPP) generate low-cost power



- Build capacity in the Liberian Electricity Corporation (LEC)



- Establish an independent regulator



**Compact goal**

**Reduced poverty through economic growth**

**Long-term outcomes**

Increased business productivity      Greater economic opportunities for households      Improved capacity for public service provision

**Intermediate outcomes**

Increased consumption of quality electricity ↔ Reduced user costs

Increased number of firms, institutions, and households connected to the grid electricity ← Improved overall functionality of energy sector



**Short-term outcomes**

- Increased generation, T&D capacity
  - Increased production of low-cost, renewable electricity (hydropower)
  - Improved distribution of low-cost electricity through rehabilitated substations
  - Hydropower accounts for an increased share of Liberia's energy consumption
- LEC demonstrates improved ability to manage, operate, and expand generation and distribution infrastructure
  - Improved ability to use data for problem solving and decision making
  - Reduced frequency and duration of outages
  - Improved customer service and trust in utility
  - Decreased time between application and connections for new customers
- LERC improves the legal, economic, and technical regulations
  - Transparent registration processes, reduced electricity theft, improved predictability of sector, and environment inviting to private investors
  - Improved tariff structure that balances lowering customer costs, meeting LEC's operational costs, and generating revenue
  - Improved technical regulations and oversight of providers

**Outputs**

- Rehabilitate MCHPP  
Construct and rehabilitate transmission infrastructure from MCHPP to electricity grid
- MSC installed with plans and activities to improve LEC's management capacity
- Establishment of Liberia's energy regulatory agency (LERC)

*Extended transmission and distribution network funded and implemented by AfDB, EU, KfW, and WB*

**Activities**

- Mt. Coffee Rehabilitation
- Capacity Building and Sector Reform

**Problem**

Insufficient quantity and quality of electricity and poor electricity infrastructure are binding constraints to economic growth in Liberia.

Note that the Activity 4, the LEC Training Center, plays a key role in meeting energy sector and utility level outcomes

Gender and Social Inclusion Plans for LEC, MLME, LERC

# Evaluation design, questions, and approach

## Performance evaluation to answer evaluation questions

1. **What implementation lessons can be drawn (*MCHPP and LEC*)?**
2. **What new energy policies, laws, and regulations have been enacted?**
3. **To what extent has the MSC improved LEC's management?**
4. **How have MCC's investments affected grid performance and new connections?**
5. **How have customers changed behaviors?**



- Pre-post evaluation using mixed methods approaches
- Analysis of implementation and early outcomes

# Liberia Evaluation Timeline

Name of round	Data collection	Data cleaning & analysis	First draft report expected	Final draft report submitted/ expected
Baseline / early interim	December 2018– November 2019	May 2019 – January 2020	January 2020	March 2020
Interim	November 2020– June 2021	January– July 2021	August 2021	October 2021
Endline	November 2023– June 2024	January– July 2024	August 2024	January 2025

# Key outcomes and data sources

Implementation outcomes

Energy sector outcomes

Utility and grid level outcomes

End users outcomes

## Document review, site visits

A thorough analysis of documents: contracts, project implementation agreements, inception and work plans, monthly, quarterly, and annual reports, schedules, commissioned studies, RFPs, TORs, SOWs, spreadsheets, financial statements, presentations, memos, laws, policies, news, maps, issue trackers, timelines from all relevant agencies. **Also**, Multiple rounds of site visits

## Administrative data

We collected, analyzed, and plotted five years of administrative data (2015-2019) from the Liberia Electricity Corporation; Subcontract Tetra Tech

## Quantitative surveys (5 samples)

**Monrovia Connected study:** Baseline (2016 recall data) outcomes (2018)

- 1) Connected households (n=1,174);
- 2) Connected small businesses (n=322); and
- 3) Medium and large end users (n=175).

**Kakata Corridor:** Unconnected study (to follow over time as they connect)

- 4) Unconnected households (n=867); and
- 5) Unconnected small businesses (n=400).

## Qualitative data

Key informant interviews with respondents from MCC, MCA, other donors, ESBI and LEC staff and board members, LERC, ministry officials, the contract monitoring consultant, and a range of contractors (n=64); also FGDs with household members, interviews with business owners, local officials, public sector staff, women's groups.

Triangulate findings, identify trends and relationships, confirm patterns or findings, and detect discrepancies or disparate experiences

Use the implementation analysis findings to contextualize the performance evaluation findings

# Overview of timeline and major events throughout the Liberia Energy Sector



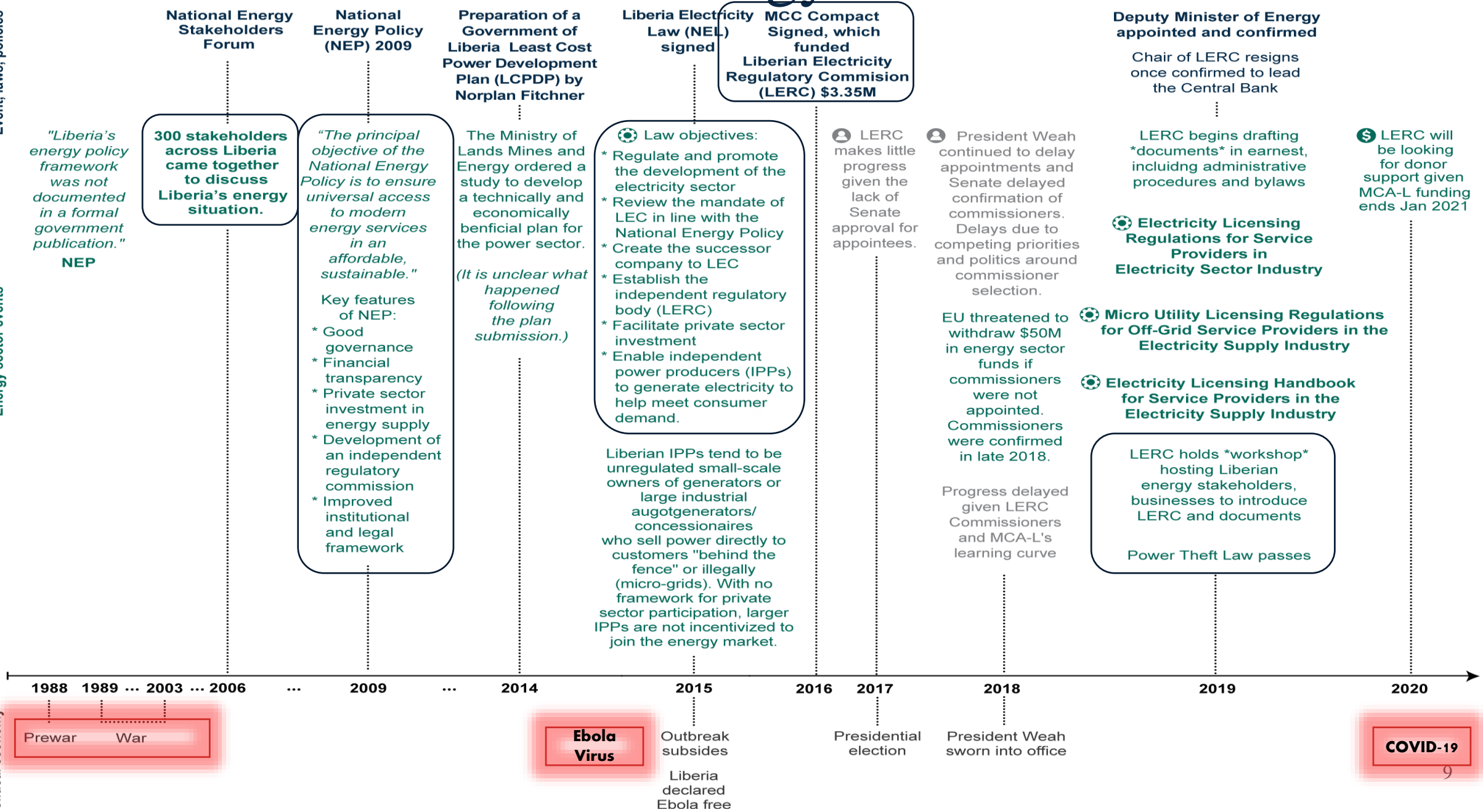


# Liberian Energy Sector

Event, laws, policies

Energy sector events

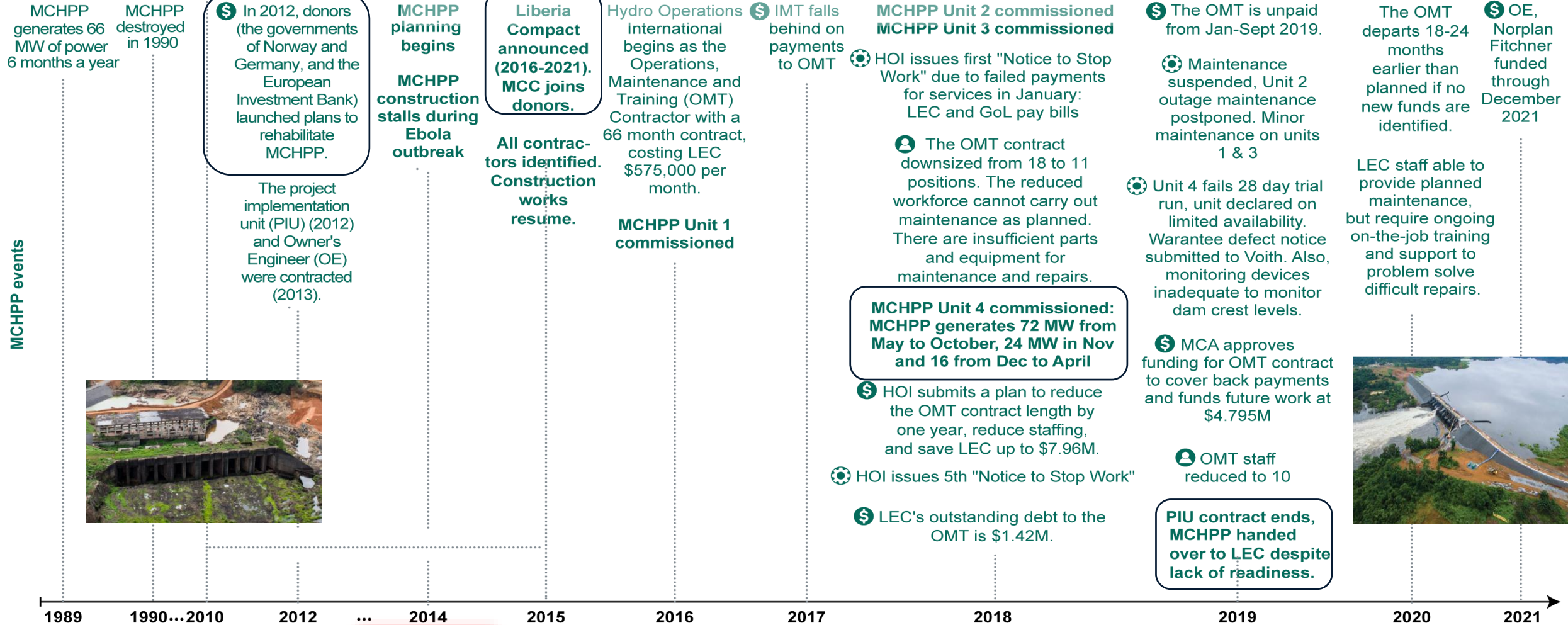
Political economy



# MCHHP

MCHHP events

Political economy



**2014**

Ebola outbreak  
National emergency

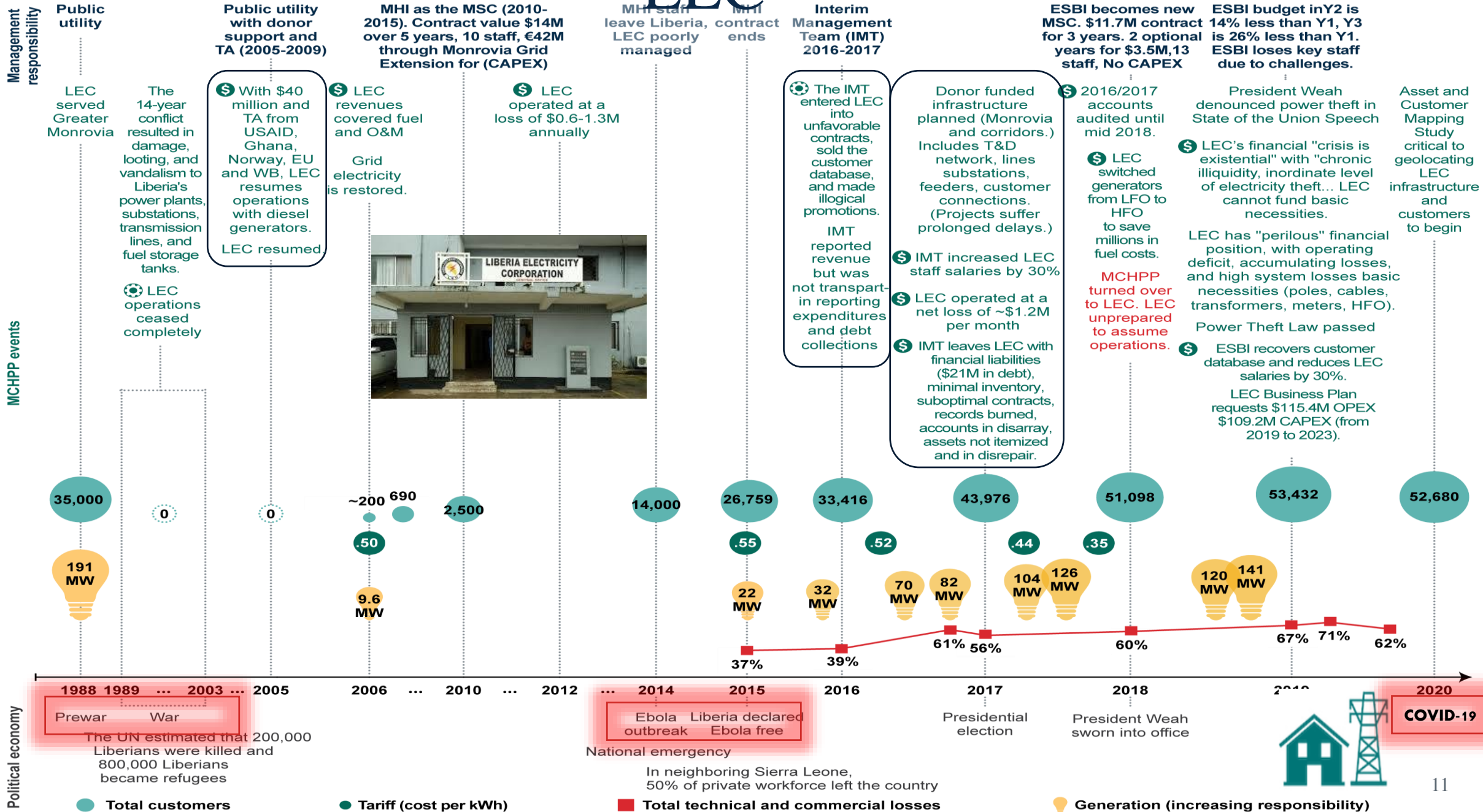
**2021**

COVID-19



In neighboring Sierra Leone, 50% of private workforce left

# LEC



# Implementation findings

# Implementation: MCHPP (Most salient findings)



## Successes

- Fully rehabilitated and operational
- MCHPP has both emotional and economic value, a symbol of rebirth, modernization, and hope
- Generates high quality, renewable, lower-cost power (~60% less than thermal per kWh)
- Stimulated a high level of donor coordination

## Threats and Challenges

- Insufficient resources OMT
- *All contractors, LEC, ESBI, hydro facility experts agree OMT insufficient. Risk plant failure, outages, higher rehab costs, emergency situations*

## Opportunities

- ***GOL must be a steward of this resource***
- ***“Turbines will go offline as parts are pillaged.”***
- Organizations are interested in service contractors or concessions.

## Lessons learned

- Donors can successfully collaborate on infrastructure projects, though the consortium structure can improve.
- Plan as systematically and realistically for the operation period as for the rehabilitation works.



# Implementation: LEC

**January 2018, LEC in a destitute financial situation. ESBI faced:**

- Negative operating, profit margin, low liquidity
- Unforeseen and extensive financial liabilities (\$21 million debt), lawsuits
- Burned records, accounts in disarray
- Minimal inventory, no asset listing, poorly maintained “*decrepit*” assets in disrepair
- Shortage of materials, equipment, and tools.
- LV network of “limited standard”, 22 kV network lacked capacity for new connections (inadequate transformers, feeders, meters)
- Suboptimal contracts, no customer listing
- Staffing increased and salaries raised 30%
- Capacity for basic emergency maintenance
- Soon to take over MCHPP, 66 and 22 kilovolt (kV) lines, substations, 230-volt distribution
- No corporate governance
- Widespread corruption throughout LEC

*LEC's financial "crisis is existential" with "chronic illiquidity."*

# LEC: Successes and stakeholder assessment

## SUCCESSSES

A careful review of data, procedures, systems, and management indicates *ESBI has improved*:

- Operations, diagnosing and problem solving
  - Re-creating financial systems, normalizing customer lists, human resource manuals,
  - Re-negotiating/severing contracts, union relationships, salary adjustments
- IMS operational for decision making
- Network performance: reduced outages
- Power Theft Law passed: improved approach
- Donor coordination (still weak, \$198 million in T&D projects)

## STAKEHOLDER ASSESSMENT

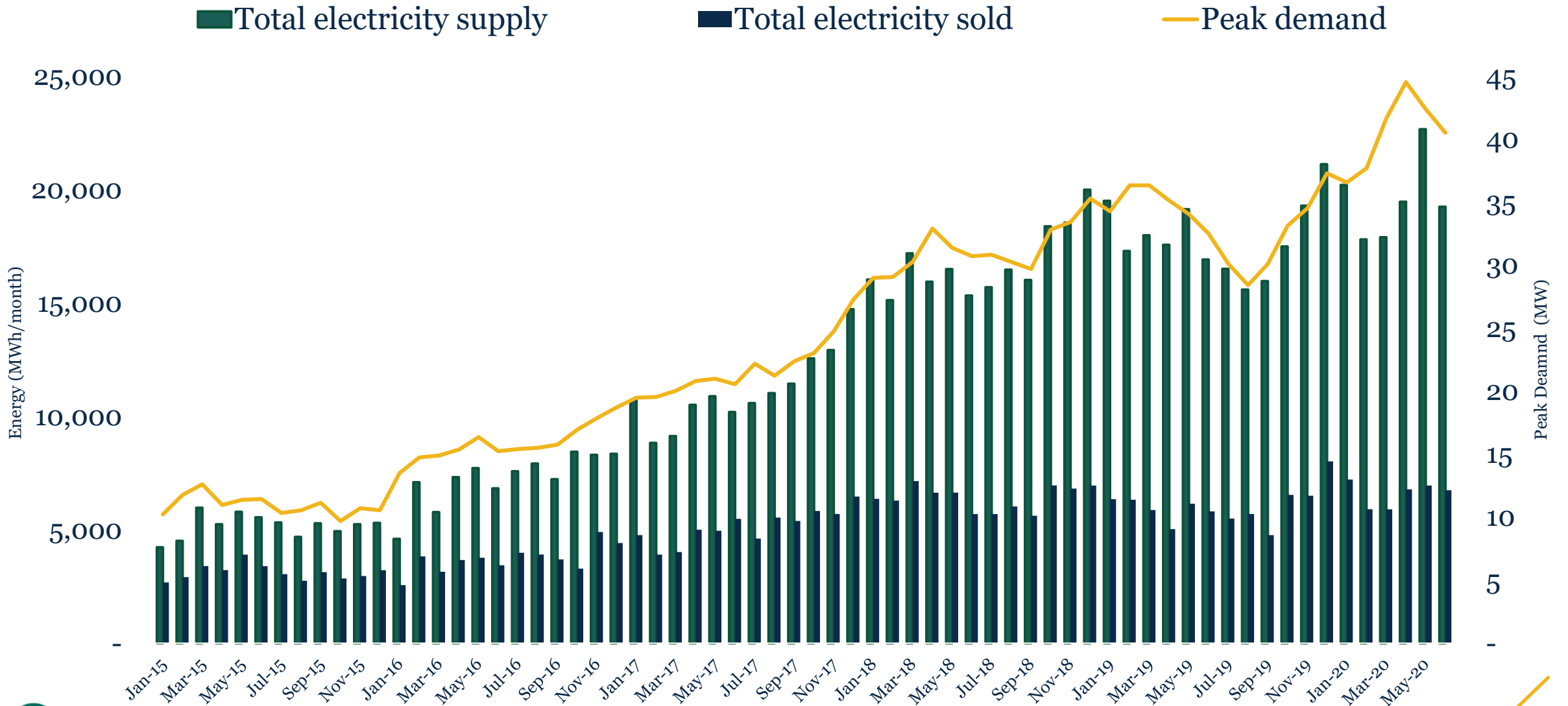
Donors and LEC staff agree that LEC is better with ESBI and would “collapse” without an MSC.

- All LEC staff reported that they thought ESBI should stay
- *“We know that we can’t turn over the utility to LEC totally.”*
- *“Liberia is a very difficult country. This is the last opportunity to fix LEC.”*
- *[We/they] underestimated how difficult the job is.”*
- *“Individually ESBI team members are working hard. But leadership has been lacking”*

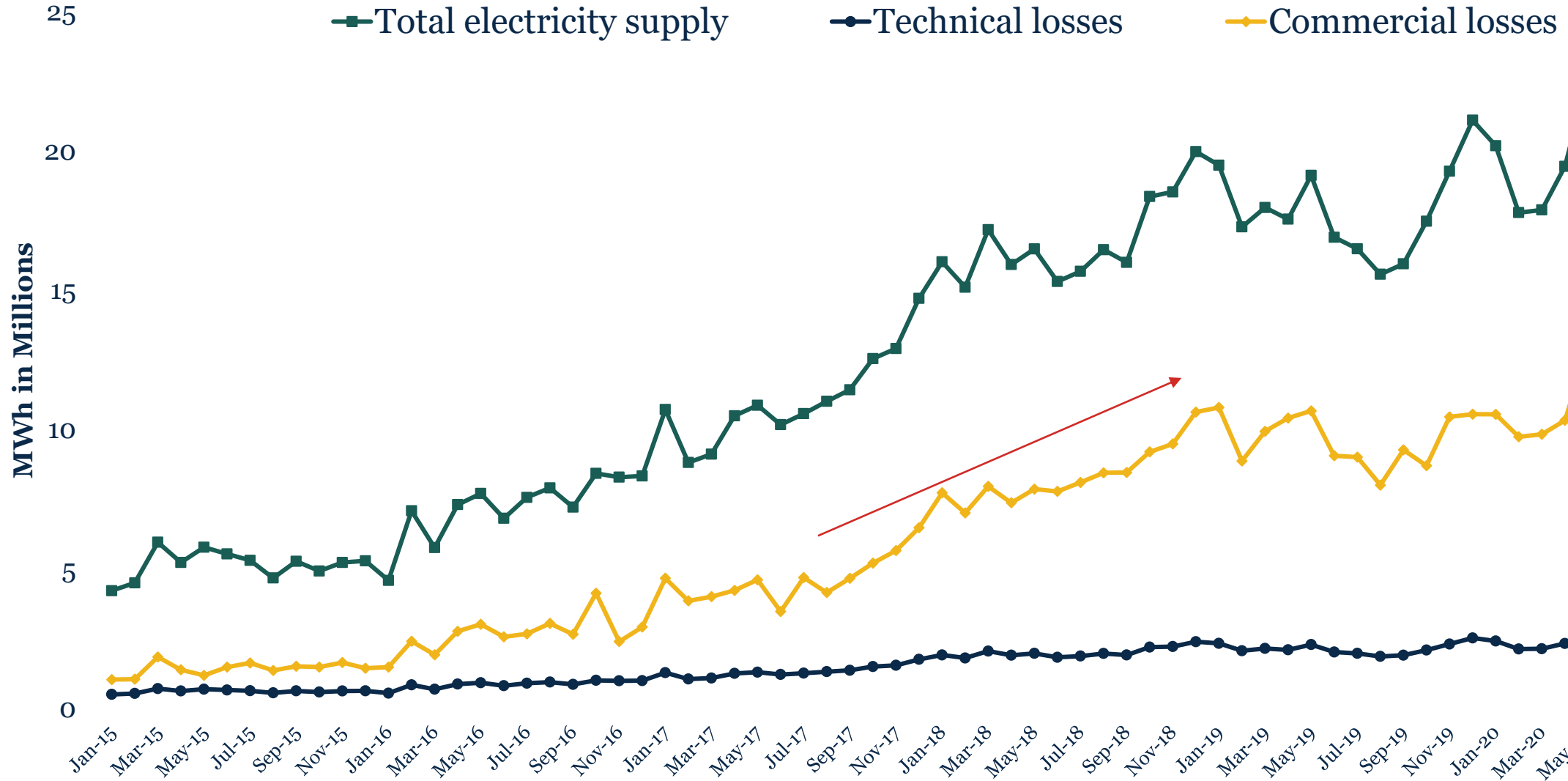
# Utility level outcomes



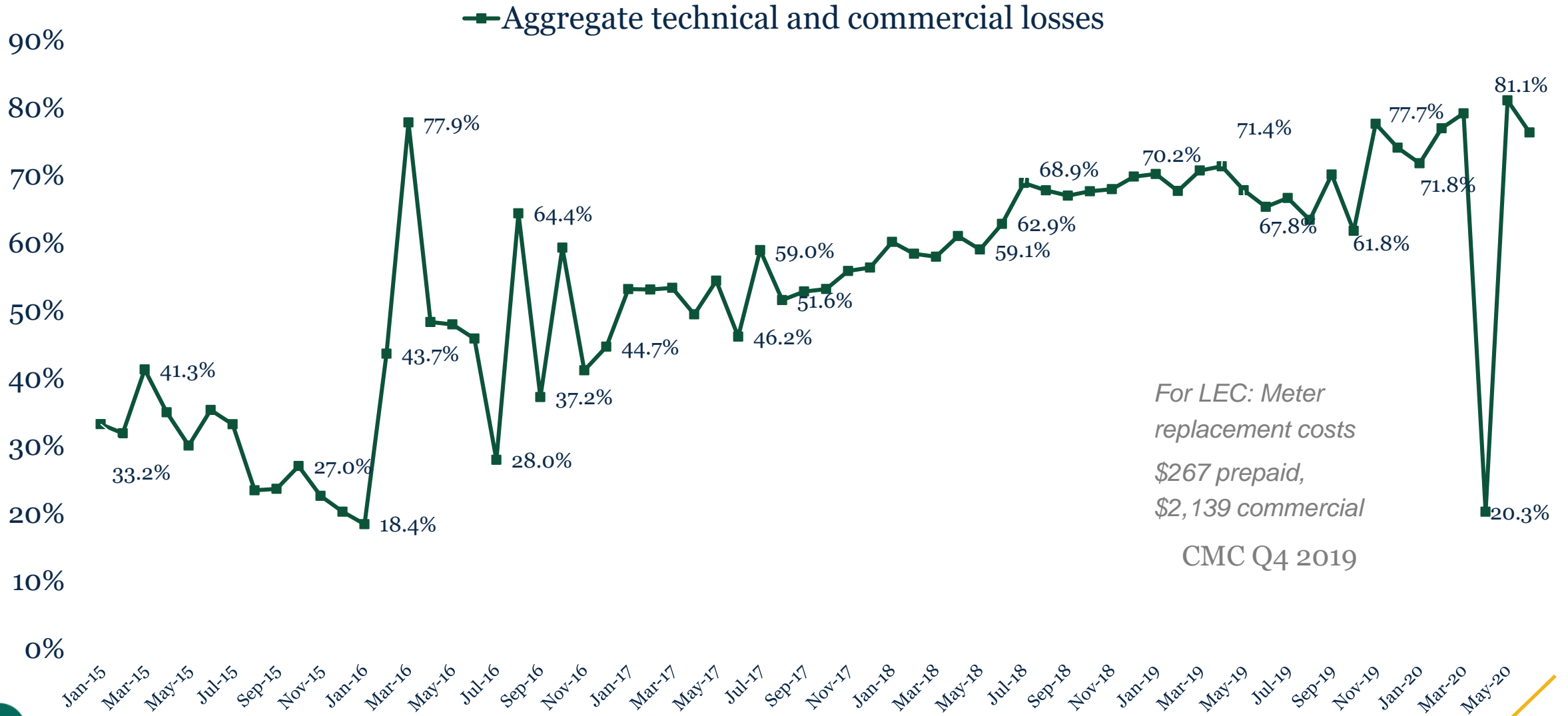
# Total electricity supply, sold, and peak demand



# Supply, technical and commercial losses

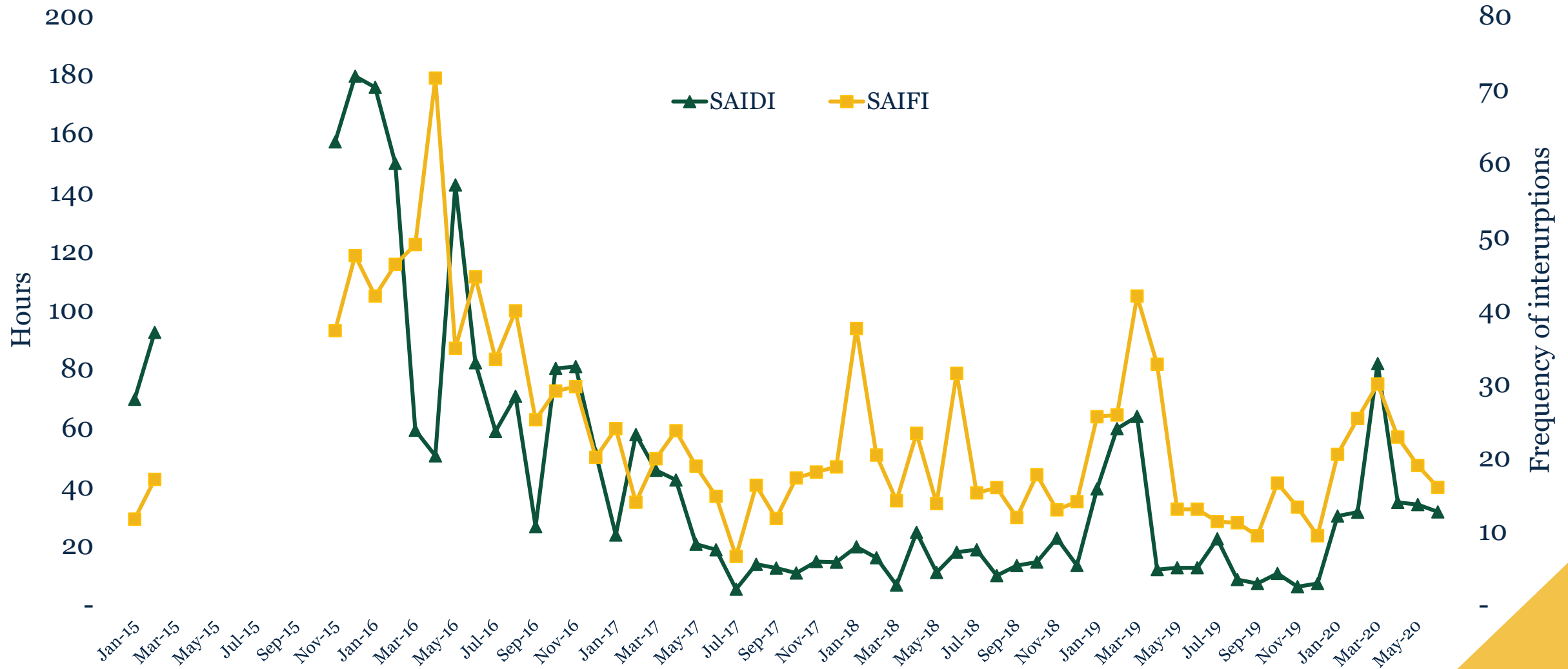


# Aggregate technical and commercial losses

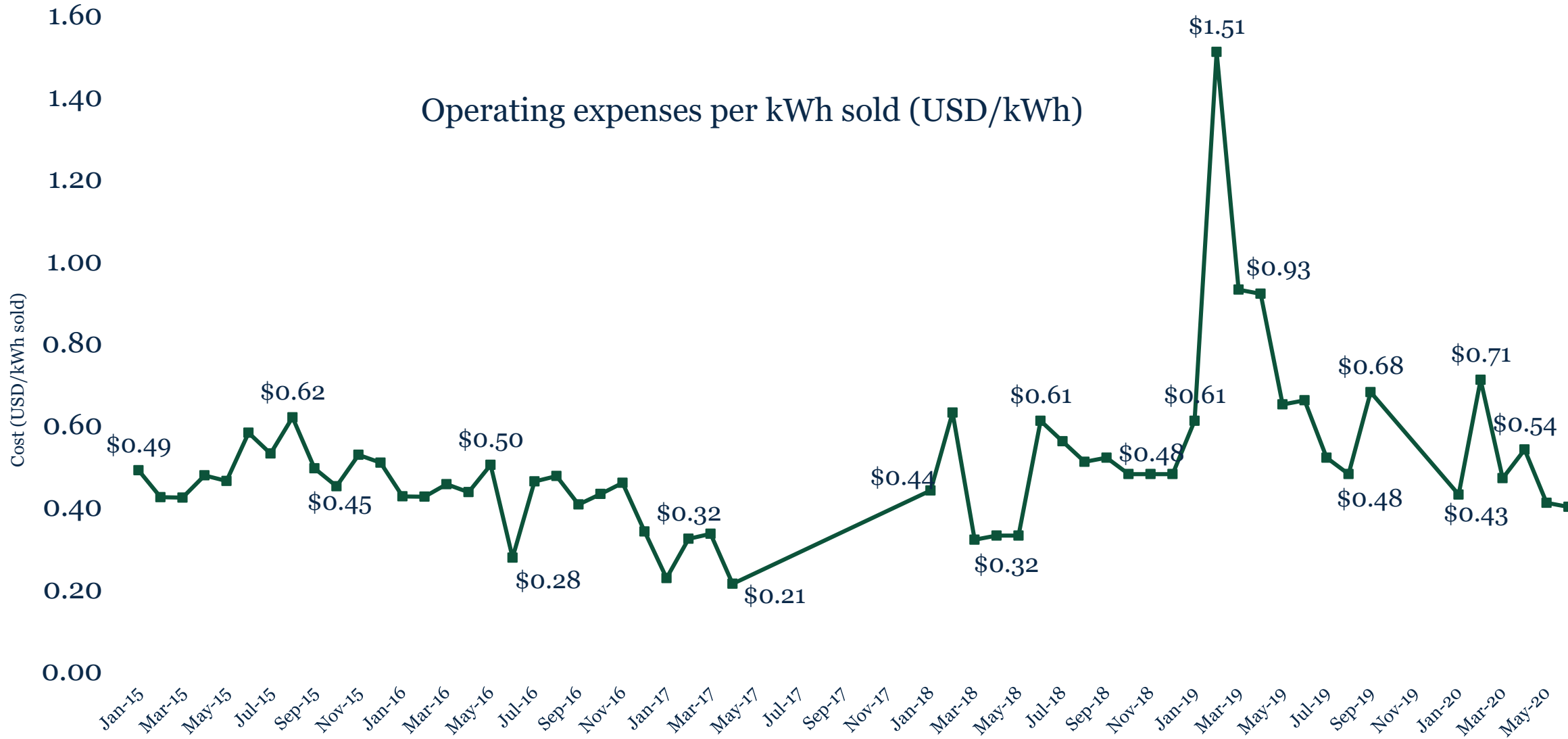


# Network performance

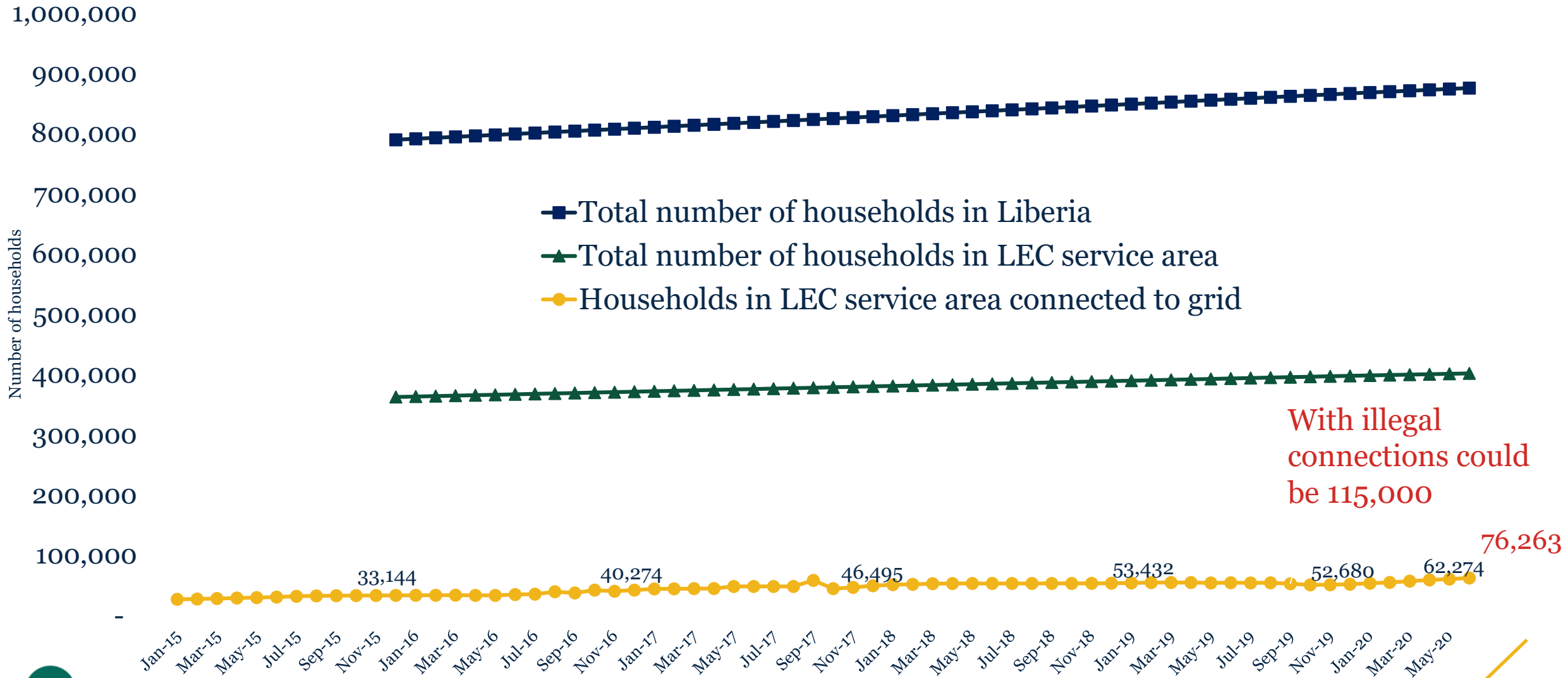
System average interruption frequency / duration index (SAIFI, SAIDI)



# Operating costs



# Trend data on customer numbers



# Utility level outcomes: Key Performance Indicators

## Aggregate technical and commercial losses (percent)

- Baseline: 43-70
- Target: 35
- Result:
  - 2018: 62-80
  - 2019: 69.8
  - 6/2020: 67.6

## Network performance (hours per customer)

- Baseline: 500
- Target: 400
- Result:
  - 2018: 187
  - 2019: 261
  - 6/2020: 243 (6 months)

## Operating cost per kilowatt (kWh) billed

- Baseline: \$0.47-\$0.64 per kWh
- Target: \$0.45
- Result:
  - 2018: \$0.47
  - 2019: \$0.77 (missing Oct-Dec)
  - 6/2020: \$0.49 driven by \$0.71 Feb fuel cost

## Number of new connections per month

- Baseline: 6,600
- Target: 25,000
- Result:
  - 2018: 359 per month
  - 2019: 240 per month
  - 2020: 1,772 per month

## Total

- Baseline: 35,000
- Target: 94,000
- Result:
  - +37,605 since 2015
  - 2018: 62,000, 115,000 with illegal
  - 76,263 (CMC-2020)

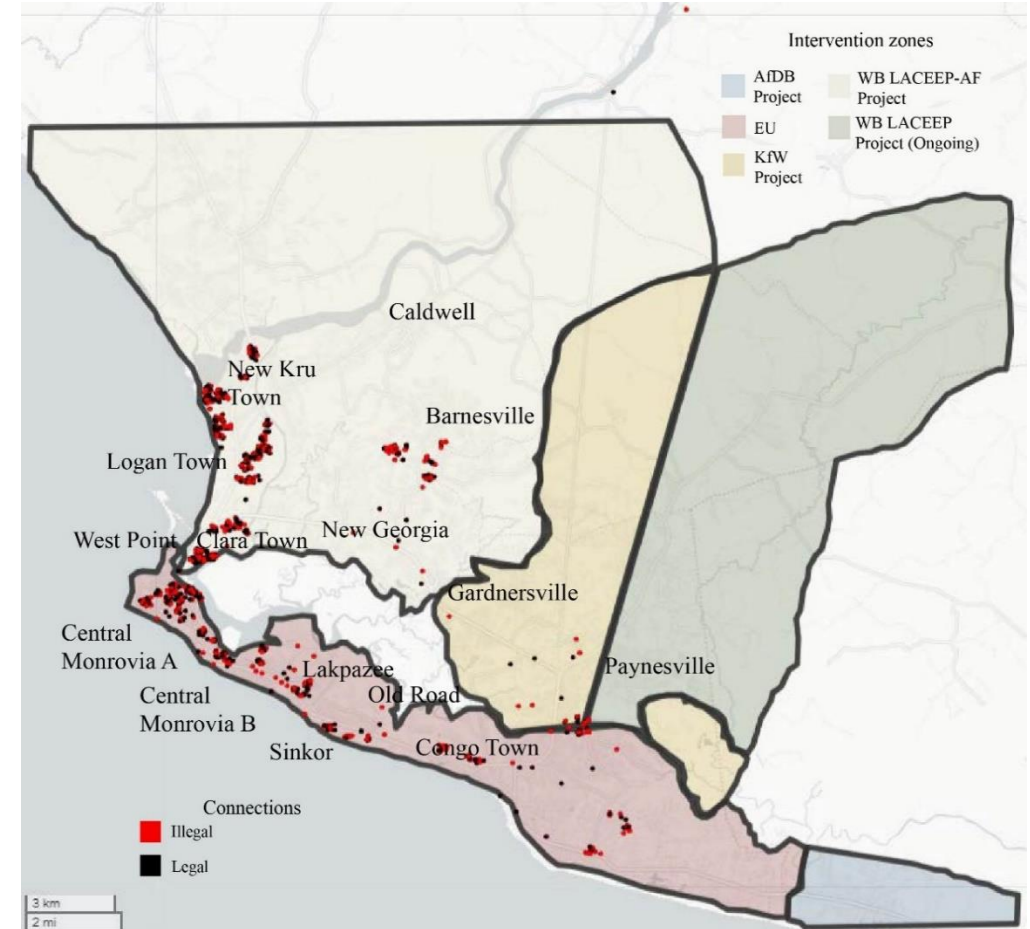
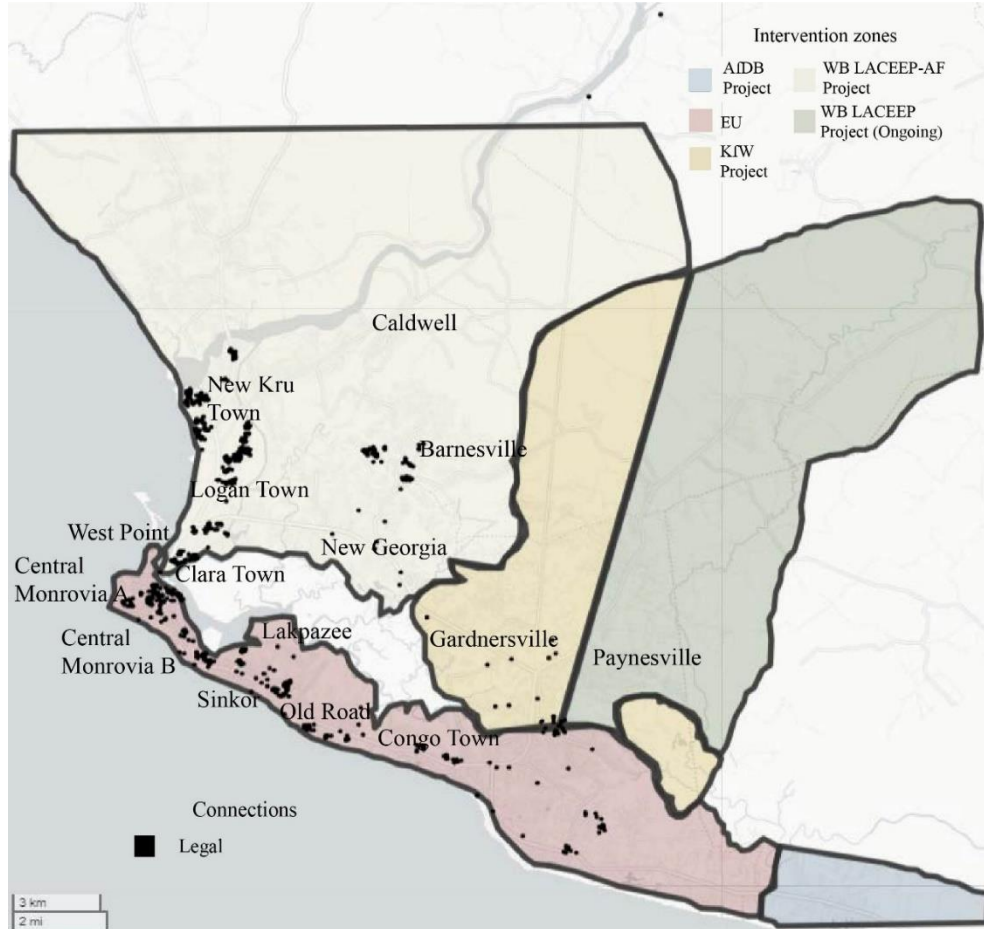


# End user level outcomes

- New end user connections were far less than anticipated however, illegal connections proliferated across donor project areas.
- Liberians place high value on electricity and have high demand for electricity.
- Once connected, many respondents report improved quality of life, increased asset ownership, changes in time use, and improved safety.
- Respondents also warn that electricity presents safety risks and communities require education on electricity safety.

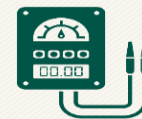


# Legal and illegal connections in donor project zones



## Meter sharing

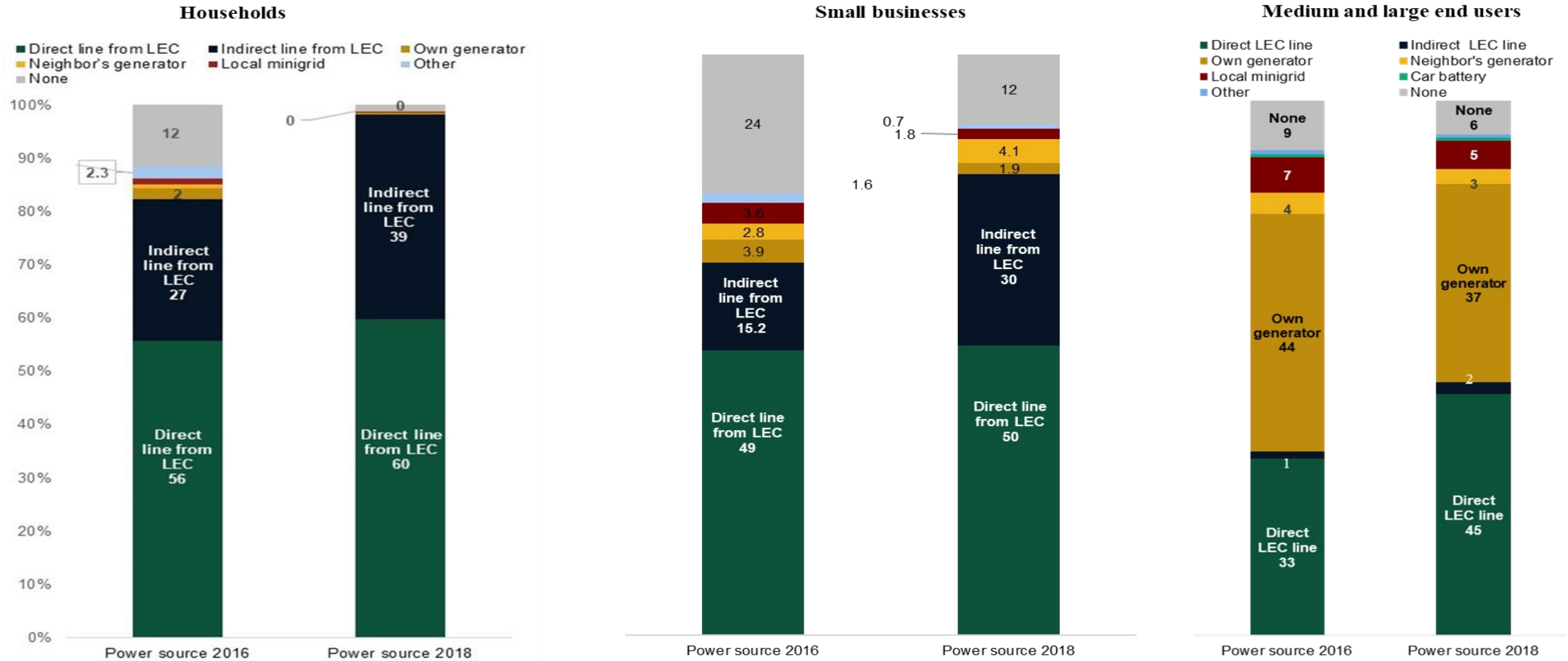
- 37% of households
- 27% of small businesses share a meter
- Those sharing meters include family, friends, neighbors, and businesses



## Average number of users per meter

- 4.2 among households
- 2 users among small businesses

# Main electricity source 2016-2018 connected end users

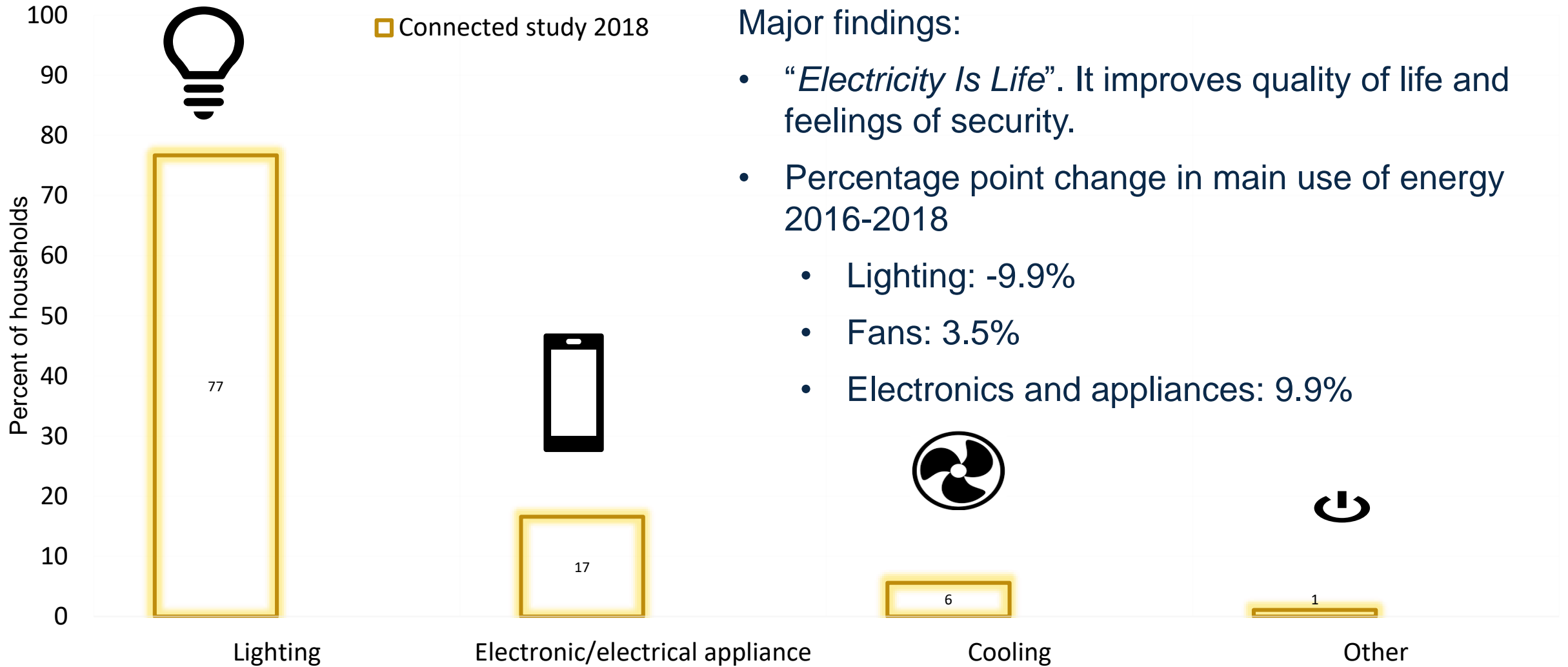


**Percentage point change in main source of electricity from 2016 to 2018**

<p><b>Households</b></p> <ul style="list-style-type: none"> <li>• Direct LEC line: +4**</li> <li>• Indirect LEC line: +12***</li> <li>• No electricity: -10***</li> </ul>	<p><b>Small businesses</b></p> <ul style="list-style-type: none"> <li>• Direct LEC line: +1</li> <li>• Indirect LEC line: +15***</li> <li>• No electricity: -12***</li> </ul>	<p><b>Medium and large end users</b></p> <ul style="list-style-type: none"> <li>• Direct LEC line: +12**</li> <li>• Indirect LEC line: +1</li> <li>• Generator: -7</li> <li>• No electricity: -2/9</li> </ul>
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\*/\*\*/\*\* Indicates statistical significance at the .05/.01/.001 level with a two-tailed test.

# Main use of electricity in households (any electricity source)



## Major findings:

- “*Electricity Is Life*”. It improves quality of life and feelings of security.
- Percentage point change in main use of energy 2016-2018
  - Lighting: -9.9%
  - Fans: 3.5%
  - Electronics and appliances: 9.9%

# Quotes on electricity

*“This is the 21st century, and you can’t live without current.”*

*“Current is life and it provides comfort.”*

*“Normally you won’t want to be in darkness, that’s why we always need light.”*

*“I don’t think Liberians want to be in darkness. People what to enjoy current (electricity), watch videos, charge our laptops, and entertain ourselves. People don’t want to always find themselves in difficult times.”*



# Summary of key findings

- **Successful MCHPP rehabilitation (Liberia's largest energy asset)**

- LEC unprepared to assume MCHPP operations, maintenance, training (OMT).
- Inadequate payments to OMT risks turbine or plant failure, performance losses, extended outages, higher rehab costs and emergency situations.

- **LEC continues to face a grave financial situation**

- However, the management services contract (MSC) Electricity Supply Board International (ESBI) has achieved some success.
- LEC requires increased funding for operating and capital expenses, sustained donor and government support to continue operations.
- LEC management and leadership is critical moving forward.
- URGE the GOL to use all mechanisms to champion the energy sector, reduce corruption and losses, and ensure LEC becomes a functional, profitable utility company.

- **Liberians value and demand "LEC current"**

- "Electricity Is Life". It improves quality of life and feelings of security.
- Limited education and low quality infrastructure present safety risks.



# Future considerations

## LEC

- *“Keep the patient alive.”* Operations improving, functional utility essential to energy goals
- Condition future funding on installing qualified LEC Board members
- Focus on reducing fraud, errors, corruption
  - Identify all drivers and sources of loss at LEC
  - Develop theory- and evidence-based approaches (technical and behavioral)
  - Involve LEC board, donors, GoL, media

## LEC continued:

- Adequately fund operating and capital expenditures
- Ongoing professionalization of Senior Resource Training Pool critical
- Add a contracts manager to ESBI to oversee all T&D plans

## MCHPP:

- Minimize risks. Maintain oversight.
- Ensure GoL understands preventive maintenance is essential
- LEC, GOL to become the steward
- Other financing models

# Lessons learned

- Donor collaboration can be successful
- Establish clear lines of authority for each agency
- Ensure that contracts align with the infrastructure needs
- Plan as systematically for the operations as the rehabilitation
- Estimate cost of completion assuming a catastrophic event to give the program a better chance to succeed
- Conduct a utility- and country-level PEA to understand the context
- Build compact and contracts to account for high likelihood of corruption
- Assume MSC will face immense challenges; apply all lessons from the literature
- Build in preconditions and identify leverage to ensure board and government accountability
- Operate as a donor block in extremely poor, post-conflict countries

*“The challenges involved are immense and should not be underestimated.” National Energy Policy 2009*