

Introduction - AEMR	Agenda	Problem Context	Key Insights & Recommendations	Energy Outages & outage reason	Forced outages	Outage duration and recovery tim..
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American Energy Market Regulator (AEMR) Executive Presentation

By Bart Teeuwen

Date: 1/20/2020

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Topics of Discussion:

- Client introduction
- Problem context
- Key insights & recommendations
- Energy outages & outage reasons
- Forced outages
- Outage duration & recovery time
- Energy outages by energy provider
- Energy outage recovery time by energy provider
- MW Loss and outage duration by energy provider
- Q&A



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The client:

- The American Energy Market Regulator (AEMR)
- Responsible for America’s energy network reliability

The problem:

- Increase of outages from 2016/2017
- Primarily forced outages
- Threat to energy network

To avoid this, AEMR’s management wants the consultant to look into

- A) Energy Stability and Market Outages
- B) Energy Losses and Market Reliability

The solution:

Analyze the US energy market to find out what is causing the increase in outages, who is responsible, and how the AEMR can take action to preserve the energy market stability & reliability.



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Key insights & recommendations

Insights

ENERGY STABILITY & MARKET OUTAGE

- **Outages**
 - Forced outages increased by 28% between 2016 and 2017
 - Most outages reported are forced (e.g., triggered by external factors)
- **Outage duration**
 - Forced outages take between 2.5 hours and 77.5 hours (~3 days) to resolve with the majority averaging less than 1 day
 - Planned outages take between 32 hours and 345 hours (~14 days) to resolve with the majority averaging 6 days

ENERGY LOSSES & MARKET RELIABILITY

- **Energy providers**
 - Some energy providers reported less outages over time while others reported more outages
 - Energy providers AURICON, GW, MELK, AUXC, and TRMOS reported most forced outages
 - Outage recovery time was mostly under 1 minute, except for ENRG, KORL, and MELK (2 to 4.5 hrs)
- **MW Loss**
 - MW loss due to forced outage rose to 82K MW over 2017
 - MW loss differed by energy provider and outage duration
- **Unreliable energy providers**
 - AURICON, GW, MELK, AUXC, and TRMOS account for the majority of outages
 - AURICON, GW, and MELK had the highest summed MW loss of all energy providers
 - MELK, COLLGAR, PMC, TSLA_MGT, and KORL had the biggest AVG MW loss
 - MELK, ENRG, and KORL had the longest recovery time in minutes

Recommendations

1. **Design energy outage forecasting model** – Design data-sharing system with energy providers to monitor and forecast outages as a means to prevent outages or limit the MW loss
2. **Establish SLAs for minimum energy supply & quality control** – measure to force energy providers to organize their energy supply for minimum supply, regardless of outages
3. **Bi-annual review of energy provider performance** – rate energy provider performance every 6 months if the number of outages are above average
4. **Establish energy backup requirement for energy providers** – require energy providers to have a backup in case outages force the energy supply to drop

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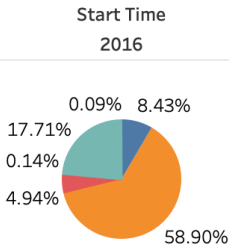
Agenda	Problem Context	Key Insights & Recommendations	Energy Outages & outage reason	Forced outages	Outage duration and recovery times	Energy outages by energy provider
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2017 saw 17% more outages than in 2016, with the majority as "Forced" outage type.

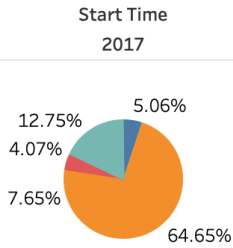
Outages between 2016/2017



Top reasons for outages in 2016



Top reasons for outages in 2017



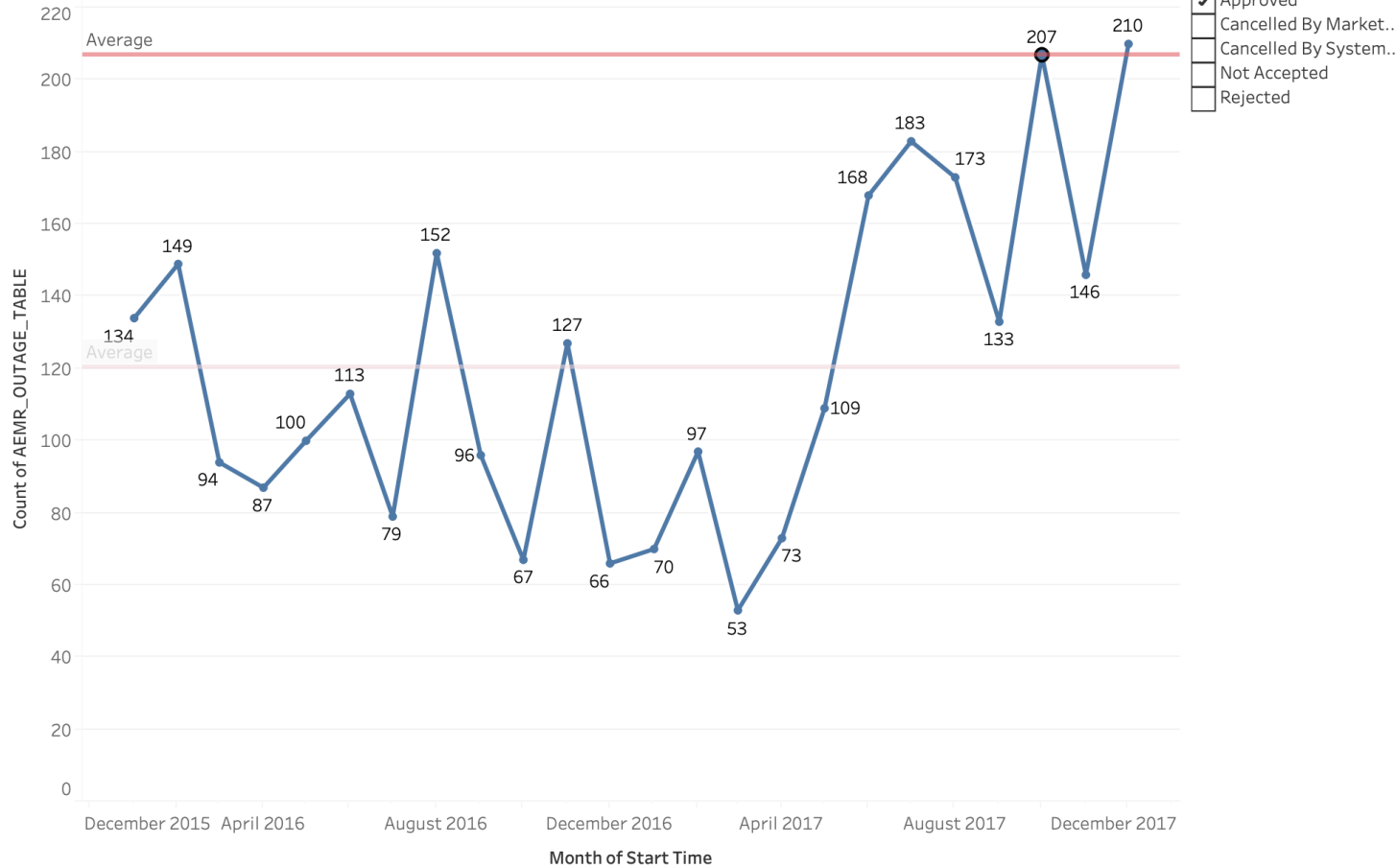
- Reason
- Consequential
 - Forced
 - Opportunistic Maintenance (Planned)
 - Scheduled (Planned)
- Status
- Accepted
 - Approved
 - Cancelled By Market Participant
 - Cancelled By System Management
 - Not Accepted
 - Rejected

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Problem Context	Key Insights & Recommendations	Energy Outages & outage reason	Forced outages	Outage duration and recovery times	Energy outages by energy provider	Energy outage recovery time by energy provider
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The forced outages mostly stayed below the average of 120/month in 2016, but has increasingly risen throughout 2017

Forced Outages by Month



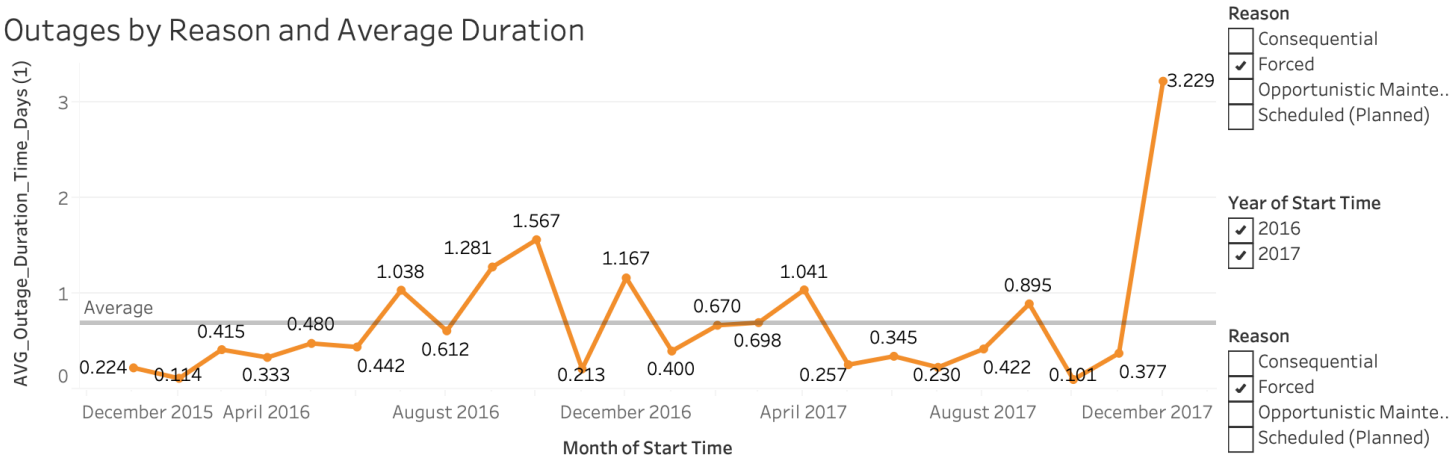
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Key Insights & Recommendations	Energy Outages & outage reason	Forced outages	Outage duration and recovery times	Energy outages by energy provider	Energy outage recovery time by energy provider	MW loss and outage duration by energy provider
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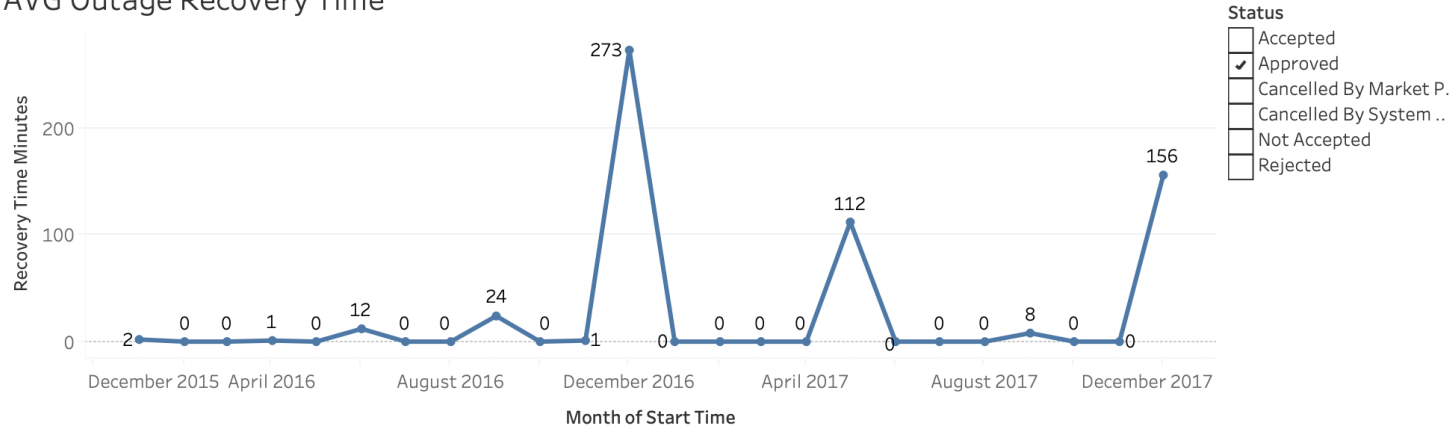
On average the duration of outages was less than 1 day (0.69) with longer outages in Q3 and Q4 2016

Most outages were resolved in less than a minute, with the exeption of some outages in months that took up to 11 days

Outages by Reason and Average Duration



AVG Outage Recovery Time



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Energy Outages & outage reason	Forced outages	Outage duration and recovery times	Energy outages by energy provider	Energy outage recovery time by energy provider	MW loss and outage duration by energy provider	Concluding summary
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As we drill down to the energy provider level, we can see that AURICON, GW, MELK, AUXC, and TRMOS account for the majority of outages

Outages by energy provider

Participant ..	Start Time	
	2016	2017
AURICON	208	490
GW	317	227
MELK	157	177
AUXC	206	120
TRMOS	65	172
PUG	24	135
PJRH	81	72
KORL	53	76
PMC	69	40
COLLGAR	29	45
STHRNCRS	13	18
ENRG	21	7
MUND	4	15
EUCT	11	3
MCG	1	12
WGUTD	2	8
TSLA_MGT	2	4
DNHR	1	1
Grand Total	1,264	1,622

Outages by energy provider %

Participant ..	Start Time	
	2016	2017
AURICON	16.46%	30.21%
GW	25.08%	14.00%
MELK	12.42%	10.91%
AUXC	16.30%	7.40%
TRMOS	5.14%	10.60%
PUG	1.90%	8.32%
PJRH	6.41%	4.44%
KORL	4.19%	4.69%
PMC	5.46%	2.47%
COLLGAR	2.29%	2.77%
STHRNCRS	1.03%	1.11%
ENRG	1.66%	0.43%
MUND	0.32%	0.92%
EUCT	0.87%	0.18%
MCG	0.08%	0.74%
WGUTD	0.16%	0.49%
TSLA_MGT	0.16%	0.25%
DNHR	0.08%	0.06%
Grand Total	100.00%	100.00%

Outages by Participant % Delta

Participant ..	Start Time	
	2016	2017
PUG		234.0%
MCG		137.5%
TRMOS		135.9%
AURICON		105.9%
WGUTD		50.0%
KORL		34.5%
COLLGAR		14.1%
DNHR		8.3%
PJRH		3.9%
MELK		1.3%
MUND		0.0%
TSLA_MGT		-1.6%
STHRNCRS		-14.6%
ENRG		-20.7%
GW		-31.3%
PMC		-34.2%
AUXC		-39.6%
EUCT		-48.6%

% of Total Count of AEMR_OUTAGE_TABLE

0.06%

30.21%

Reason

☐ Consequential

☒ Forced

☐ Opportunistic Maintenance (Planned)

☐ Scheduled (Planned)

Status

☐ Accepted

☒ Approved

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Year of Start Time

☒ 2016

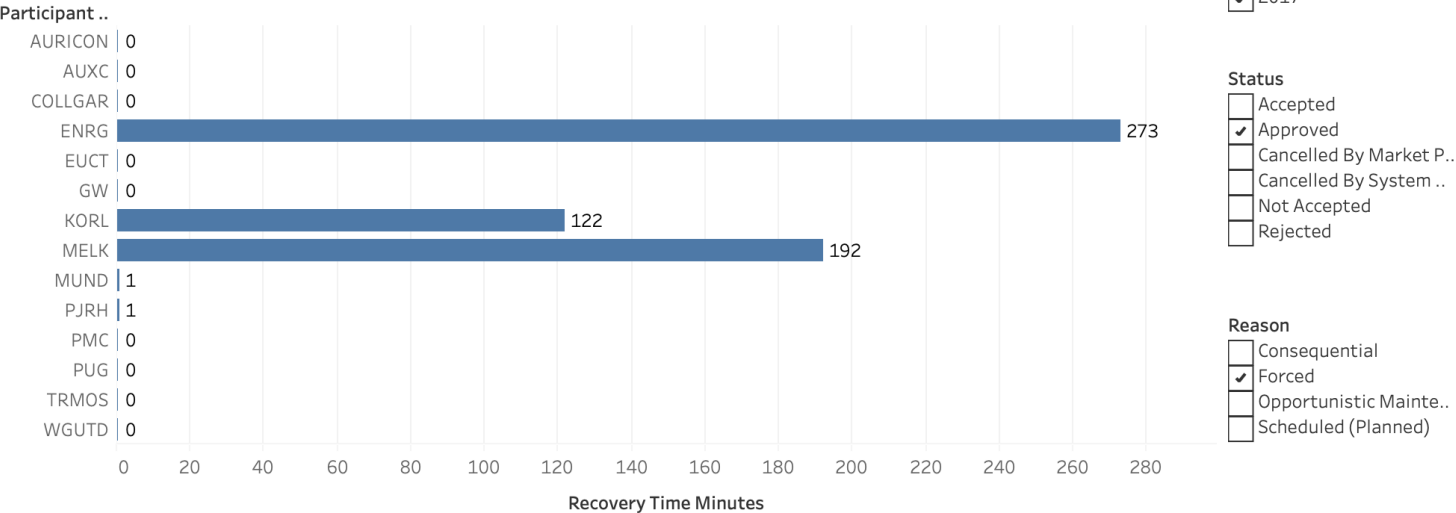
☒ 2017

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Forced outages	Outage duration and recovery times	Energy outages by energy provider	Energy outage recovery time by energy provider	MW loss and outage duration by energy provider	Concluding summary	Q&A
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Energy providers with the biggest recovery time are ENRG, MELK, and KORL

Outage recovery time in minutes by energy provider



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Energy providers with the biggest MW loss based on AVG outage duration in days are AURICON, PMC, GW, PJRH, and MELK

Year of Start Time

☒ 2016

☒ 2017

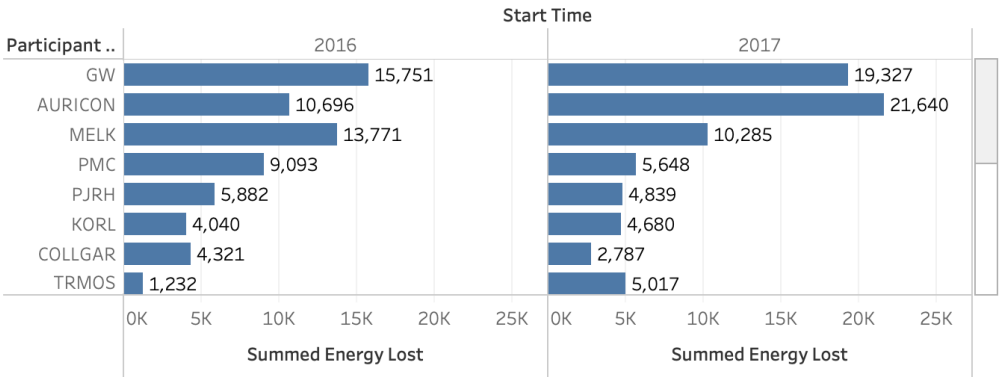
Energy providers with the highest avg MW loss are COLLGAR, PMC, MELK, TSLA_MGT, and KORL

Year of Start Time

☒ 2016

☒ 2017

Summed MW loss & AVG Outage Duration by year and energy provider



Summed MW Loss

Start Time	2016	2017
	70,301	82,007

Status

☐ Accepted

☒ Approved

☐ Cancelled By Market P..

☐ Cancelled By System ..

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Reason

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☒ Forced

☐ Opportunistic Mainte..

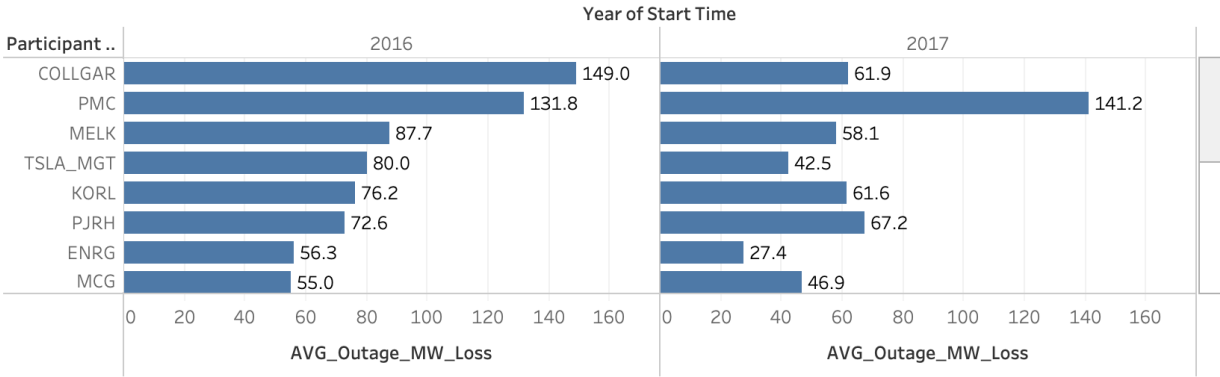
☐ Scheduled (Planned)

Year of Start Time

☒ 2016

☒ 2017

AVG MW loss by year and energy provider



Status

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Conclusion

AEMR Problem

- Increase of energy outages from 2016/2017
- Focus on forced outages due to impact on the energy network and reliability
- Analysis of energy outages to find cause and solutions

Key Learnings

- The number of outages increased in 2017, in particular forced outages
- Outages typically last from several hours to multiple days – a hazard for the energy supply
- Outages mostly different by provider and year, but only a few providers had the most outages
- Most energy providers recovered quickly from outages, with a select few taking longer than expected
- Outages and slow recovery time made up about 82K in MW loss over 2017
- The MW loss isn't dependent on outage duration only
- Energy provider MELK was the #1 most unreliable overall based on outages, MW loss, and recovery time

Recommendations

1. Design energy outage forecasting model
2. Establish SLAs for minimum energy supply & quality control
3. Bi-annual review of energy provider performance
4. Establish energy backup requirement for energy providers

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THANK YOU!