GATESAIRCONNECT VIRTUAL events

TOTAL COST OF OWNERSHIP (TCO):

THE ECONOMICS OF DEPLOYING HIGH-EFFICIENCY TRANSMITTERS

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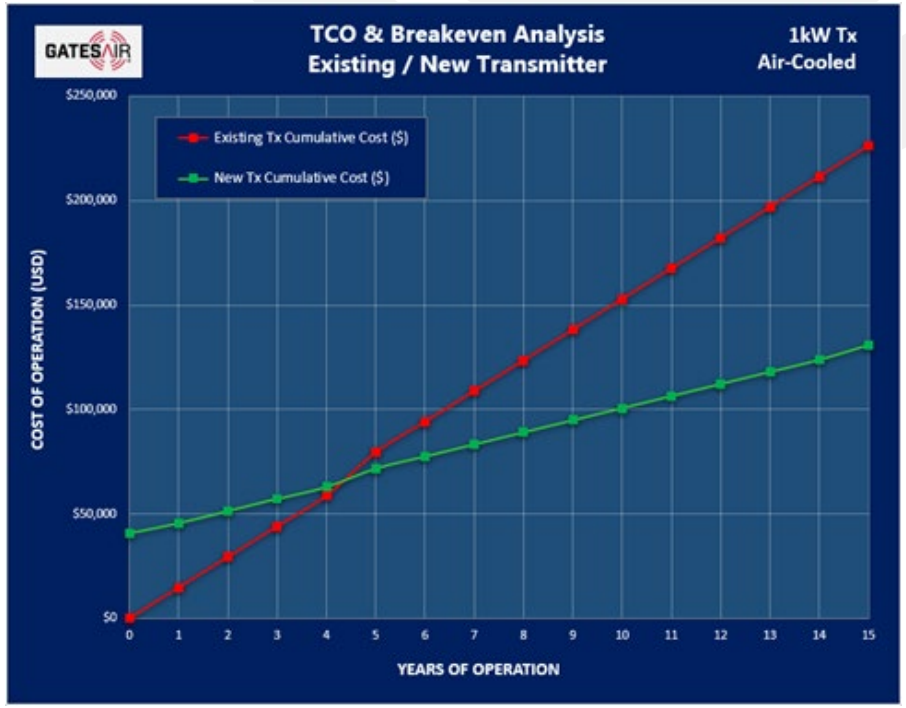
TOTAL COST OF OWNERSHIP (TCO)

Today's Virtual Event Topic

- High-efficiency transmitters are the cornerstone of low TCO, though many other factors are equally important.
- Today we will look at all the major drivers of total cost of ownership, including repairability, modularity, footprint, and several other factors that can help you select a reliable transmitter that will provide you cost-effective operation throughout the life of the product.

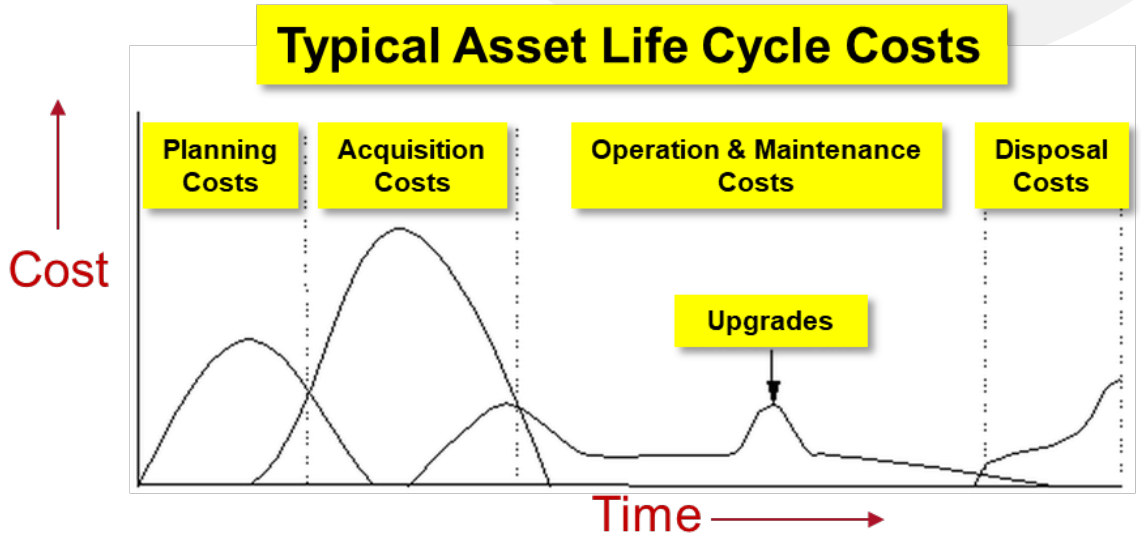


TOTAL COST OF OWNERSHIP DEFINITION

There are many definitions for TCO, these fit best:

1. **"Total Cost of Ownership is the total cost of acquisition and operating costs over the asset life cycle".** A TCO analysis can be used to gauge the viability of any capital investment.

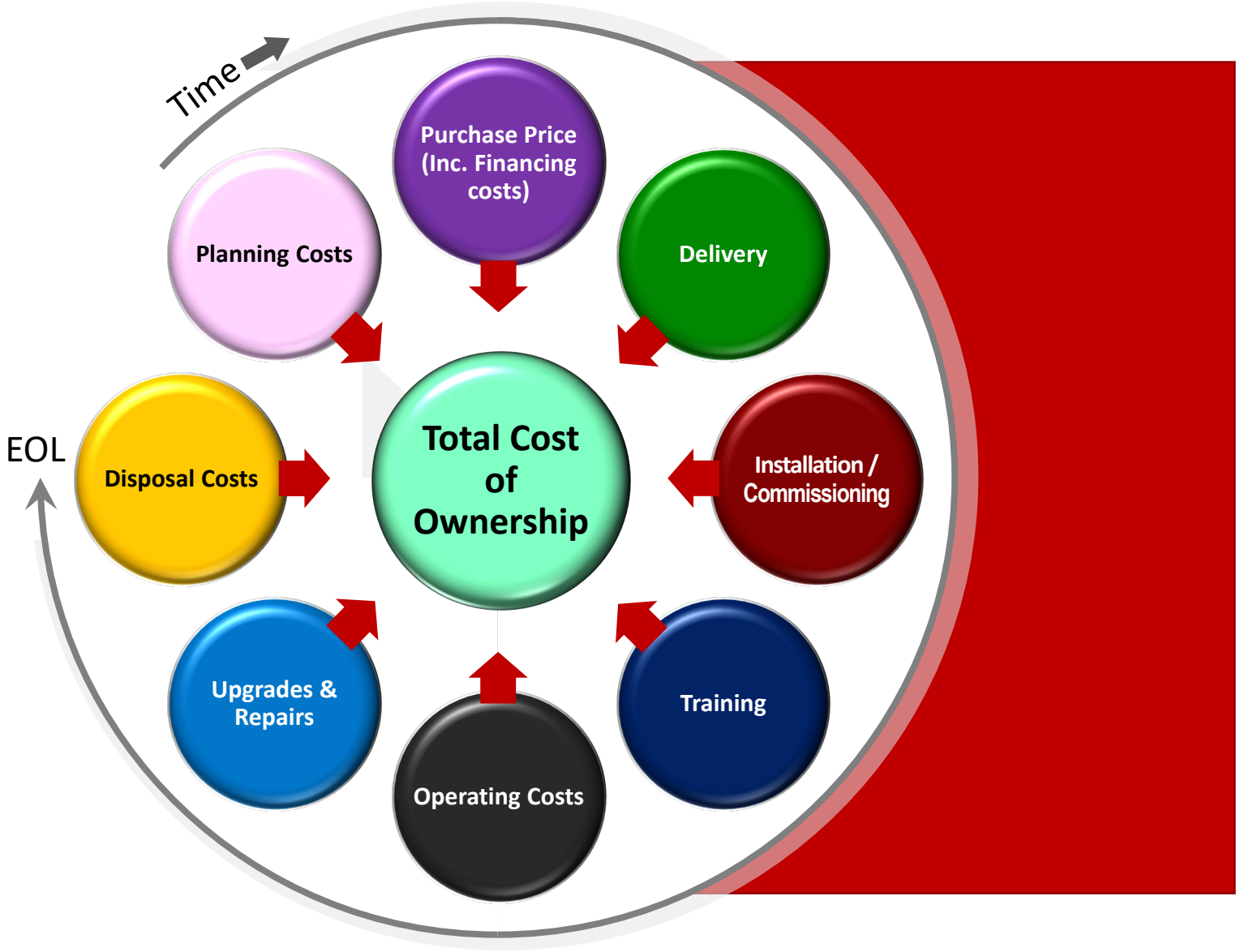
2. **"Total cost of ownership (TCO) is an analysis that places a single value on the complete life cycle of a capital purchase".** This value includes every phase of ownership: acquisition, operation, and the softer costs of change management that flows down from acquisition such as documentation and training.



Courtesy: http://www.wilsonmar.com/1tco.htm

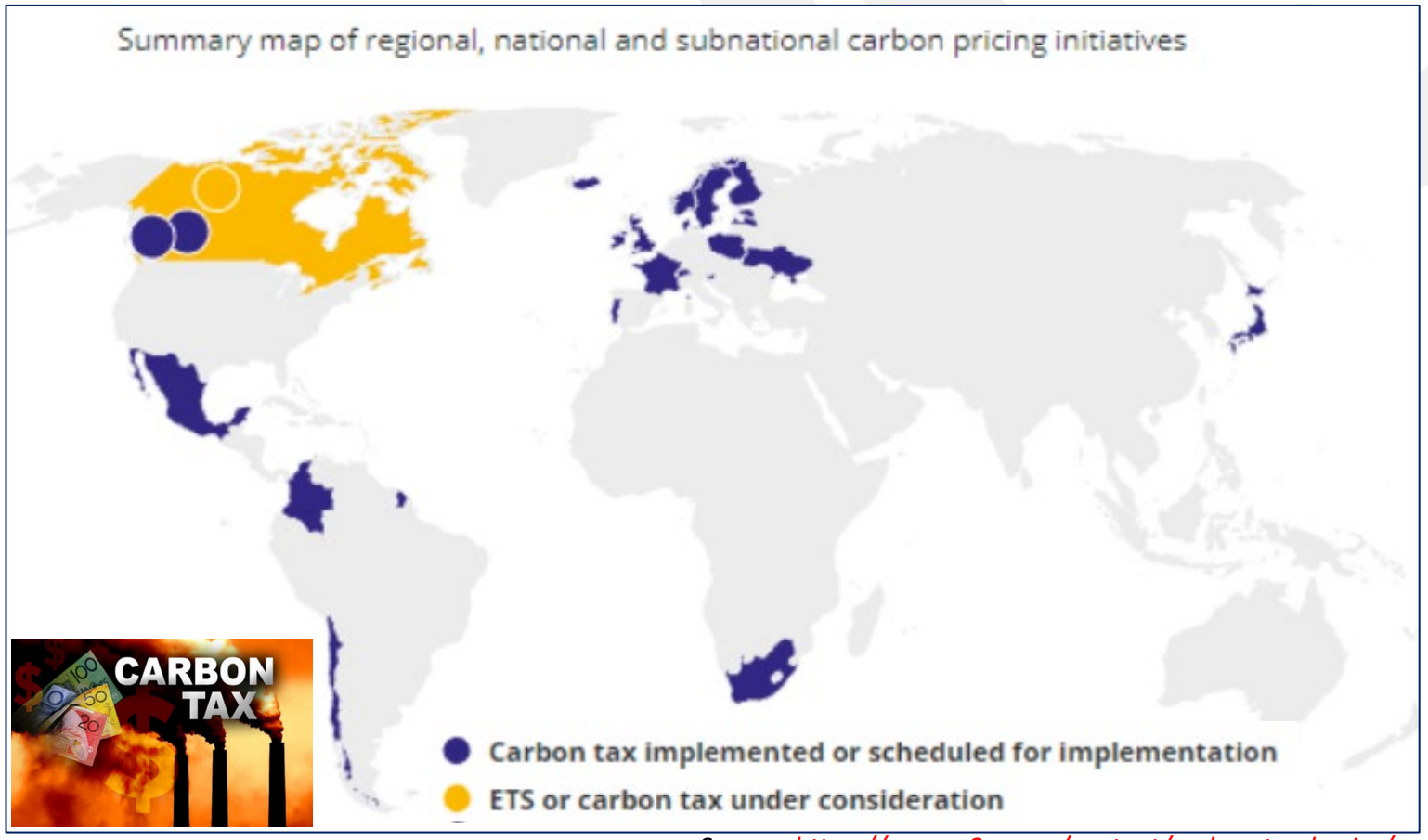
LIFE CYCLE COSTS

- Look beyond the purchase price
- Other things must be considered
- Significant operational costs:
  - Electricity
    - Transmitter
    - HVAC
  - Maintenance & Repair cost factors
    - Reliability (MTBF / TTF)
    - Time To Repair (MTTR)
    - Cost of replacement parts / availability
    - Site visit costs - Factory Technician (travel/labor/per diem)



CARBON TAX

- Some countries either have implemented or are considering implementing “Carbon Tax”
- Based on Tons of CO2 emitted to the atmosphere
- In some cases taxes are levied to utility companies or businesses that consume electrical power
- Just another reason to replace old inefficient equipment and replace with modern high efficiency products
- Go Green!



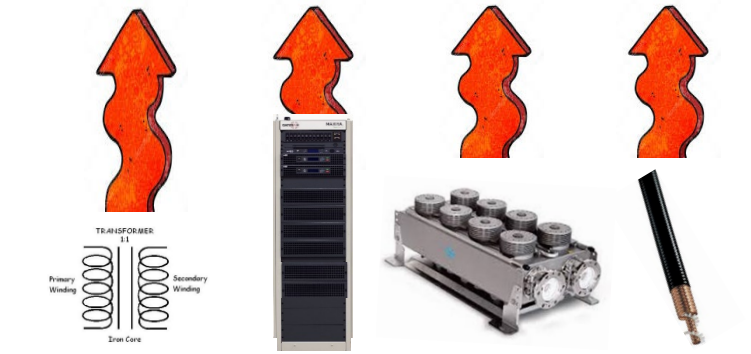
Source: https://www.c2es.org/content/carbon-tax-basics/

TCO VERSUS TRANSMITTER EFFICIENCY

TCO

- It's the total cost to own and operate the transmitter system over time
- Includes initial equipment cost and delivery
- Includes the installation / commissioning costs
- Routine and unscheduled maintenance costs
- Repair/replacement and other operational costs

Energy converted to heat

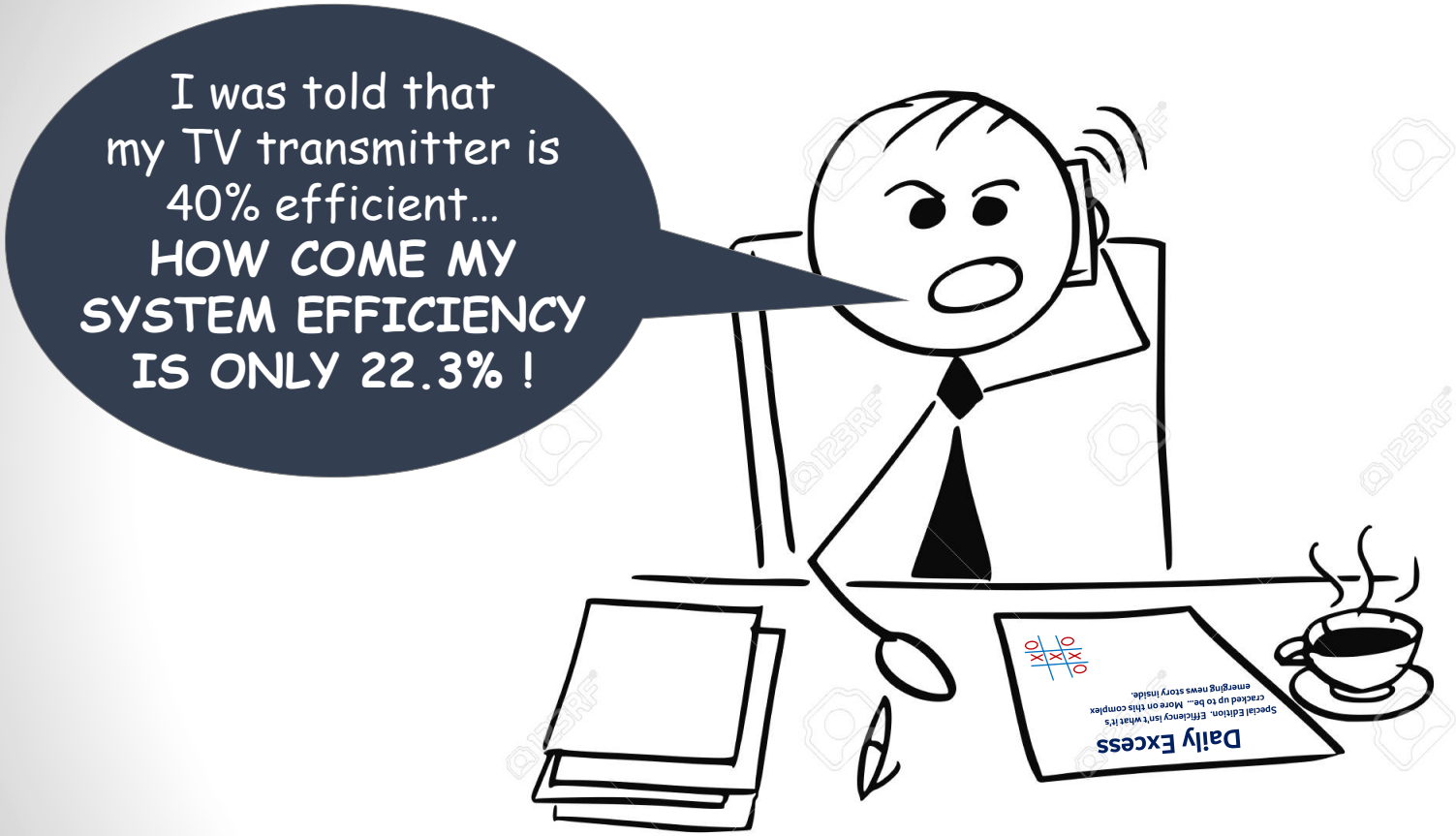


Transformer Transmitter Filter RF Line

EFFICIENCY

- Transmitter efficiency = Power Out / Power In (tx only)
- System level efficiency may also include::
  - AC transformers and voltage regulators
  - Heat load to the room (HVAC power costs)
  - RF system losses (often significant)
  - RF feeder losses (often significant)
  - Even antenna gain and pattern?

SYSTEM EFFICIENCY



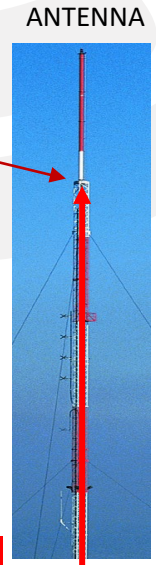
SYSTEM EFFICIENCY - LOSS ANALYSIS

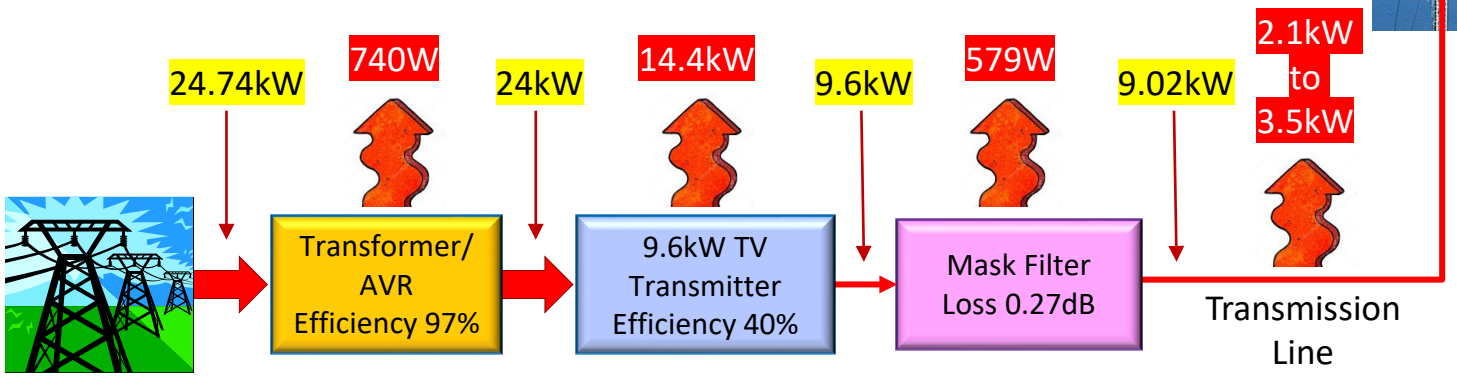
This example uses 200 meters transmission line. Frequency 560MHz.

Ch 29 (560MHz)										
Line size / type	Loss/ 100ft (dB)	Line Loss (dB) 200 meters (656ft)	Mask Filter Loss (dB)	Total Loss (dB)	Tx Power (kW)	Antenna Input Power (kW)	Tx AC Input Power (kW)	AVR Efficiency	AC Input Power	System Efficiency
3" Flex HCA-300-50J	0.325	-2.132	-0.270	-2.402	9.6	5.52	24	97%	24.74	22.3%
3-1/8" 50 Ohm Rigid	0.220	-1.443	-0.270	-1.713	9.6	6.47	24	97%	24.74	26.2%
4-1/16" 50 Ohm Rigid	0.174	-1.141	-0.270	-1.411	9.6	6.94	24	97%	24.74	28.0%

- The transmitter is only one part
- Adding losses for:
  - AVR
  - Mask Filter (typ. 0.27dB)
  - 200 meters transmission line (See table for losses)
- Assume Tx is 40% Efficient
  - AC input = 9.6/0.40 = 24kW

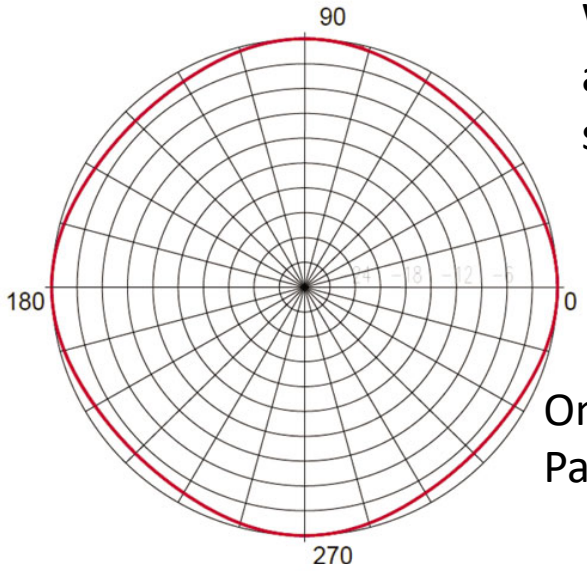
System Efficiency (AC in vs. Power to Antenna) = 22.3% to 28%





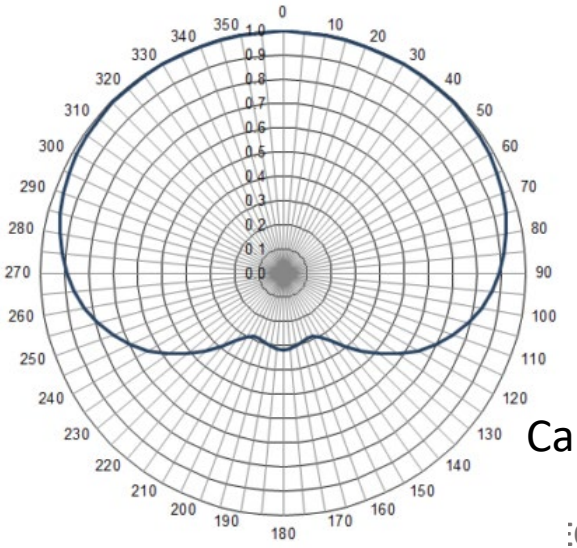
Of the 24.74kW power going into the transmitter, only 5.52kW feeds the antenna!

BAD ANTENNA PATTERN = WASTED POWER



Which is the better antenna to cover the small town of El Cuarto?

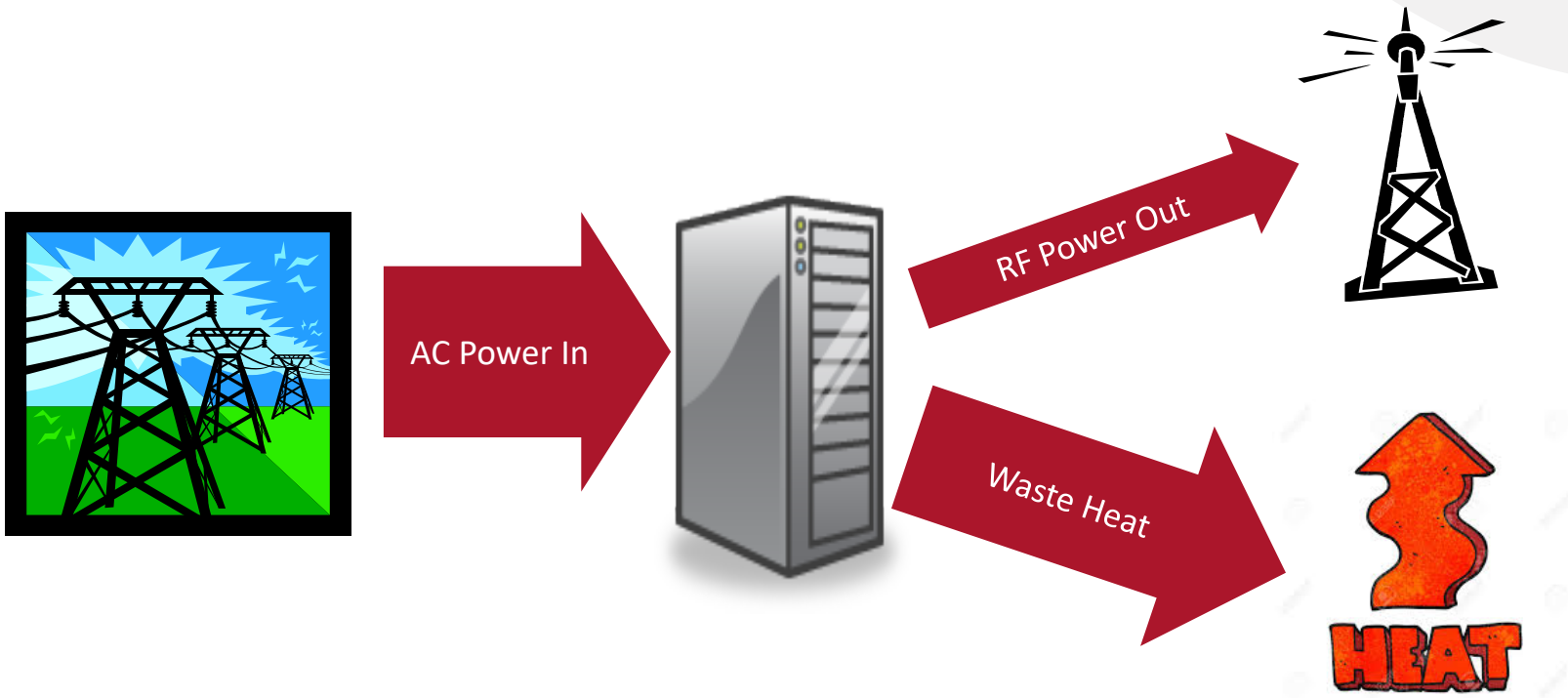
Omnidirectional Pattern



Cardioid pattern

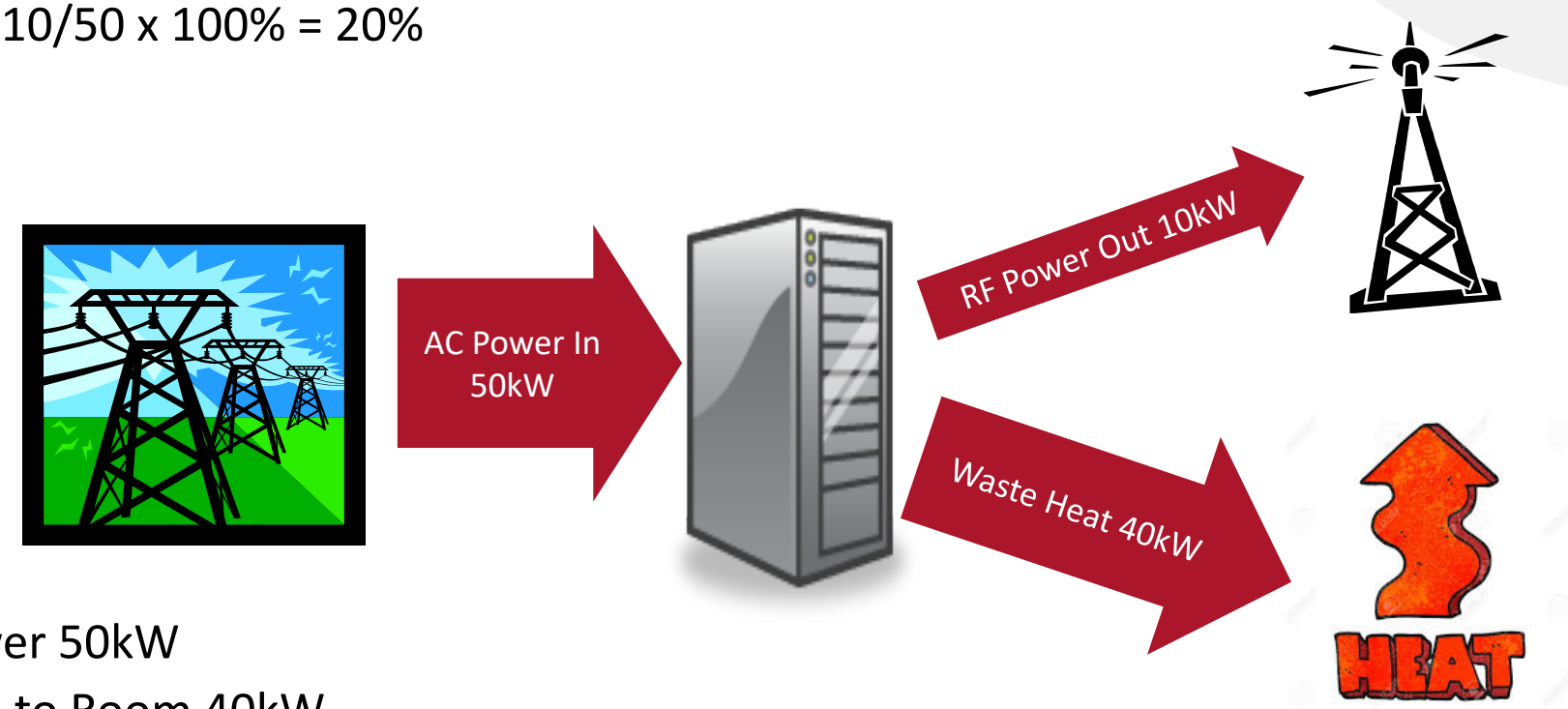
TRANSMITTER EFFICIENCY

- **Efficiency of a transmitter:**
  - Definition: (RF Power Out / AC Power In) x 100%



TRANSMITTER EFFICIENCY

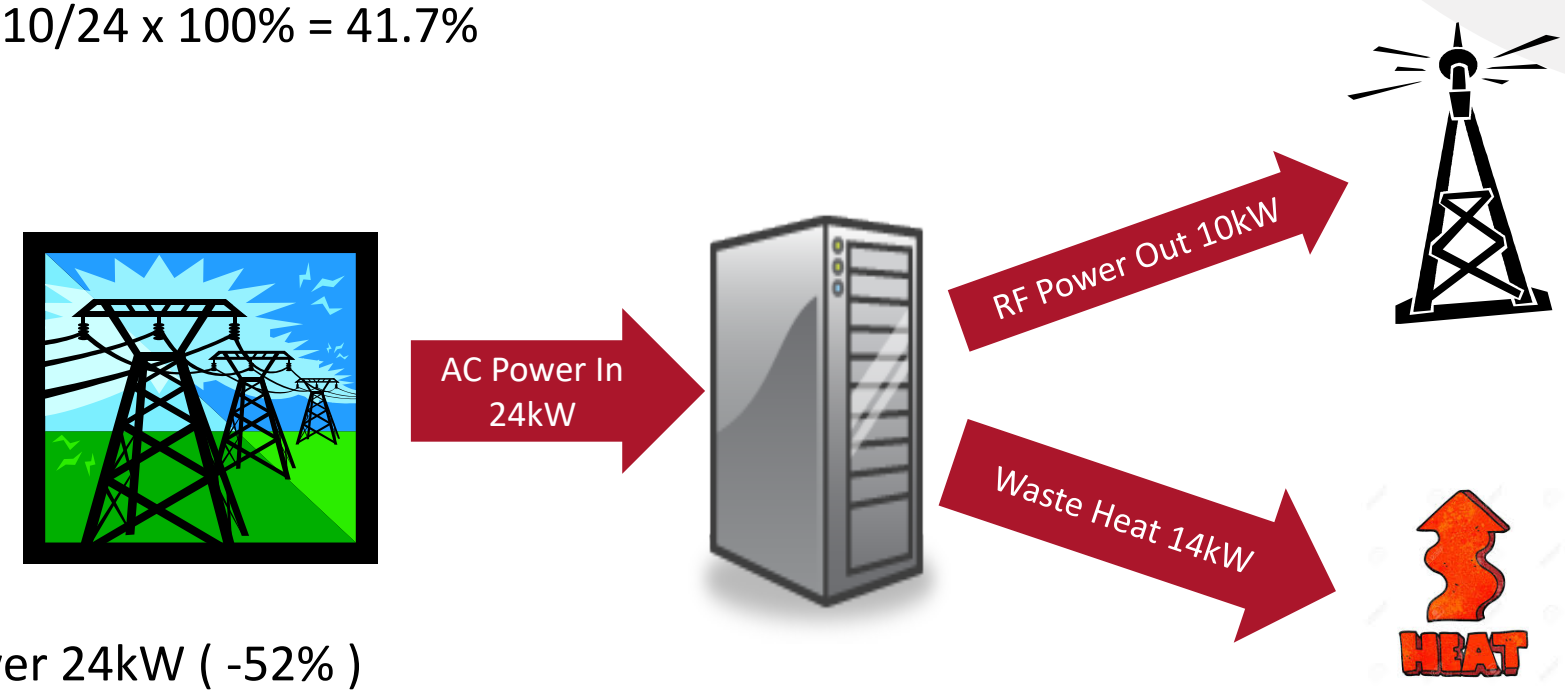
- **Older Technology TV Transmitter**
  - 10kW Class AB UHF DTV Transmitter
  - Efficiency 10/50 x 100% = 20%



  - Input Power 50kW
  - Heat Load to Room 40kW

TRANSMITTER EFFICIENCY

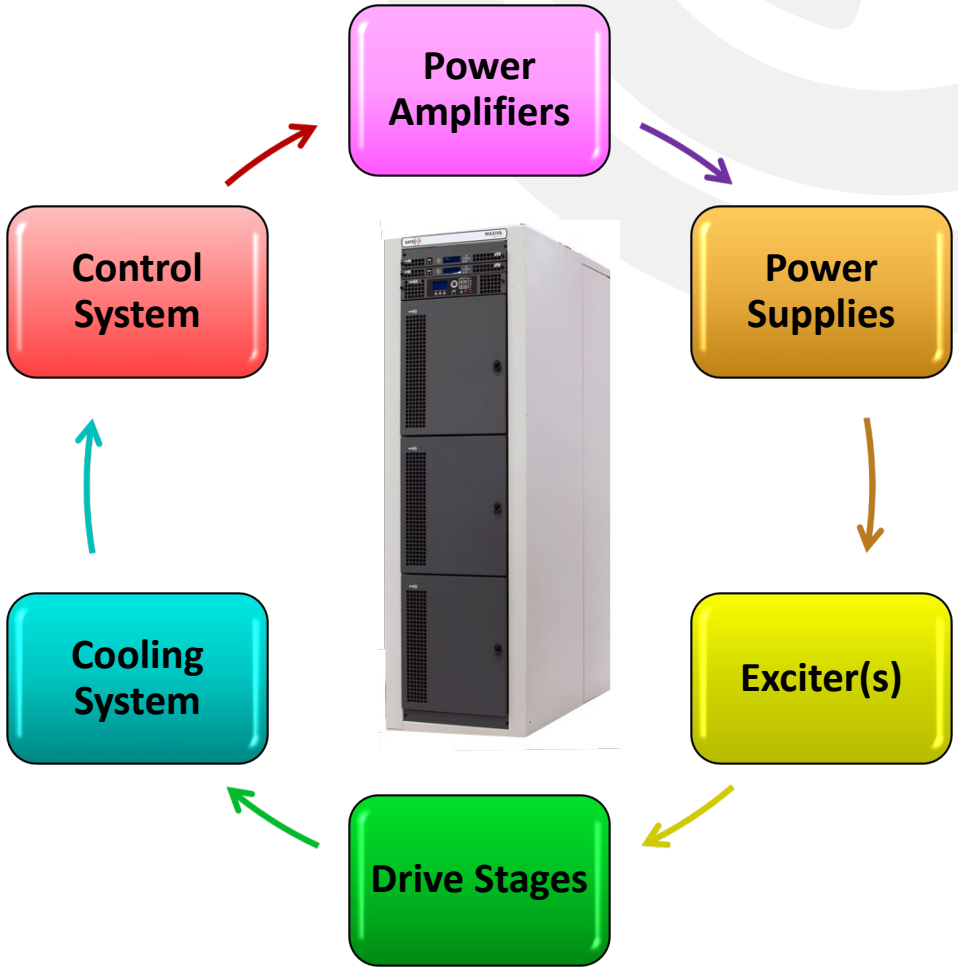
- **Very Efficient TV Transmitter**
  - 10kW High-Efficiency UHF DTV Transmitter (New Generation)
  - Efficiency 10/24 x 100% = 41.7%



  - Input Power 24kW (-52%)
  - Heat Load to Room 14kW (-65%)

TRANSMITTER EFFICIENCY

- Transmitter System Efficiency
- Some Items may have fixed losses:
  - Control System
  - Exciters
- Some Items may have varying losses:
  - PA Module (varies with modulation, saturation)
  - Drivers (varies with modulation, saturation)
  - Cooling System (speed-controlled pumps and fans)
  - Power Supplies (can vary depending on load)
- Why are low power transmitters less efficient than high power?
  - As power is reduced, fixed losses become a larger part of the equation



PRIMARY EFFICIENCY DRIVERS IN A TX

- Power Amplifiers
  - Most older designs used Class AB PA's
    - PA Efficiency in range 23% to 33% (Overall Tx efficiency in range of 16% to 27%)
  - Most new designs uses High-Efficiency (Doherty) PA's
    - PA Efficiency over 50% VHF and UHF (Overall Tx efficiency often > 40%)
- Power Supplies
  - 12 years ago 86% was "state-of-the-art" efficiency
  - Today – power supplies can be up to 96% efficient
- Cooling System
  - Older less efficient transmitters used large high volume and pressure blowers
  - Large pumps and heat exchangers in liquid-cooled transmitters
  - New systems use variable speed fans and pumps and have less heat to remove

EFFECT OF POWER SUPPLY EFFICIENCY

Item	Old Technology PS 86% Effy.	Recent Power Supply 90% Effy	New High Eff. PS 96% Effy.
RF Power Output (W)	10,000	10,000	10,000
Power Amplifier Efficiency	51%	51%	51%
Combining losses (dB)	0.30	0.30	0.30
RF power before losses (W)	10,715	10,715	10,715
DC Power to PA's (W)	21,010	21,010	21,010
Power Supply Efficiency	86%	90%	96%
AC Power to Power Supplies (W)	24,430	23,345	21,886
Power Supply Loss (W)	3420	2334	875
Drivers	600	600	600
Exciters	150	150	150
Control	120	120	120
Cooling	600	600	600
Total AC Input (kW)	29,321	27,149	24,231
Overall Tx Efficiency	34%	37%	41%

- Clearly, the design of the power supply has a significant impact on total efficiency
- Example of a high-efficiency power supply:
  - Efficiency 96% at 50% FL
  - Power factor typ. 0.995
- Input voltage range typ. 185 – 300 VAC

RELIABILITY, MODULARITY & REPAIRABILITY

1. Reliability
   - "*State the transmitter MTBF*" is asked by customers and in bidding documents
   - MTBF for transmitters can be vague in some respects
   - Definition of a "failure"?
     - An LED failing may have no effect on transmitter power, versus a tx controller that could take you off-air
   - A reasonable definition of a "failure" occurring is when RF power drops to below a threshold (such as 80% of nominal)
   - External factors such as AC power problems, transient surges, lightning, etc. can have a dramatic effect on the ability of the equipment to stay operational
- Reliability, MTBF (Mean Time Between Failures), TTF (Time To Failure) and Failure Rate will be discussed in a future Webinar!

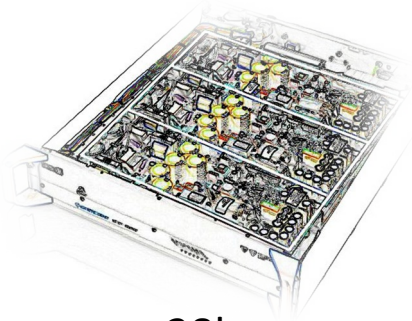
RELIABILITY, MODULARITY & REPAIRABILITY

2. Modularity & Repairability

- A modular approach can greatly ease accessibility which can greatly reduce repair time
- Here is a good example of a PA Power Supply needing to be replaced:

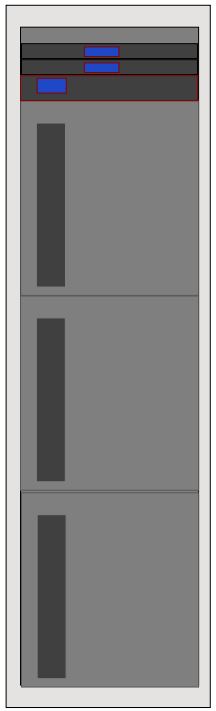
Tx Brand X

PA Module Weighs ~ 62lbs. (28kg).
Power Supply is internal to PA (62lbs.)
Power supply has failed and needs to be replaced.
Heavy PA Module must be removed, hardware removed, parts replaced, re-assembled and module inserted into tx.
2-person operation, several hours.



28kg

Disclaimer - Similarity to any brand is purely coincidental



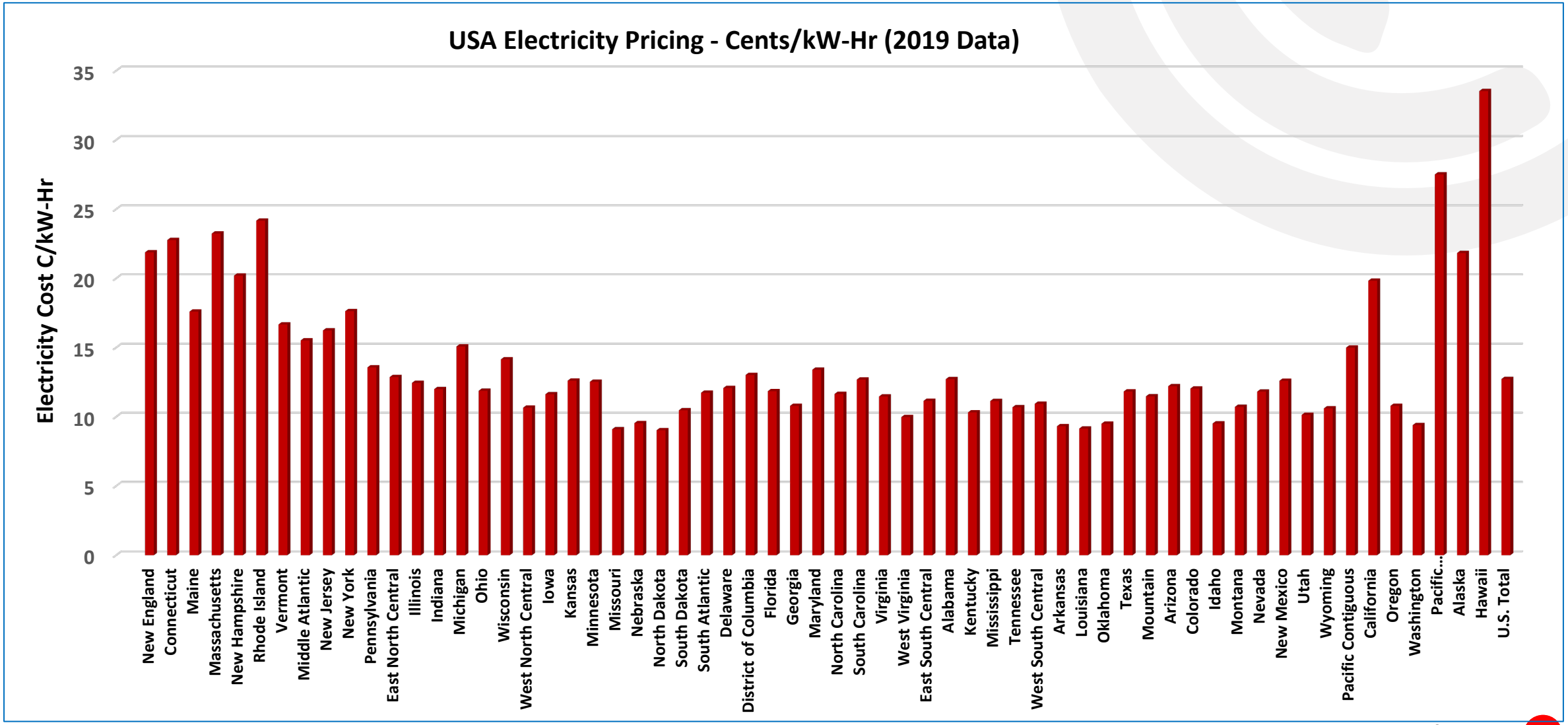
Tx Brand Y

Power Supply is external to PA.
Power Supply weighs < 5lb (< 2.2kg).
Power supply has failed and needs to be replaced.
Unplug power supply and insert a new one
Push tx “on” button to reset.
Takes one person about 1 minute.

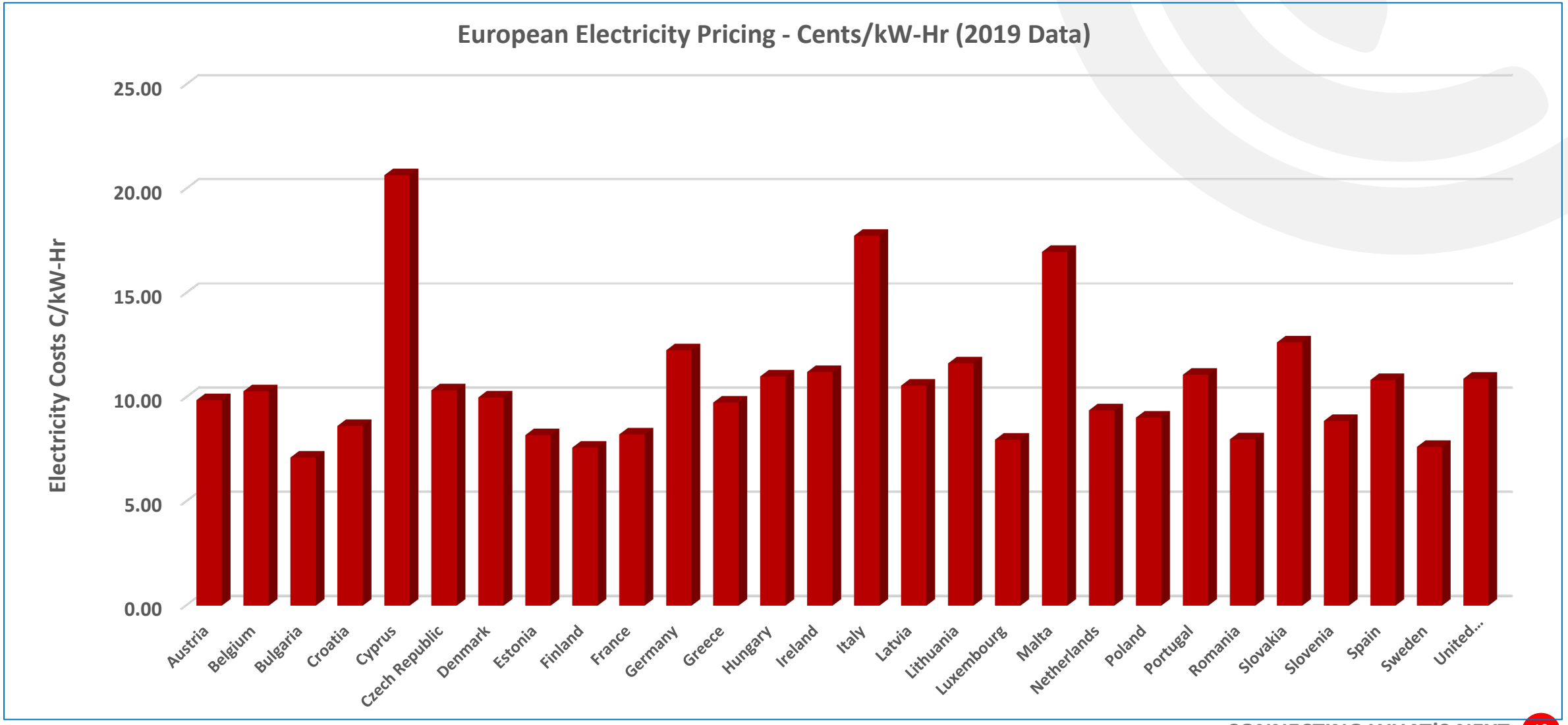
2.2kg

Disclaimer - Similarity to any brand is purely coincidental

ELECTRIC POWER COSTS



ELECTRIC POWER COSTS



TOTAL COST OF OWNERSHIP & BREAKEVEN CALCULATIONS

GATESAIR

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CALCULATING TCO & BREAKEVEN ANALYSIS

- Each element of the Transmitter lifecycle has a cost
- Over the lifetime of the Transmitter, the total cost may far exceed the purchase price by several times

Questions:

- Is it really worth buying a new transmitter?
- Will I see a return on investment?
- When will it pay back for itself?

Let's use the TCO Calculator and find out…

AIR-COOLED 9.6KW TX TCO AND BREAKEVEN

TCO & Breakeven Analysis

User Entry Cells:

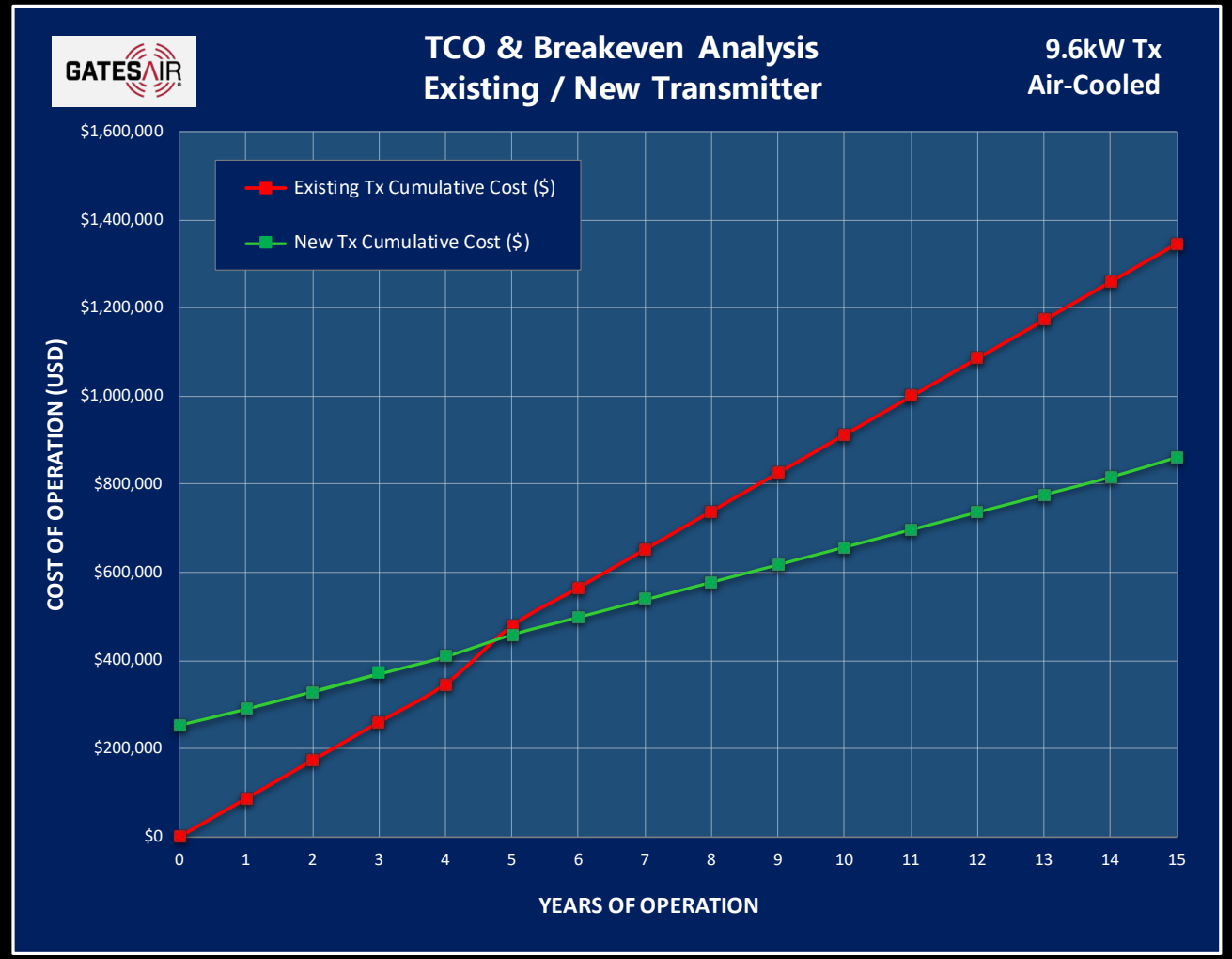
Result Cells:

Item	Existing Transmitter	New Transmitter	Unit
Transmitter Model	**Diamond DHD45P2**	**UAXTE-16**	
Tx Average Power Output	9.6	9.6	kW
Cooling Method (select Air or Liquid)	Air	Air	
Planning Costs	$0	$1,200	USD
New Transmitter Cost	$0	$216,000	USD
Delivery / Shipping Costs	$0	$5,500	USD
Installation / Commssioning Costs	$0	$29,000	USD
Training Costs	$0	$2,500	USD
Average Annual Maintenance Costs	$11,000	$4,500	USD
Transmitter Efficiency	19.9%	41.0%	%
Electricity Cost ($ per kW/hr)	$0.15	$0.15	USD
Operational Hr/day	24	24	Hrs.
Operational days/year	365.25	365.25	Days
Major Repair / Upgrade at Year 5**	$45,000	$10,000	USD
Disposal Costs at EOL	$10,000	$10,000	USD
HVAC Efficiency Rating*	14	14	SEER

Calculated Summary Results		
Estimated Breakeven Period	**4 Years, 9 Months**	Y / M
Reduction in Heat Load to Room	**84,712**	Btu/hr
Annual Reduction in Carbon Emmissions	**134.0**	Tons CO_2
Tx Power cost savings per year	**$32,644**	USD
HVAC Power Cost Savings per Year	**$7,956**	USD
Total Power Cost Savings per year	**$40,601**	USD

** SEER (Seasonal Energy Effiiency Ratio) usually between 10 and 22 (typical 14)*

*** For Tube Transmitters, include replacement Tube Costs*



EXCEL TCO CALCULATION WORKSHEET

			Existing Tx		New Tx	
Cost Item	Date	Year	Existing Tx Cost ($)	Existing Tx Cumulative Cost ($)	New Tx Cost ($)	New Tx Cumulative Cost ($)
Planning	January-20	0	$ -	0	$1,200	$1,200
Tx Cost	March-20	0	$ -	0	$216,000	$217,200
Delivery	June-20	0	$ -	0	$5,500	$222,700
Installation	June-20	0	$ -	0	$29,000	$251,700
Training	June-20	0	$ -	0	$2,500	$254,200
Power Cost Year 1	July-21	1	75,816	75,816	35,215	$289,415
Maintenance Year 1	October-21	1	11,000	86,816	1,125	$290,540
Power Cost Year 2	July-22	2	75,816	162,632	35,215	$325,755
Maintenance Year 2	October-22	2	11,000	173,632	4,500	$330,255
Power Cost Year 3	July-23	3	75,816	249,447	35,215	$365,470
Maintenance Year 3	October-23	3	11,000	260,447	4,500	$369,970
Power Cost Year 4	July-24	4	75,816	336,263	35,215	$405,185
Maintenance Year 4	October-24	4	11,000	347,263	4,500	$409,685
Power Cost Year 5	July-25	5	75,816	423,079	35,215	$444,901
Major Upgrade Year 5	July-25	5	45,000	468,079	10,000	$454,901
Maintenance Year 5	October-25	5	11,000	479,079	4,500	$459,401
Power Cost Year 6	July-26	6	75,816	554,895	35,215	$494,616
Maintenance Year 6	October-26	6	11,000	565,895	4,500	$499,116
Power Cost Year 7	July-27	7	75,816	641,711	35,215	$534,331
Maintenance Year 7	October-27	7	11,000	652,711	4,500	$538,831
Power Cost Year 8	July-28	8	75,816	728,527	35,215	$574,046
Maintenance Year 8	October-28	8	11,000	739,527	4,500	$578,546
Power Cost Year 9	July-29	9	75,816	815,342	35,215	$613,761
Maintenance Year 9	October-29	9	11,000	826,342	4,500	$618,261
Power Cost Year 10	July-30	10	75,816	902,158	35,215	$653,476
Maintenance Year 10	October-30	10	11,000	913,158	4,500	$657,976
Power Cost Year 11	July-31	11	75,816	988,974	35,215	$693,191
Maintenance Year 11	October-31	11	11,000	999,974	4,500	$697,691
Power Cost Year 12	July-32	12	75,816	1,075,790	35,215	$732,906
Maintenance Year 12	October-32	12	11,000	1,086,790	4,500	$737,406
Power Cost Year 13	July-33	13	75,816	1,162,606	35,215	$772,622
Maintenance Year 13	October-33	13	11,000	1,173,606	4,500	$777,122
Power Cost Year 14	July-34	14	75,816	1,249,422	35,215	$812,337
Maintenance Year 14	October-34	14	11,000	1,260,422	4,500	$816,837
Power Cost Year 15	July-35	15	75,816	1,336,237	35,215	$852,052
Disposal Cost	July-35	15	11,000	1,347,237	10,000	$862,052

Note: Below calculations assume all tx waste heat is not ducted outside but handled by room air-conditioning.
HVAC sizing is for the transmitter only and will need to be larger to include other building heat loads

Data new Tx		
Item	Data	Unit
Transmitter Power	9.6	kW
Planning Costs	$1,200	USD
Tx Purchase Price	$216,000	USD
Tx Delivery Costs	$5,500	USD
Installation/Commissioning	$29,000	USD
Training Cost	$2,500	USD
Tx Efficiency	41%	%
Tx Input Power	23.4	kW
Tx Power Cost per kW-Hr	$ 0.15	USD
Op Hours per year	8766	Hrs
Power Cost / Yr	$ 35,215	USD
Average Annual Maintenance	$ 4,500	USD
Major Repair or upgrade	$ 10,000	USD
Disposal Cost	$ 10,000	USD

New Tx heat Load data				
Item	Data	Unit		
Cooling Method (Air/Liquid)	Air		% Heat to Room	% Heat to Outside
Heat load to room	13.815	kW	100%	0%
Heat load in btu/hr	47,137	Btu/hr		
HVAC Size Required for Tx	4	Tons AC		
HVAC SEER Rating*	14	SEER		
HVAC Power consumed	3.37	kW		
AC Power Costs per kW/hr	$ 0.15	USD		
HVAC Operating cost/hr	$ 0.51	USD		
HVAC Operating cost/yr	$ 4,427	USD		

*SEER (Seasonal Energy Efficiency Ratio) usually between 10 and 22 (typical 14)

Data existing Tx		
Item	Data	Unit
Transmitter Power	9.6	kW
Planning Costs	$0	USD
Tx Purchase Price	$0	USD
Tx Delivery Costs	$0	USD
Installation/Commissioning	$0	USD
Training Cost	$0	USD
Tx Efficiency	20%	%
Tx Input Power	48.2	kW
Tx Power Cost per kW-Hr	$ 0.15	USD
Op Hours per year	8766	Hrs
Power Cost / Yr	$ 75,816	USD
Average Annual Maintenance	$ 11,000	USD
Major Repair or upgrade	$ 45,000	USD
Disposal Cost	$ 10,000	USD

Existing Tx heat Load data				
Item	Data	Unit		
Cooling Method (Air/Liquid)	Air		% Heat to Room	% Heat to Outside
Heat load to room	38.641	kW	100%	0%
Heat load in btu/hr	131,849	Btu/hr		
HVAC Size Required for Tx	11	Tons AC		
HVAC SEER Rating*	14	SEER		
HVAC Power consumed	9.42	kW		
AC Power Costs per kW/hr	$ 0.15	USD		
HVAC Operating cost/hr	$ 1.41	USD		
HVAC Operating cost/yr	$ 12,383	USD		

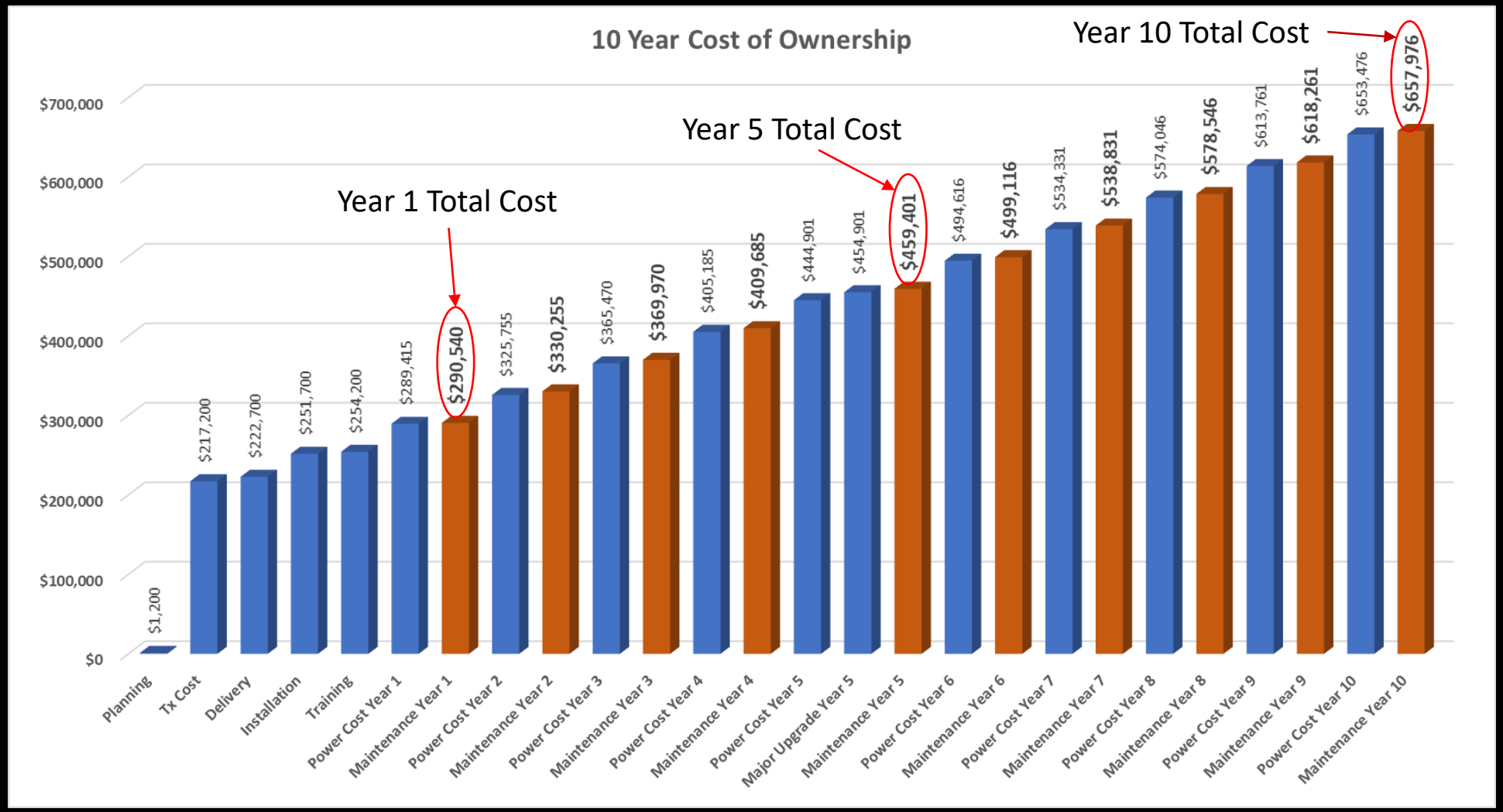
*SEER (Seasonal Energy Efficiency Ratio) usually between 10 and 22 (typical 14)

Breakeven Time	4.8	Years

Greenhouse Gas Calculation (USA 2018 formula)	
234,767.47	New Tx kW-hr/Year
505438.8498	Old tx kW-hr/Year
270,671.38	Difference kW-hr/Year
267,964.67	lbs CO2* to atmosphere
121.55	Metric Tons CO2
133.98	Short Tons CO2

*CO2 emmissions vary depending on fuel source to generate

AIR-COOLED 9.6KW TX 10 YEAR TCO



AIR TO LIQUID-COOLED 9.6KW TX TCO AND BREAKEVEN

TCO & Breakeven Analysis

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Result Cells:

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Transmitter Model	**Diamond DHD45P2**	**ULXTE-16**	
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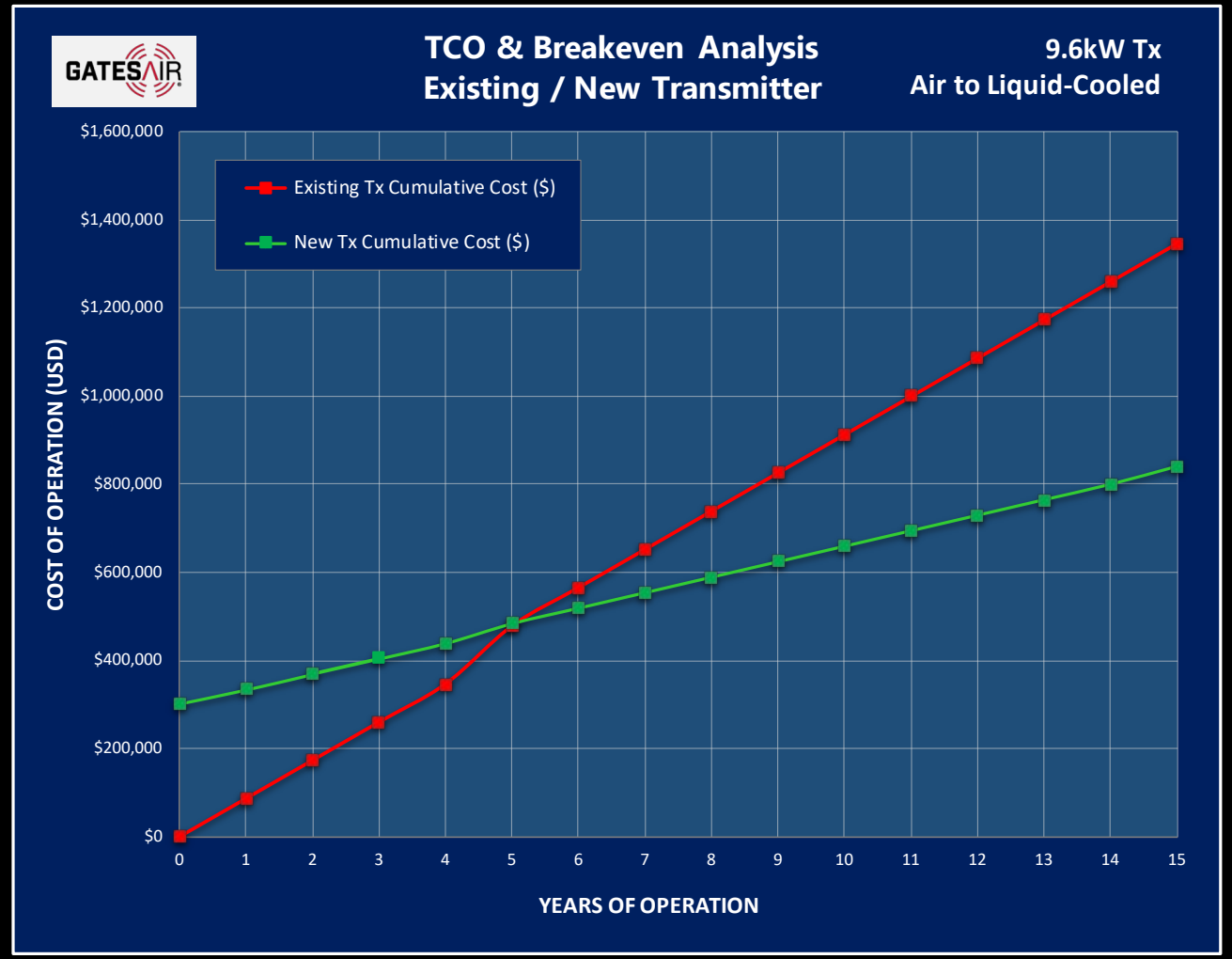
New Transmitter Cost	$0	$265,000	USD
Delivery / Shipping Costs	$0	$5,500	USD
Installation / Commssioning Costs	$0	$29,000	USD
Training Costs	$0	$2,500	USD
Average Annual Maintenance Costs	$11,000	$4,500	USD
Transmitter Efficiency	19.9%	42.2%	%
Electricity Cost ($ per kW/hr)	$0.15	$0.15	USD
Operational Hr/day	24	24	Hrs.
Operational days/year	365.25	365.25	Days
Major Repair / Upgrade at Year 5**	$45,000	$10,000	USD
Disposal Costs at EOL	$10,000	$10,000	USD
HVAC Efficiency Rating*	14	14	SEER

Calculated Summary Results		
Estimated Breakeven Period	**5 Years, 2 Months**	Y / M
Reduction in Heat Load to Room	**126,465**	Btu/hr
Annual Reduction in Carbon Emmissions	**149.8**	Tons CO_2
Tx Power cost savings per year	**$33,520**	USD
HVAC Power Cost Savings per Year	**$11,878**	USD
Total Power Cost Savings per year	**$45,398**	USD

** SEER (Seasonal Energy Effiiency Ratio) usually between 10 and 22 (typical 14)*

*** For Tube Transmitters, include replacement Tube Costs*



AIR-COOLED 1.2KW TX TCO AND BREAKEVEN

TCO & Breakeven Analysis

User Entry Cells:

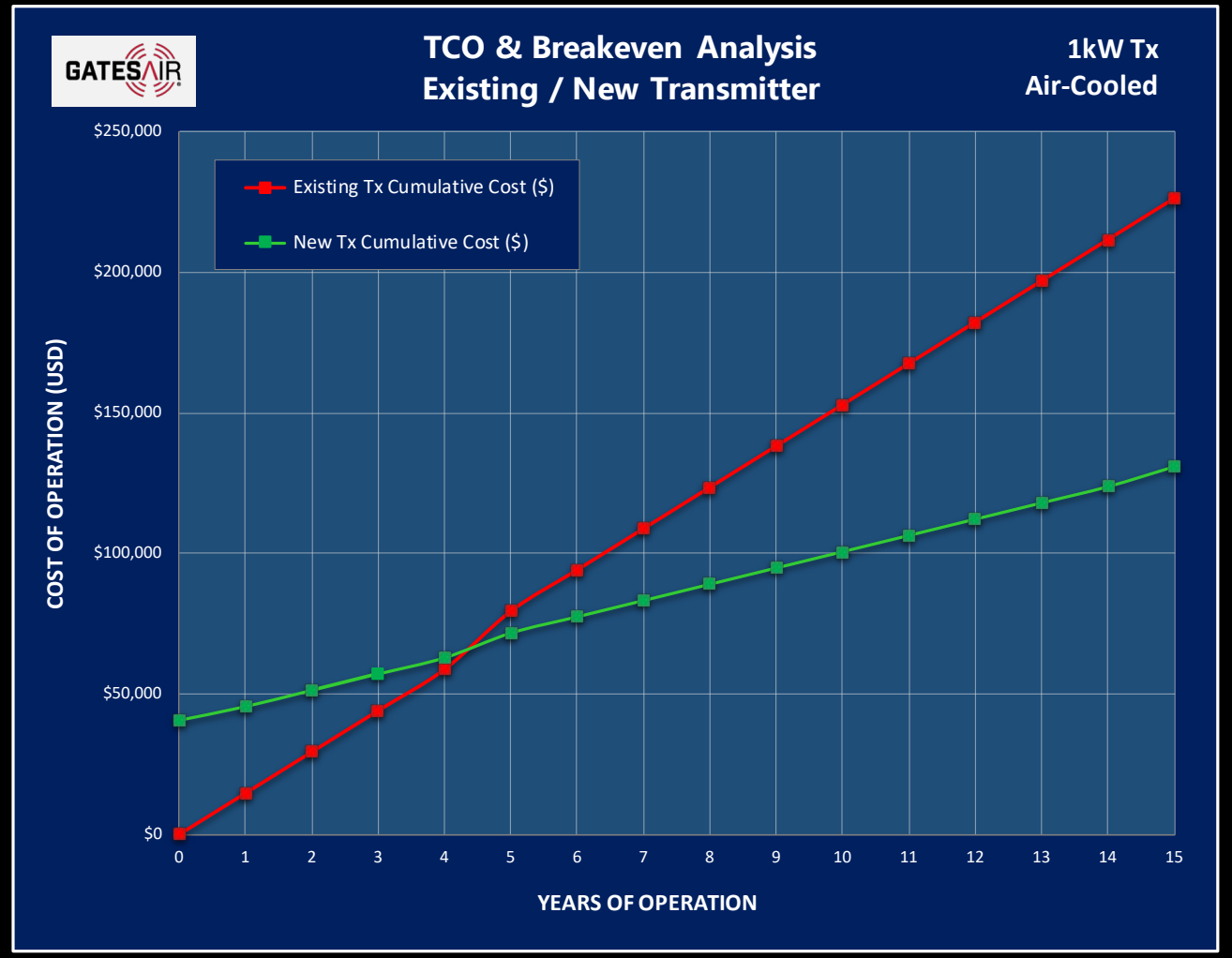
Result Cells:

Item	Existing Transmitter	New Transmitter	Unit
Transmitter Model	**Brand X**	**UAX-OP-1500**	
Tx Average Power Output	1.2	1.2	kW
Cooling Method (select Air or Liquid)	Air	Air	
Planning Costs	$0	$1,000	USD
New Transmitter Cost	$0	$25,000	USD
Delivery / Shipping Costs	$0	$3,500	USD
Installation / Commssioning Costs	$0	$10,000	USD
Training Costs	$0	$1,200	USD
Average Annual Maintenance Costs	$5,250	$1,200	USD
Transmitter Efficiency	20.0%	39.5%	%
Electricity Cost ($ per kW/hr)	$0.15	$0.15	USD
Operational Hr/day	24	24	Hrs.
Operational days/year	365.25	365.25	Days
Major Repair / Upgrade at Year 5**	$6,000	$3,000	USD
Disposal Costs at EOL	$2,500	$2,500	USD
HVAC Efficiency Rating*	14	14	SEER

Calculated Summary Results		
Estimated Breakeven Period	**4 Years 4 Months**	Y / M
Reduction in Heat Load to Room	**10,107**	Btu/hr
Annual Reduction in Carbon Emmissions	**16.0**	Tons CO_2
Tx Power cost savings per year	**$3,895**	USD
HVAC Power Cost Savings per Year	**$949**	USD
Total Power Cost Savings per year	**$4,844**	USD

** SEER (Seasonal Energy Effiiency Ratio) usually between 10 and 22 (typical 14)*

*** For Tube Transmitters, include replacement Tube Costs*



AIR-COOLED 100W TX TCO AND BREAKEVEN

TCO & Breakeven Analysis

User Entry Cells:

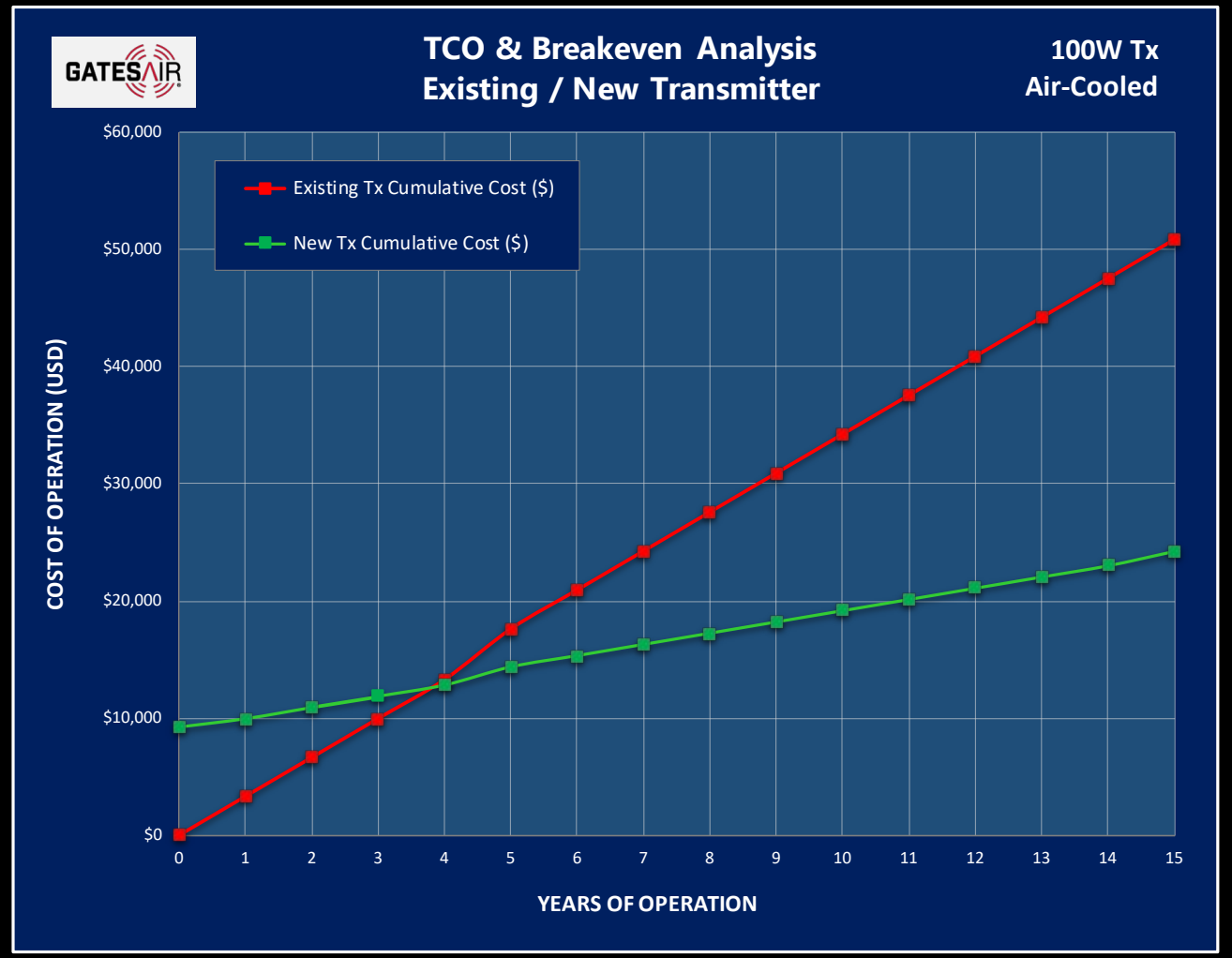
Result Cells:

Item	Existing Transmitter	New Transmitter	Unit
Transmitter Model	**Brand X**	**UAXTE-130-UC**	
Tx Average Power Output	0.1	0.1	kW
Cooling Method (select Air or Liquid)	Air	Air	
Planning Costs	$0	$0	USD
New Transmitter Cost	$0	$7,500	USD
Delivery / Shipping Costs	$0	$500	USD
Installation / Commssioning Costs	$0	$1,200	USD
Training Costs	$0	$0	USD
Average Annual Maintenance Costs	$1,750	$330	USD
Transmitter Efficiency	10.2%	24.6%	%
Electricity Cost ($ per kW/hr)	$0.15	$0.15	USD
Operational Hr/day	24	24	Hrs.
Operational days/year	365.25	365.25	Days
Major Repair / Upgrade at Year 5**	$1,000	$600	USD
Disposal Costs at EOL	$600	$600	USD
HVAC Efficiency Rating*	14	14	SEER

Calculated Summary Results		
Estimated Breakeven Period	**3 Years 9 Months**	Y / M
Reduction in Heat Load to Room	**1,958**	Btu/hr
Annual Reduction in Carbon Emmissions	**3.1**	Tons CO_2
Tx Power cost savings per year	**$755**	USD
HVAC Power Cost Savings per Year	**$184**	USD
Total Power Cost Savings per year	**$939**	USD

** SEER (Seasonal Energy Effiiency Ratio) usually between 10 and 22 (typical 14)*

*** For Tube Transmitters, include replacement Tube Costs*



LIQUID-COOLED 38KW TX TCO AND BREAKEVEN

TCO & Breakeven Analysis

User Entry Cells:

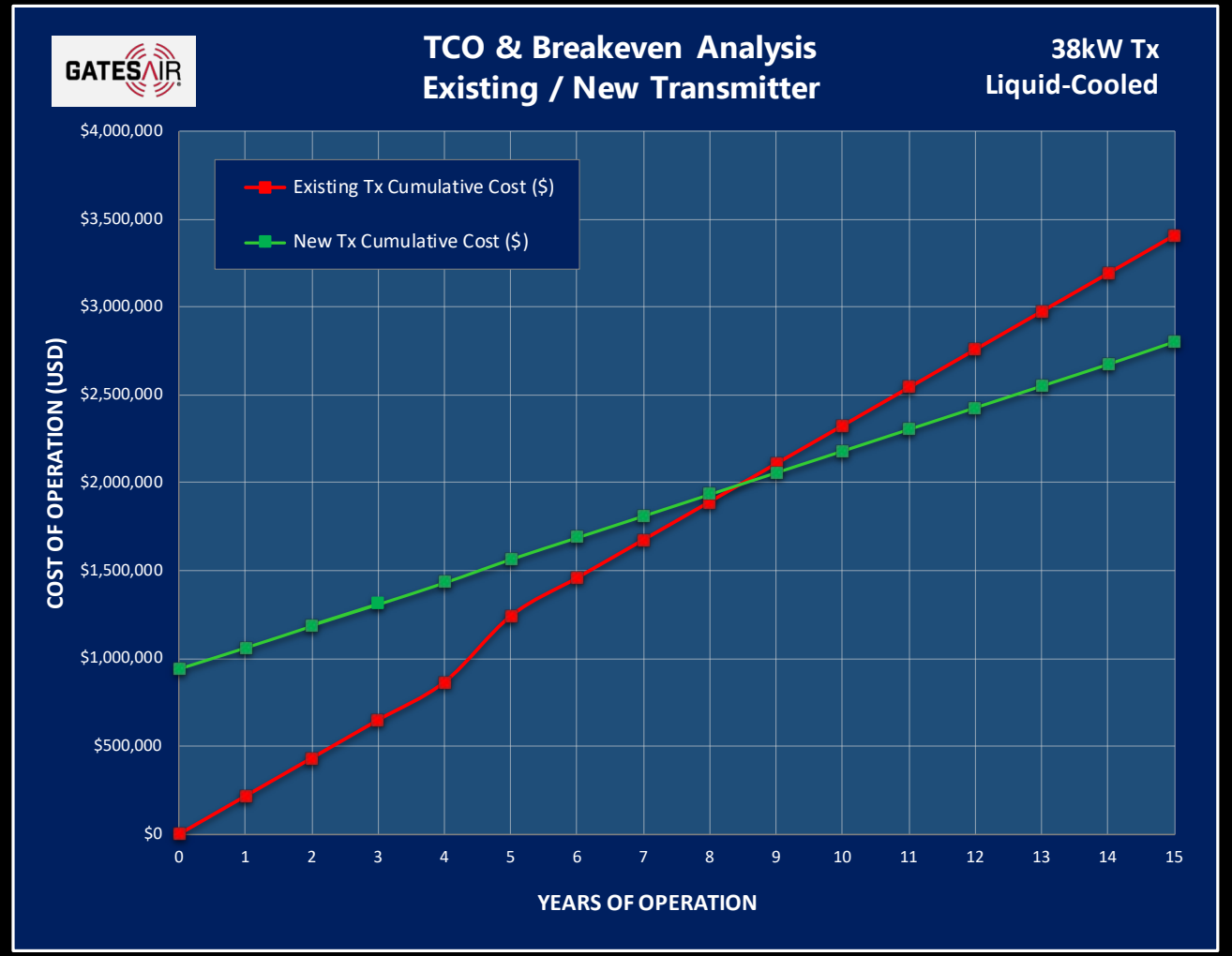
Result Cells:

Item	Existing Transmitter	New Transmitter	Unit
Transmitter Model	**Sigma 2-Tube**	**ULXTE-60**	
Tx Average Power Output	38.0	38.0	kW
Cooling Method (select Air or Liquid)	Liquid	Liquid	
Planning Costs	$0	$1,600	USD
New Transmitter Cost	$0	$900,000	USD
Delivery / Shipping Costs	$0	$10,000	USD
Installation / Commssioning Costs	$0	$30,000	USD
Training Costs	$0	$2,500	USD
Average Annual Maintenance Costs	$30,000	$5,000	USD
Transmitter Efficiency	27.5%	43.0%	%
Electricity Cost ($ per kW/hr)	$0.15	$0.15	USD
Operational Hr/day	24	24	Hrs.
Operational days/year	365.25	365.25	Days
Major Repair / Upgrade at Year 5**	$160,000	$10,000	USD
Disposal Costs at EOL	$10,000	$10,000	USD
HVAC Efficiency Rating*	14	14	SEER

Calculated Summary Results		
Estimated Breakeven Period	**8 Years, 4 Months**	Y / M
Reduction in Heat Load to Room	**30,650**	Btu/hr
Annual Reduction in Carbon Emmissions	**225.6**	Tons CO_2
Tx Power cost savings per year	**$65,495**	USD
HVAC Power Cost Savings per Year	**$2,879**	USD
Total Power Cost Savings per year	**$68,373**	USD

** SEER (Seasonal Energy Effiiency Ratio) usually between 10 and 22 (typical 14)*

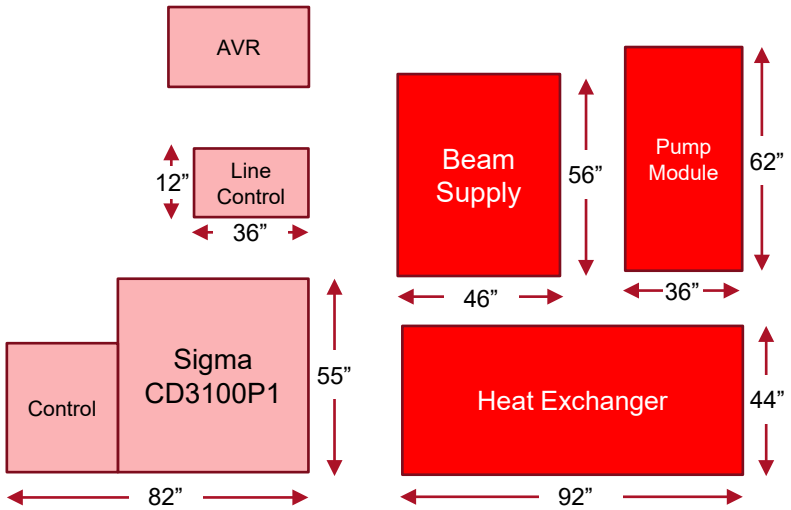
*** For Tube Transmitters, include replacement Tube Costs*



SAVINGS BEYOND THE TCO CALCULATOR FROM TUBE TO SOLID-STATE

1. Space Savings - (38kW transmitter needs less room than an older 25kW Tx)

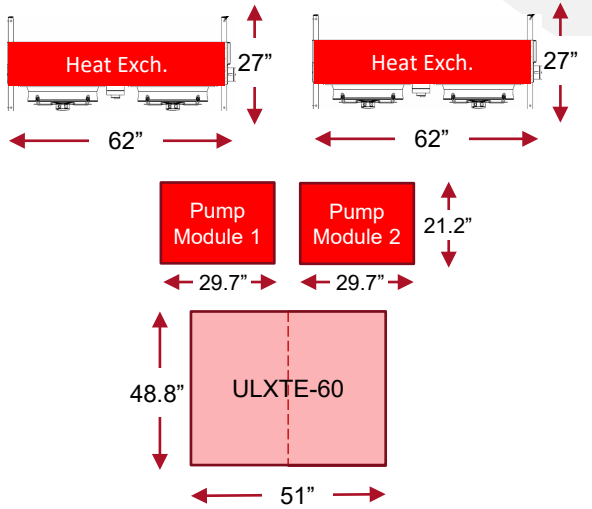
Old Tx



Tube Tx – Example Sigma 1-Tube IOT

Power	27.5 kW average power (pre-filter)
Indoor footprint	34.3 ft²
Outdoor footprint	61.5 ft²
Total footprint	**95.8 ft² / 8.9 m²**

New Tx



Solid State Tx – Example ULXTE-60 (2 x 42RU)

Power	38kW average power
Indoor footprint	26.0 ft²
Outdoor footprint	23.3 ft²
Total footprint	**49.3 ft² / 4.58 m²**

Total Space Savings: 49%

SAVINGS BEYOND THE TCO CALCULATOR FROM TUBE TO SOLID-STATE

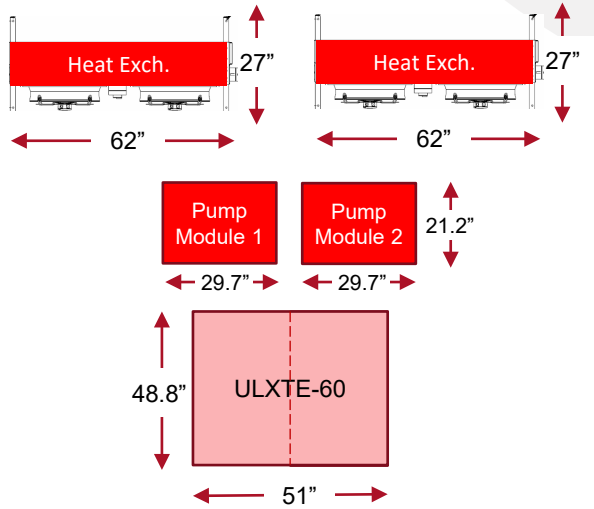
1. Space Savings - (38kW transmitter needs less room than an older 42kW Tx)

Old Tx

Tube Tx – Example Sigma 2-Tube IOT

Power	42 kW average power
Indoor footprint	59,9 ft²
Outdoor footprint	79.4 ft²
Total footprint	**139.3 ft² / 12.94 m²**

New Tx



Solid State Tx – Example ULXTE-60 (2 x 42RU)

Power	38kW average power
Indoor footprint	26.0 ft²
Outdoor footprint	23.3 ft²
Total footprint	**49.3 ft² / 4.58 m²**

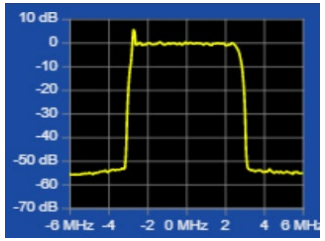
Total Space Savings: 65%

SAVINGS BEYOND THE TCO CALCULATOR FROM TUBE TO SOLID-STATE

2. Safety - Solid State vs. older Tube Technology
   - 50V DC versus 36kV DC
   - Highest voltage is the AC Power source

3. No Arcing & Sparking
   - No crowbar circuit!

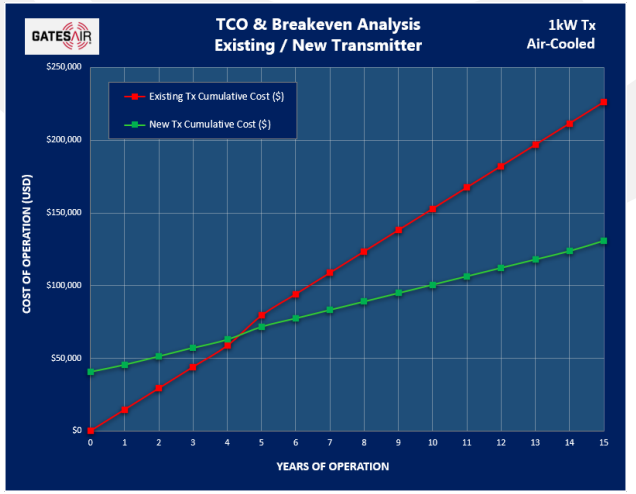
4. No AVR needed
   - New, modern power supplies easily handle ± 15% voltage changes
   - AVR can easily lose between 2% and 5% of efficiency!



5. Better long-term stability and performance
   - Modern fast adaptive correction
   - No “aging” of vacuum tubes

WRAP-UP

- TCO is an important tool to estimate the value of replacing older Transmitters
- Eight good reasons to consider replacing the old transmitter
  1. Efficiency – Drive down the energy usage and lower your bill
  2. Reliability – Some new designs offer better redundancy and more reliable operation. Reduce number of site visits.
  3. Maintainability – Spend less time at site, less skill required
  4. Repairability – Can I fix it, or do I need to call for help, or send to factory?
  5. Space Savings – Save on rental space, or make room for Nextgen tx, etc.
  6. Technology – Advanced remote control/diagnostics/better performance/stability
  7. Time to Repair – Modular and easy to access saves time and money
  8. Obsolescence – How much longer will parts be available for the old transmitter?



THANKS FOR WATCHING
QUESTIONS?

More Upcoming Virtual Events: https://go.gatesair.com/virtual-events.html

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