

Wind Energy Conversion Systems (WECS) – Revised Regulations Discussion

Community Meeting

1/12/2023

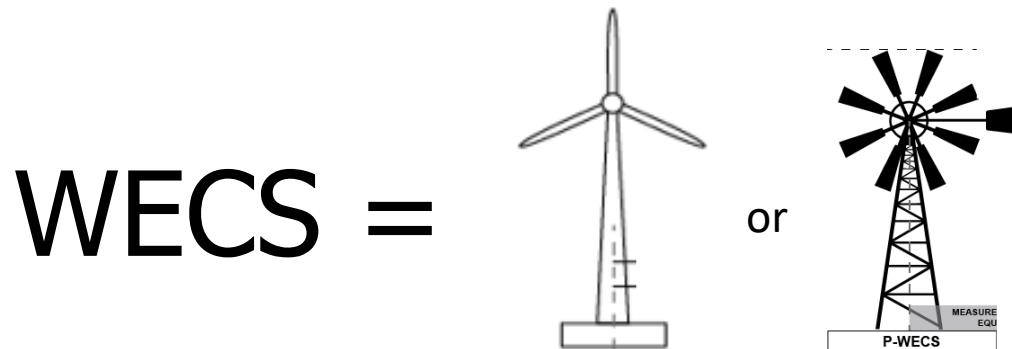
Quick Definition

WECS

A Wind Energy Conversion System is a system of wind-driven generators that convert wind energy into electrical power.

Individual machines are also referred to as a turbine, wind tower, windmill, or wind pump.

A WECS may be for personal or commercial use, these two varying uses are referred to as P-WECS and C-WECS, respectively.



History of WECS Regulations

In 2013 & 2014 interest in exploring wind energy in Douglas County prompted multiple meetings with Staff, Planning Commission, and the County Commission. Three MET (meteorological evaluation towers) were approved via CUP by the Planning Commission during this time.

It was understood during these public hearings that the MET towers were going to collect data which would assist in determining the viability of a wind turbine at/near the MET tower site. Having no way of regulating commercial-scale turbines at the time, other than by assessing a WECS proposal as if it was a Wireless Communication Tower by proxy – the County Commission adopted a *temporary* Moratorium on Large-WECS applications so that staff would have time to draft zoning regulations on this land-use.

City and County Planning staff worked alongside County Legal staff to draft the existing regulations.

The Lawrence Douglas County Planning Commission and County Commission approved the existing wind regulations in 2016 through Resolution No. 17-12. The existing regulations are in Section 12-306-44 of the Douglas County Zoning and Land Use Regulations.

Since the adoption of Section 12-306-44 there have been no proposals for a commercial- scale wind farm in the Unincorporated Territory of Douglas County.

Existing Regulations

These existing regulations at a glance include:

- Five definitions including all regulations on “Small” Personal WECS
 - Small Wind Energy Conversion System (SWECS)
 - Large Wind Energy Conversion System (CWECS)
 - Prescribed Burning
 - Road agreement for maintenance
 - Extraordinary Events
- Identify a CUP as being the process to establish the WECS Project
 - Notice sent to those 1,000 ft from project boundary
 - Application contents includes concept plan, map of residences within 1000’, inventory of existing wildlife/wetland/flora/fauna in project area, transportation plan, safety plan, extraordinary event response plan, noise impact (not described), maintenance plan.
- Design Standards include:
 - Setback of 110% of the height of tower plus length of blade, and 1500’ from dwellings.
 - No maximum height standards - minimum clearance 100’, lighting shall minimize adverse impacts, neutral colored monopole with no logos, access roads designed in compliance with County Public Works Director.
- A decommissioning plan to take place within 18 months of abandonment
 - Abandoned once non-producing electricity for 1 year, foundation excavated to 4’, identified landowner and operator as jointly responsible for removal. Does not define \$\$ amount to be secured – BoCC to specify.

Proposed Regulations

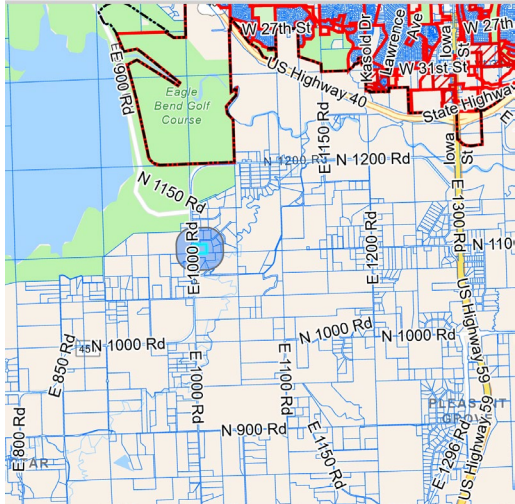
These existing regulations include, but are not limited to:

- 24 definitions
- Personal - Wind Energy Conversion System (P-WECS)
 - Treated as an accessory structure, requires building permit approval + site planning if in industrial or business zoning districts
 - Maximum permitted height: 75 feet
 - Setback 100% height to property lines
 - Regulate maximum power rating on site, does allow “net metering” i.e. proving leftover power back to the grid.
- Commercial - Wind Energy Conversion System (C-WECS)
 - Identify a CUP as being the process to establish the WECS Project
 - A thorough, incredibly detailed application which would include assessments of the proposed impacts to the environment, noise conditions, and view shed amongst many other required documentation.
 - Notice sent to those 2 miles from project boundary
 - Turbines setback 1,500 feet from the Participating Landowner’s dwelling and from the property line of non-participating property owners. Turbines shall be set back from public roads and rights-of-way 110% of the total height of the turbine
 - Permitted height regulated, based on “hub height” at 80 meters (~263’)
 - Ongoing performance standards including noise, shadow flicker, lighting, and environmental impact, and infrastructure impact including mitigation techniques.
- A decommissioning plan to take place within 90 days of abandonment
 - Abandonment defined differently for individual turbines versus entire project, foundation excavated to 4’, identified landowner and operator as jointly responsible for removal. Amount of security equal to 100% cost of reclamation + includes additional cost based on inflation.

Comparing Notice Regulations

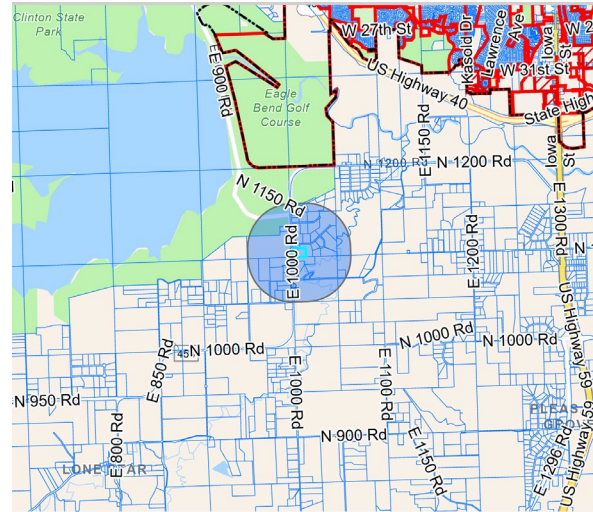
Example Location: Greenbush School

Statutory Protest Boundary 1000'



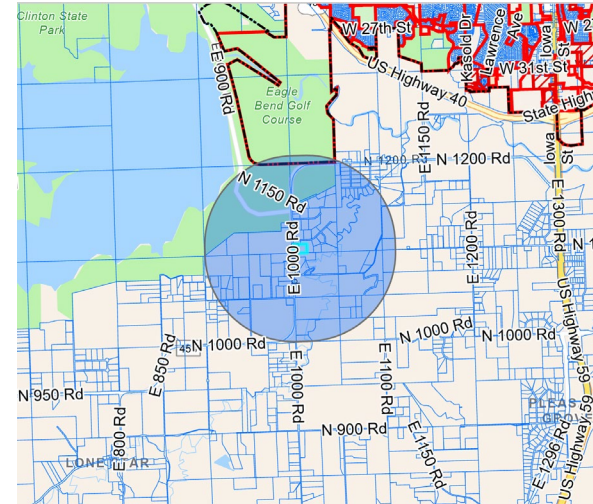
State requirement for all zoning actions allowing property owners to register a protest petition with local governing body

Standard ½ Mile Notice Boundary



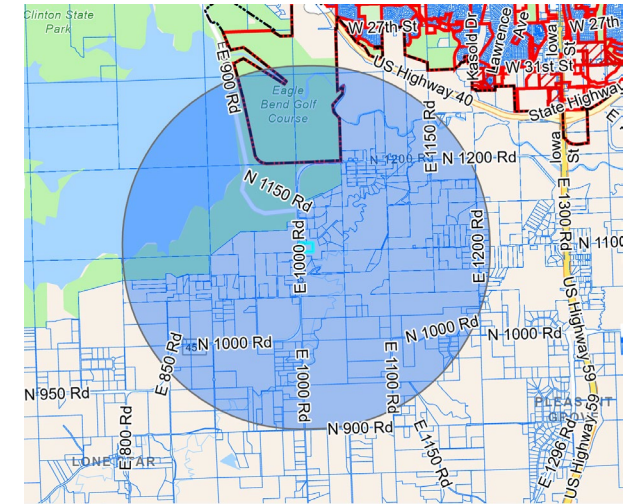
County zoning ordinance provides notice to those ½ mile (2640') of a development application e.g. CUPs, Rezoning, etc.

Existing 1 Mile Notice Boundary



EXISTING County zoning ordinance provides notice to those 1 mile (5280') for cell towers and C-WECS applications

Proposed 2 Mile Notice Boundary



PROPOSED County zoning ordinance provides notice to those 2 mile (10,560') for C-WECS applications

Purpose

The intent of revising the existing WECS regulations is to provide clarity for both applicants and staff when reviewing Wind Farm proposals.

Amendments have been made to mirror the structure and depth of review to the recently adopted Solar Regulations (12-306-49)

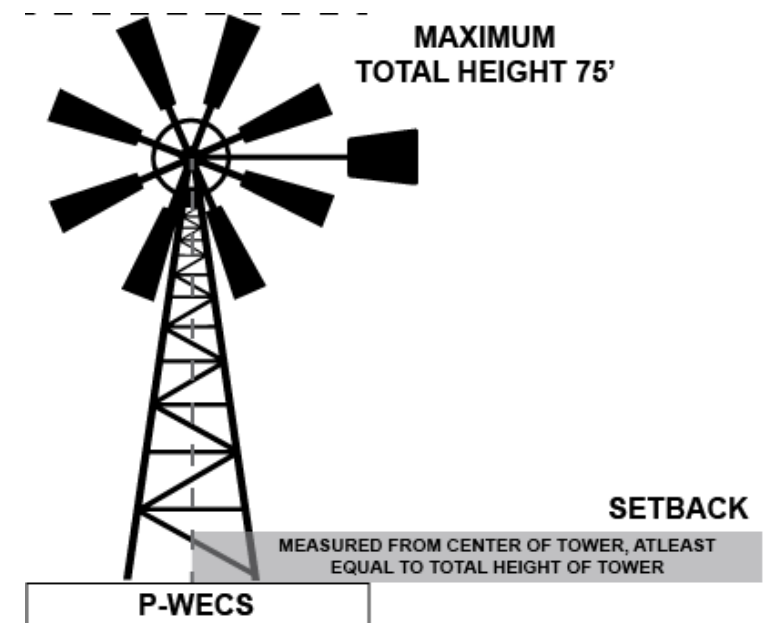
Additionally, these revised regulations seek to:

- Provide conditions required of Personal-Scale (WECS) e.g., windmill, wind pump, etc.
- Create a thorough process to permit the development of a Commercial-Scale Wind Farms (C-WECS Projects);
- Provide a basis for public discussion and informed comment on the C-WECS Project;
- Identify and mitigate significant environmental, social, and economic effects related to a proposed C-WECS Project;
- Ensure the land in the County remains viable for agricultural uses during the life of the C-WECS Project and following decommissioning.

Overview of Revised WECS Regulations

12-306-44.02 Personal - Wind Energy Conversion System (P-WECS)

- Cumulative maximum power rating of 50 kilowatts of electrical power on site.
- Total height shall not exceed 75 feet.
- Setback from the nearest property line: Total height of the P-WECS, measured from the center of the tower.
- Setback from roadways: dimensional standards of the zoning district.
- Subject to appropriate building permits and site plan requirements.
- P-WECS sited on industrially-zoned or business-zoned properties are subject to site plan requirements.
- A small, personal-use wind energy conversion system shall be subject to Chapter 13 of the Douglas County Code for original approval, periodic review, and standards associated with an accessory structure.



C-WECS

Key Changes

12-306-44.03.03 Design Standard

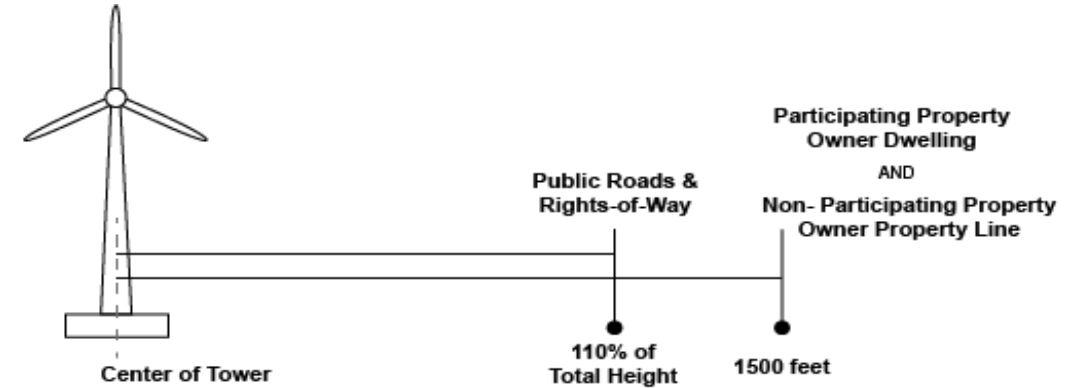
Staff Proposed Setbacks

- **1,500 feet** to the participating landowner's residence and any other occupied structures.
- **1,500 feet** from the property line of non-participating property owners.
- **110%** of the total height of the turbine from public roads and rights-of-way.

Additional or reduced setback requirements may be imposed by Board of County Commissioners as conditions of approval to the project

Definition:

Participating Landowner; Property owners who have entered into leases or other monetary arrangements with an Applicant or Operator whereby they have reasonable expectation to benefit from approval, construction, and operation of a C-WECS Project. Any person(s) who is not a Participating Landowner shall be referred to as a non-participating landowner.



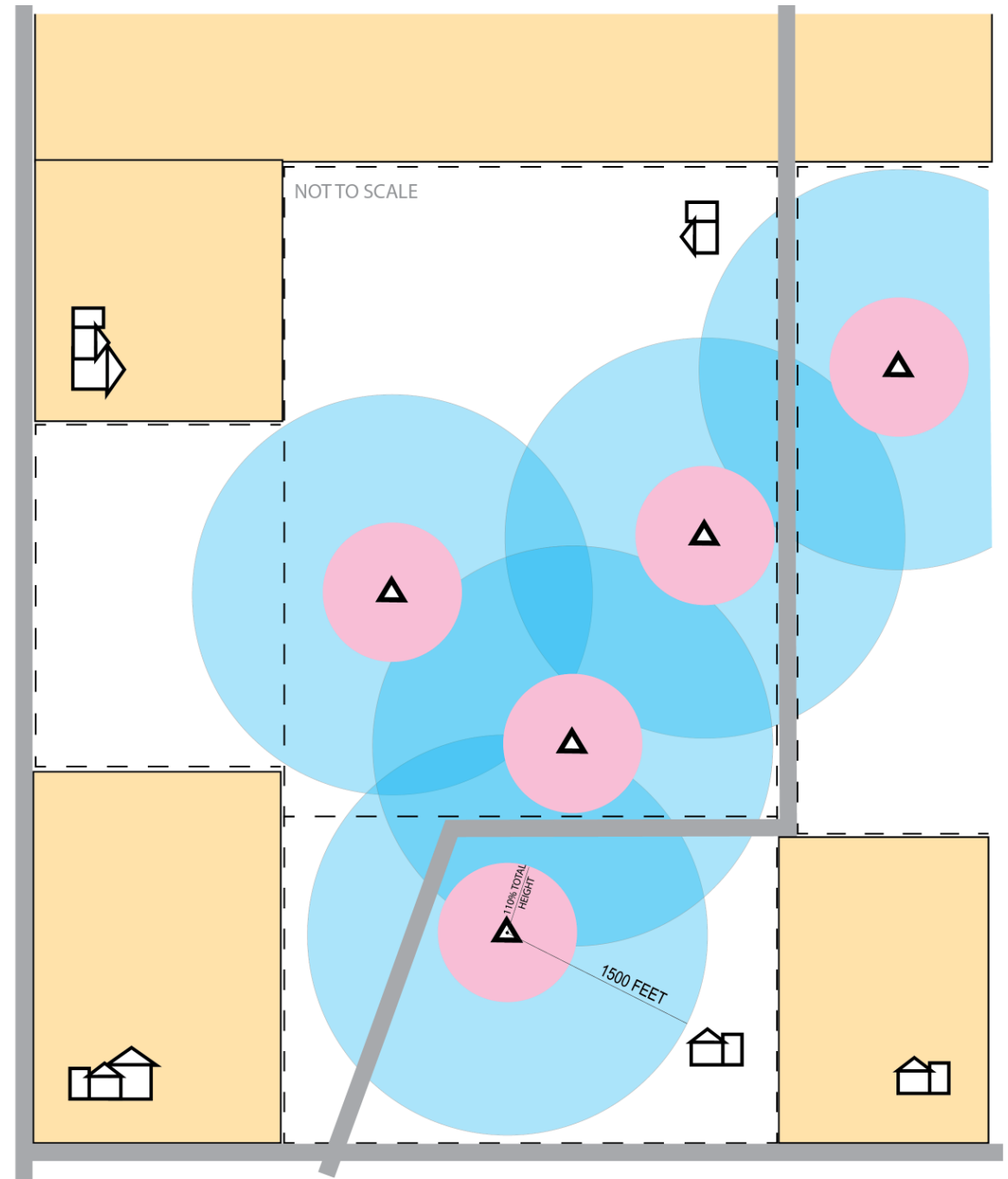
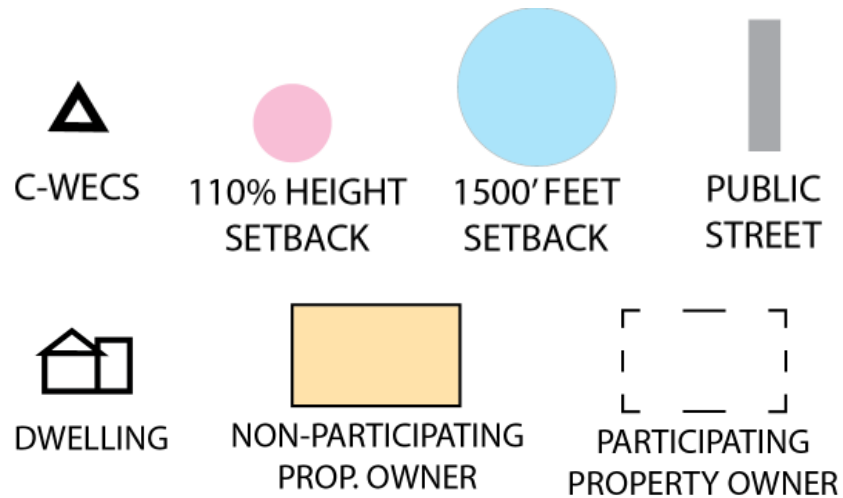
C-WECS

Key Changes

12-306-44.03.03 Design Standard

Setbacks (continued)

Not to scale, example



Key Changes

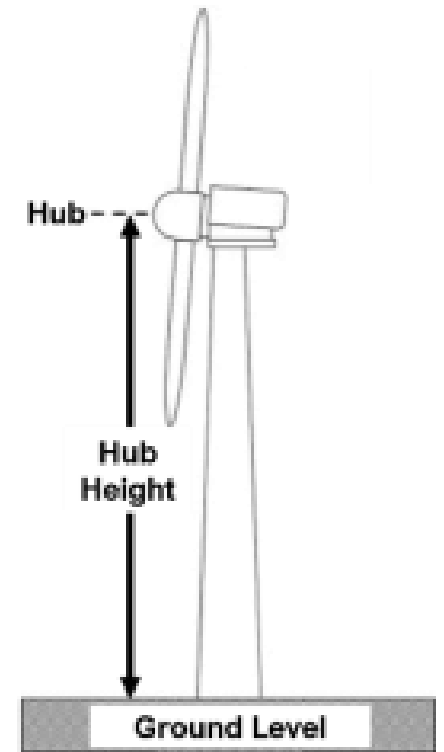
12-306-44.03.03 Design Standard

Staff Proposed Permitted Height

Permitted height shall be determined by the hub height for each individual turbine. The maximum hub height shall be **80 meters**, as measured by manufacturer specifications.

The Board of County Commissioners may approve greater height for individual turbines, but not greater than 110 meters hub heights, if increased tower height better aligns with the purpose and intent of this section.

Staff's recommendation is based on the balance between maintaining the character of Douglas County, reviewing nearby existing turbines, and industry standards and equipment. [This paper](#) written by the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy makes recommendations which we propose adopting.

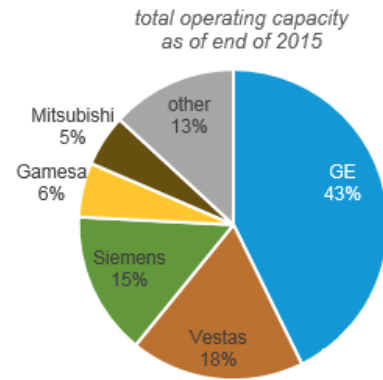


Proposed Permitted Height

Why use meters?

Three turbine manufacturers provide more than 75% of U.S. wind energy production

- GE
- Vestas
- Siemens



Source: U.S. Energy Information Administration, EIA Form-860

These companies all use meters when describing the technical specifications of wind turbines.

Additionally, a majority of scholarly articles and government resources use meters when describing height of towers.

Meters	Feet
1m	3.28ft
10m	32.81ft
20m	65.62ft
30m	98.43ft
40m	131.23ft
50m	164.04ft
60m	196.85ft
70m	229.66ft
80m	262.47ft
90m	295.28ft
100m	328.08ft
110m	360.89ft
120m	393.70ft
130m	426.51ft
140m	459.32ft
150m	492.13ft
160m	524.93ft
170m	557.74ft
180m	590.55ft
190m	623.36ft
200m	656.17ft

Proposed Permitted Height

Examples of turbines from each company currently on the market

GE

2 MW - 116	
2 MW platform	2 MW -- 116
Output (MW)	2.3 to 2.7
Rotor diameter (m)	116
Hub heights (m)	80, 90, 94
Frequency (Hz)	50, 60
Vavg (m/s)	8.0
Ve50 (m/s)	53.2
Cut-in (m/s)	3.0
IEC Wind Class	IIS/IIIS

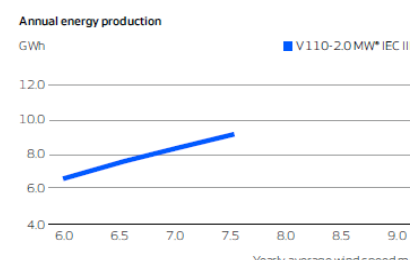
Siemens

SG 2.1-114

General details	
Rated power	2.1 MW
Wind class	IEC IIA/IIIA/S
Control	Pitch and variable speed
Standard operating temperature	Range from -20°C to 40°C ⁽²⁾
Rotor	
Diameter	114 m
Swept area	10,207 m ²
Power density	205.74 W/m ²
Blades	
Length	56 m
Airfoils	Siemens Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin
Tower	
Type	Multiple technologies available
Height	80, 93, 106, 125, 127, 153 m and site-specific
Gearbox	
Type	3 stages
Generator	
Type	Doubly-fed induction machine
Voltage	690 V AC
Frequency	50 Hz/60 Hz
Protection class	IP 54
Power factor	0.95 CAP-0.95 IND throughout the power range ⁽²⁾

Vestas

V110-2.2MW

Power regulation	
Pitch regulated with variable speed	
Operating data	
Rated power	2,000kW
Cut-in wind speed	3m/s
Cut-out wind speed	2.1m/s
Re cut-in wind speed	1.8m/s
Wind class	IEC IIIA
Standard operating temperature range from -20°C to 45°C	
Sound power	
Maximum	107.6dB*
*Sound Power Metric available	
Rotor	
Rotor diameter	110m
Swept area	9,503m ²
Air brake	full blade feathering with 3 pitch cylinders
Electrical	
Frequency	50/60Hz
Generator type	4-pole (50Hz)/6-pole (60Hz) doubly fed generator, slip rings
Gearbox	
Type	one planetary stage and two helical stages
Tower	
Hub heights	75m (IEC IIIA) 80m (IEC IIIA) 95m (IEC IIIA/IEC IIIB) 110m (IEC IIIB) 120m (IEC IIIB) 125m (IEC IIIB)
Nacelle dimensions	
Height for transport	4m
Height installed (incl. CoolerTop*)	5.4m
Length	10.4m
Width	3.5m
Hub dimensions	
Max. transport height	3.4m
Max. transport width	4m
Max. transport length	4.2m
Blade dimensions	
Length	5.4m
Max. chord	3.9m
Max. weight per unit for transportation 70 metric tonnes	
Turbine options	
<ul style="list-style-type: none"> - Power Optimised Modes up to 2.2 MW (site specific) - Condition Monitoring System - Vestas Ice Detection - Smoke Detection - Shadow Detection - Low Temperature Operation to -30°C - Aviation Lights - Aviation Markings on the Blades - Vestas IntelliLight* - Vestas Bat Protection System 	
Sustainability	
Carbon Footprint	7.2g CO ₂ e/kWh
Return on energy break-even	8 months
Lifetime return on energy	31 times
Recyclability rate	84.5%
*Configuration 80m hub height and wind class IEC IIIA. Depending on site-specific conditions.	
Annual energy production	
GWh	

Meters	Feet
1m	3.28ft
10m	32.81ft
20m	65.62ft
30m	98.43ft
40m	131.23ft
50m	164.04ft
60m	196.85ft
70m	229.66ft
80m	262.47ft
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170m	557.74ft
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Proposed Permitted Height

Examples of turbines from each company currently on the market

GE

2 MW - 116	
2 MW platform 2 MW - 116	
Output (MW)	2.3 to 2.7
Rotor diameter (m)	116
Hub heights (m)	80, 90, 94
Frequency (Hz)	50, 60
Vavg (m/s)	8.0
Ve50 (m/s)	53.2
Cut-in (m/s)	3.0
IEC Wind Class	IIS/IIIS

80 + 58 = 138 m
TH = 453 feet

Total Height
HH + 1/2 RD =

Siemens

SG 2.1-114

General details	
Rated power	2.1 MW
Wind class	IEC IIA/IIIA/S
Control	Pitch and variable speed
Standard operating temperature	Range from -20°C to 40°C ⁽²⁾
Rotor	
Diameter	114 m
Swept area	10,207 m ²
Power density	205.74 W/m ²
Blades	
Length	56 m
Airfoils	Siemens Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin
Tower	
Type	Multiple technologies available
Height	80, 93, 106, 125, 127, 153 m and site-specific
Gearbox	
Type	3 stages
Generator	
Type	Doubly-fed induction machine
Voltage	690 V AC
Frequency	50 Hz/60 Hz
Protection class	IP 54
Power factor	0.95 CAP-0.95 IND throughout the power range ⁽²⁾

80 + 57 = 137 m
TH = 449 feet

Vestas

V120-2.2MW

Power regulation	Pitch regulated with variable speed	
Operating data		
Rated power		2,000kW
Cut-in wind speed		3m/s
Cut-out wind speed		2.1m/s
Re cut-in wind speed		1.8m/s
Wind class		IEC IIIA
Standard operating temperature range	from -20°C to 45°C	
Sound power		
Maximum		107.6 dB*
*Sound Power Metric available		
Rotor		
Rotor diameter		110m
Swept area		9,500m ²
Air brake	full blade feathering with 3 pitch cylinders	
Electrical		
Frequency		50/60Hz
Generator type	4-pole (50Hz)/6-pole (60Hz) doubly fed generator, slip rings	
Gearbox		
Type	one planetary stage and two helical stages	
Tower		
Hub heights		7.5m (IEC IIIA) 8.0m (IEC IIIA) 9.5m (IEC IIIA/IEC IIIB) 11.0m (IEC IIIB) 12.0m (IEC IIIB) 12.5m (IEC IIIB)
Nacelle dimensions		
Height for transport		4m
Height installed (incl. CoolerTop*)		5.4m
Length		10.4m
Width		3.5m
Hub dimensions		
Max. transport height		3.4m
Max. transport width		4m
Max. transport length		4.2m
Blade dimensions		
Length		5.4m
Max. chord		3.9m
Max. weight per unit for transportation	70 metric tonnes	
Turbine options		
- Power Optimised Modes up to 2.2 MW (site specific)		
- Condition Monitoring System		
- Vestas Ice Detection		
- Smoke Detection		
- Shadow Detection		
- Low Temperature Operation to -30°C		
- Aviation Lights		
- Aviation Markings on the Blades		
- Vestas IntelliLight*		
- Vestas Bat Protection System		
Sustainability		
Carbon Footprint		7.2g CO ₂ e/kWh
Return on energy break-even		8 months
Lifetime return on energy		31 times
Recyclability rate		84.5%
*Configuration 80m hub height and wind class IEC IIIA. Depending on site-specific conditions.		
Annual energy production		
GWh		
■ V110-2.0MW* IEC IIIA		
	6.0	6.5
	7.0	7.5
	8.0	8.5
	9.0	
	Yearly average wind speed m/s	

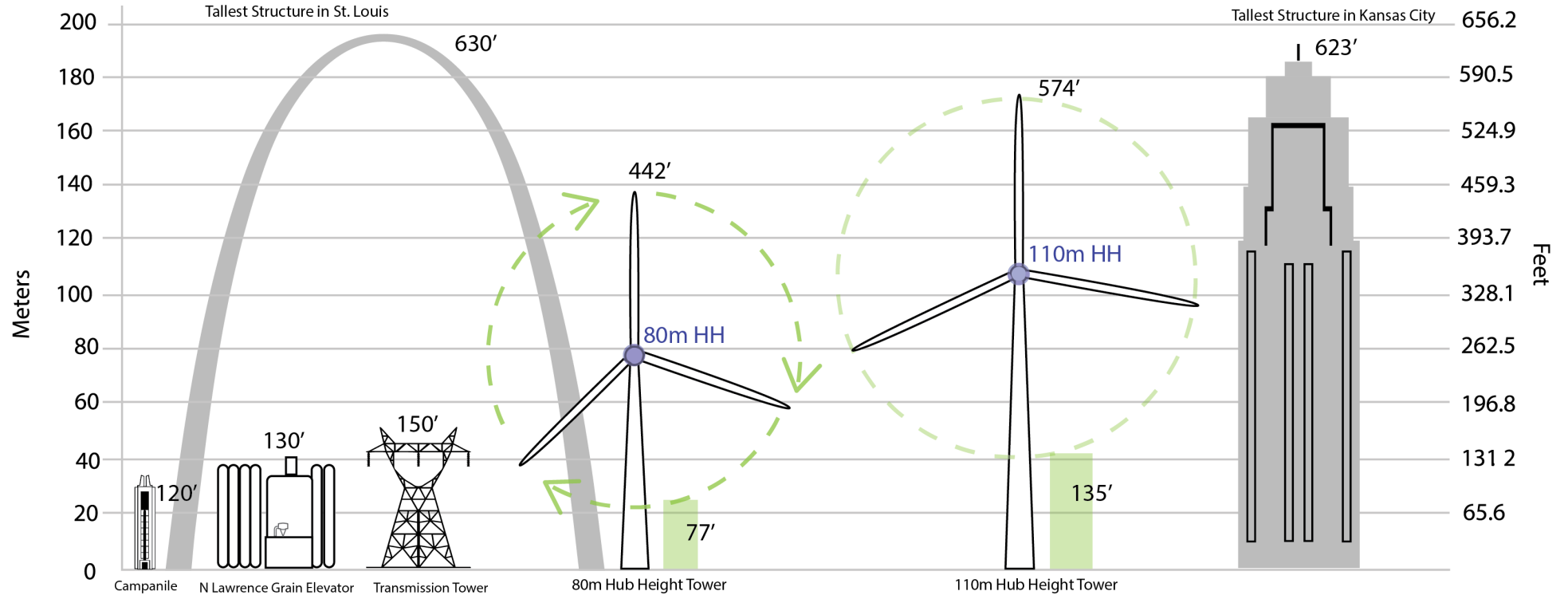
80 + 55 = 135 m
TH = 443 feet

Meters	Feet
1m	3.28ft
10m	32.81ft
20m	65.62ft
30m	98.43ft
40m	131.23ft
50m	164.04ft
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170m	557.74ft
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200m	656.17ft

C-WECS

Key Changes


Permitted Height (continued)



Campanile, 120'
N Lawrence Grain Elevator, 130'
Non-Specific Transmission Tower, 150'

Tallest Structures in KC/ STL:
One Kansas City Place, 623'
St. Louis Arch, 630'

 Clearance height

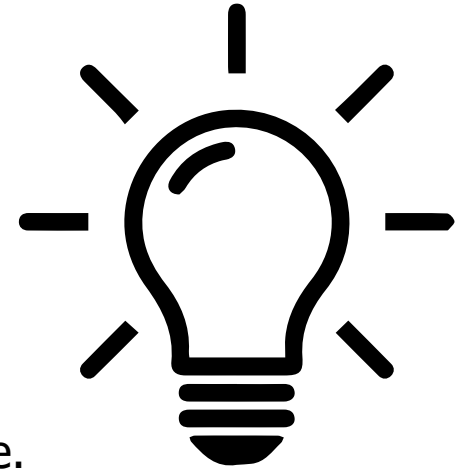
 HH = Hub Height, The distance measured from the ground immediately adjacent to the tower foundation to the center of the rotor hub.

Key Changes

12-306-44.03.04 Performance Standard

Staff Proposed Lighting Standards

All turbines and accessory facilities shall be sited to minimize adverse visual effect on the environment. Blade glint and shadow flicker shall be avoided to the greatest extent possible.



Lighting of turbines shall be **radar activated** and in compliance with current FAA Aircraft Detection Lighting System regulations. Any emergency reserve lighting shall follow “daytime white / nighttime red” standards.

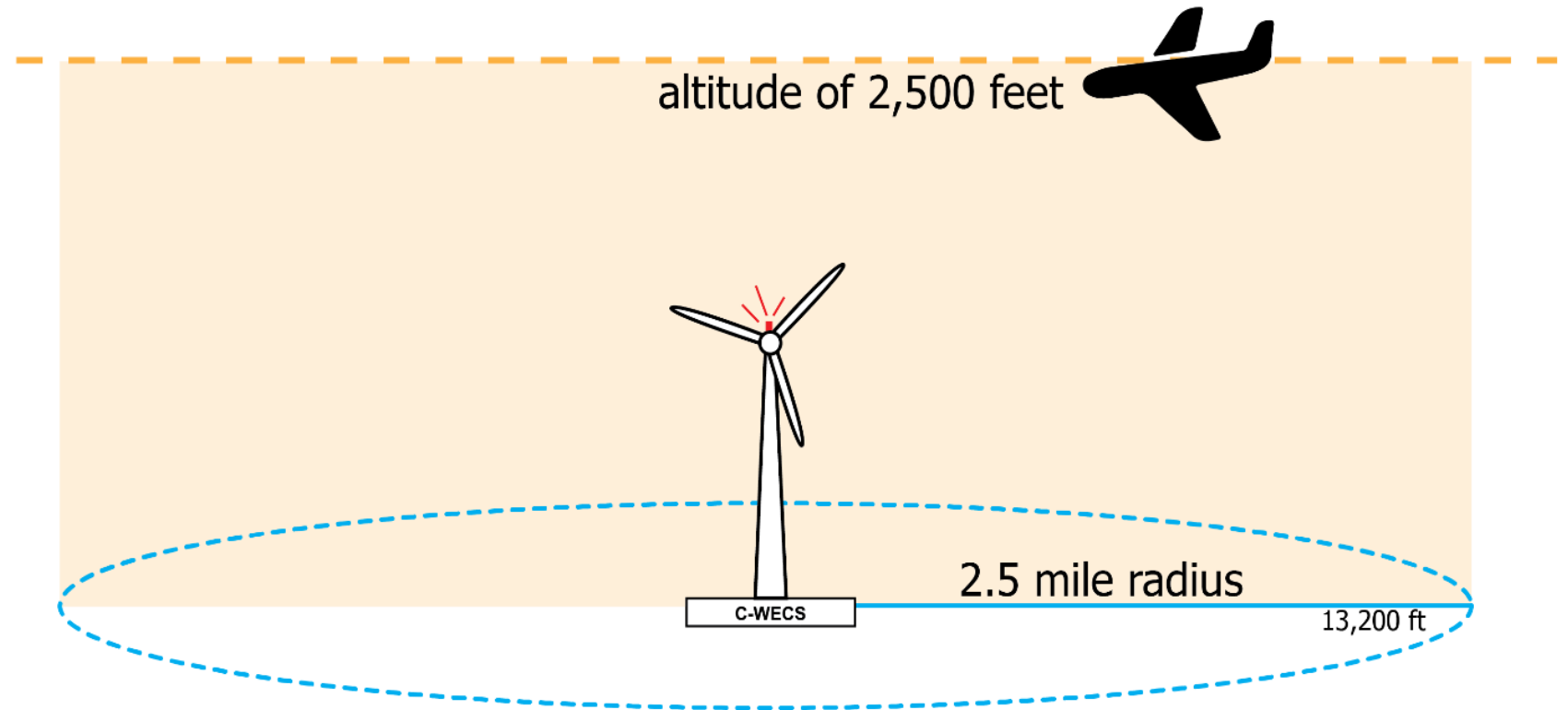
If built C-WECS project area materially differs from simulations and descriptions provided in the visual impact assessment, greater mitigation techniques will be required as determined by the Governing Body. These mitigation techniques may include but are not limited to, landscape screening, fencing, or removal of individual turbines at operator’s expense.

Key Changes

Staff Proposed Lighting Standards

This radar activated system is a system regulated by the FAA which would turn a light atop the turbine on only when an airplane goes below 2,500' altitude in an area less than 2.5 miles away from a turbine.

Otherwise the light would remain off.



Key Changes

12-306-44.03.04 Performance Standard

Staff Proposed Noise Standards

Construction: During construction phase of C-WECS development, construction activities of any nature may only occur from one hour after sunrise until one hour before sunset.

Operation: Noise level shall not exceed **50 decibels** measured at the property line of the nearest non-participating property owners. Noise caused by operating turbines shall not cause adverse low-frequency sounds which disrupt non-participating property owners.

A good faith effort shall be made by the C-WECS Operator to mitigate any unforeseen issues caused by demonstrable noise impacts.



Key Changes

Staff Proposed Noise Standards

Perception of volume is always subjective and depends on one's own hearing but generally speaking, an increase of 10 dB roughly corresponds to the perceived volume doubling in intensity.

For example, 60 dB is perceived as twice as loud as 50 dB.

How loud is a... ?



Whisper
30 dB



Refridgerator
40 dB



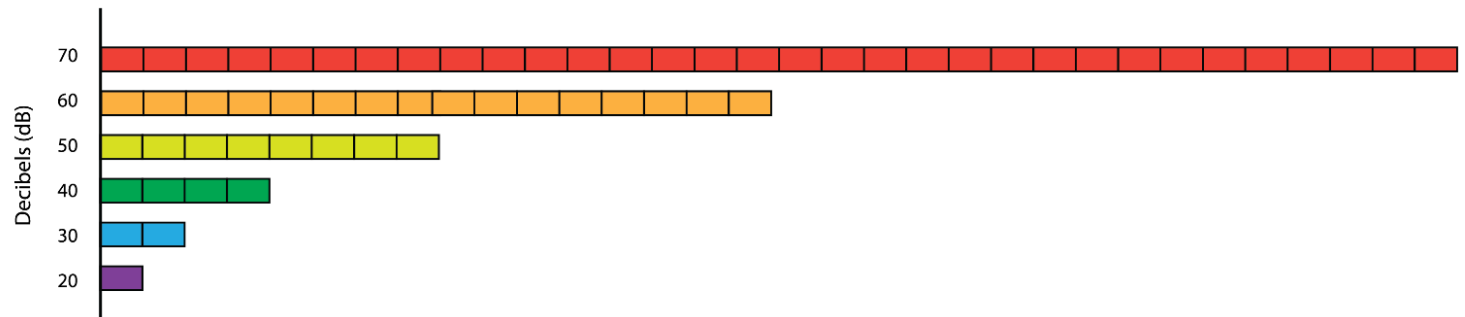
Dishwasher
50 dB



AC Unit
60 dB



Vacuum
70 dB



Next Steps

January 23rd – Regularly scheduled Planning Commission Meeting where staff will provide feedback on what was heard at this community meeting. Staff also intends to discuss the proposed application requirements more in depth. There will be an opportunity for public comment in front of the Planning Commissioners.
Online + In-Person

January 30th – Staff hosting open house meeting at City Hall Riverfront from 2pm-7pm. This is an opportunity for the public to make any additional comments and ask staff questions. There may be a few commissioners who attend, but there will be no action proposed or vote taken. This meeting will be hosted in-person and may include an online portion. Check the website for more details to come.

February 5th @ 11:59PM – the public comment period will close on the Draft Wind Regs. Comments will be compiled and received by the Planning Commission at their following PC Meeting.

www.lawrenceks.org/windregs

Dedicated email address: windregs@lawrenceks.org

Proposed Calendar

Date	Action
12/7	Publish Draft Revised Regulations
12/14	Mid-Month Study Session with PC
12/19	PC “open” public hearing , present staff report + PC to continue public hearing to 1/23/23.
1/12	Hold Community Meeting in SW County (Greenbush School, 6pm-9pm)
1/23	Update PC on discussion from community meeting + PC to continue public hearing to 2/22/23. Announce that formal public comment on WECS text will close 2/5
1/30	Open House held in Riverfront City Hall (2pm-7pm)
2/5	Public Comment will close (11:59PM)
2/22	PC Share “what we heard” analysis + PC to continue public hearing to 3/20/23.
3/8	Mid-Month, Present new revised regulations from previous guidance and changes made from pub comment
3/20	Present final draft of TA to be considered, Revised Staff Report + final public hearing

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