

# *Generation Clean*

*Commercial – Municipal – Agriculture*

The image shows a close-up of a white wind turbine nacelle. The word "Renewegy" is printed in a large, blue, sans-serif font across the side of the nacelle. The nacelle is attached to a tower, and a portion of a blade is visible in the foreground. The background is a plain, light color.

*VP-20 Wind Turbine  
Commercial grade wind  
power designed specifically  
for your business needs*



*Manufactured in  
Oshkosh, Wisconsin*

*Renewegy, LLC  
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Oshkosh, Wisconsin, 54901  
(877) 424-4632  
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# Why are Customers Considering Wind Power?



*Offset rising energy costs  
Marketing and increased sales  
Currently the lowest cost renewable  
Provides a reasonable return on investment  
Reduce dependence on fossil fuels*



**“Make it  
where you use it!”**

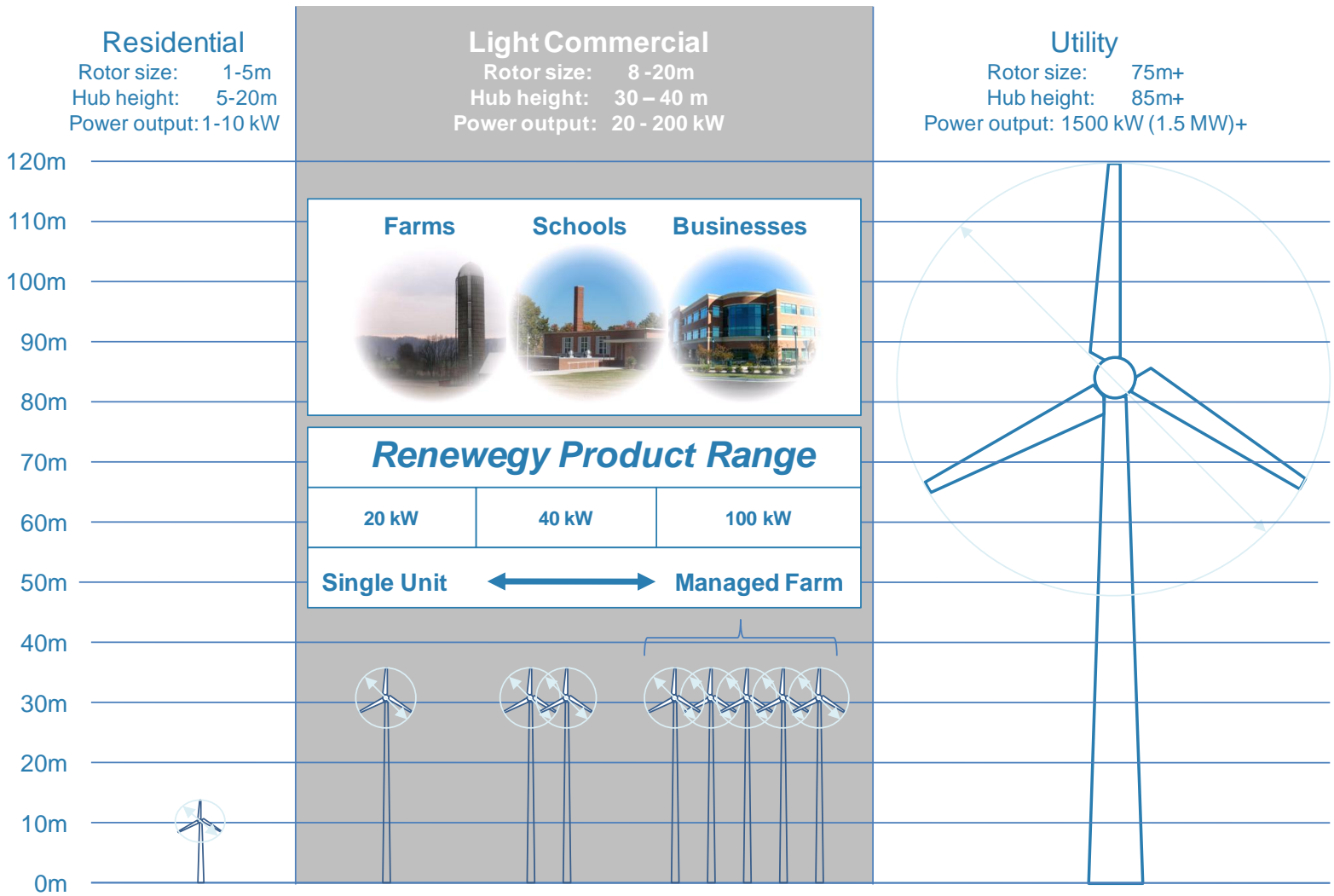
*Mike Dillon - SCA Tissue*

**“It’s just the  
right thing to do”**

*John Bergstrom - Bergstrom Automotive*

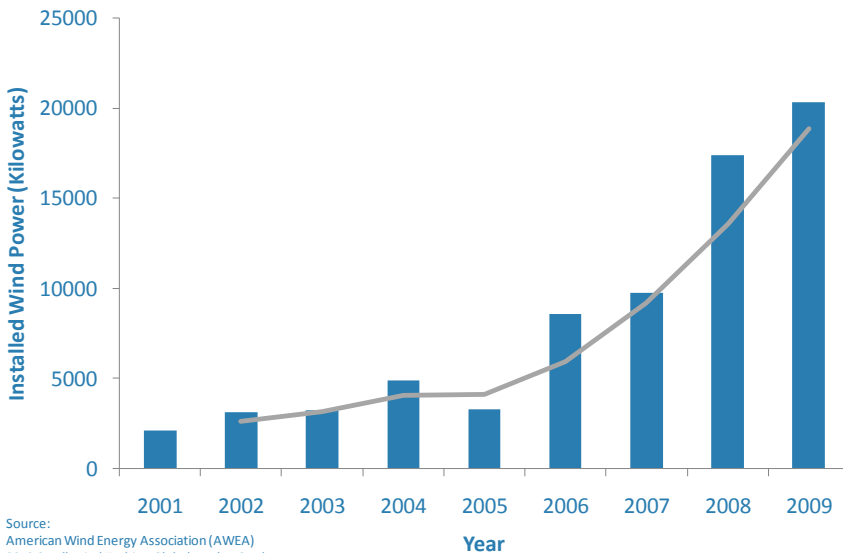


# Intelligently Scalable to Meet Your Needs



**Renewegy has brought big turbine technology and reliability into the light commercial market. Now businesses, schools, municipalities, and farms can enjoy the same renewable energy that our utilities have been harnessing for years. Whether you are looking for 20 kilowatts (single turbine) or 100 kilowatts (5 turbines) of wind power, Renewegy has a solution for you.**

## Growth of Small Wind (USA)



## Who's Installing Wind Power

- Commercial Businesses
- Industrial Businesses
- Agricultural Businesses
- National Retailers
- Schools and Universities
- Municipalities
- Non-profit Organizations

# Unique Tip-Down Tower for Ease of Service

*Our monopole tower system has been custom designed specifically for our 20kW turbine to provide simple and cost-effective installation and serviceability. The hydraulic tip-up design eliminates the expense of large cranes and service equipment. Renewegy's hydraulic cylinders and power supply are fit to the tower during installation and servicing. When the tower is erected and securely bolted in place, the cylinders are removed. The result is a reduction in installation and service costs that saves time and money.*



Tower Delivery



Tower Assembly



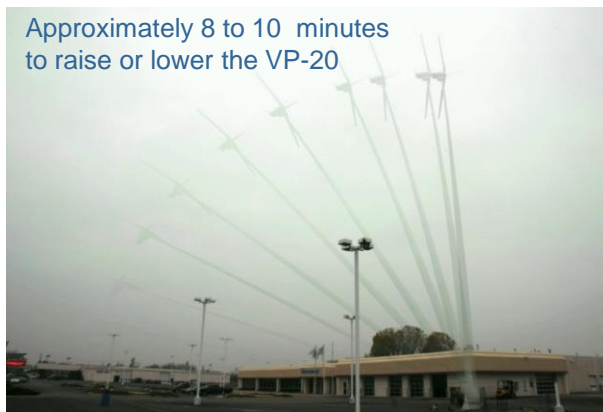
Turbine Head Attachment



VP-20 ready for tip up

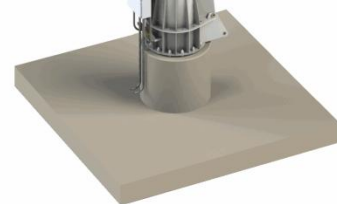


Hydraulic Tip-up System

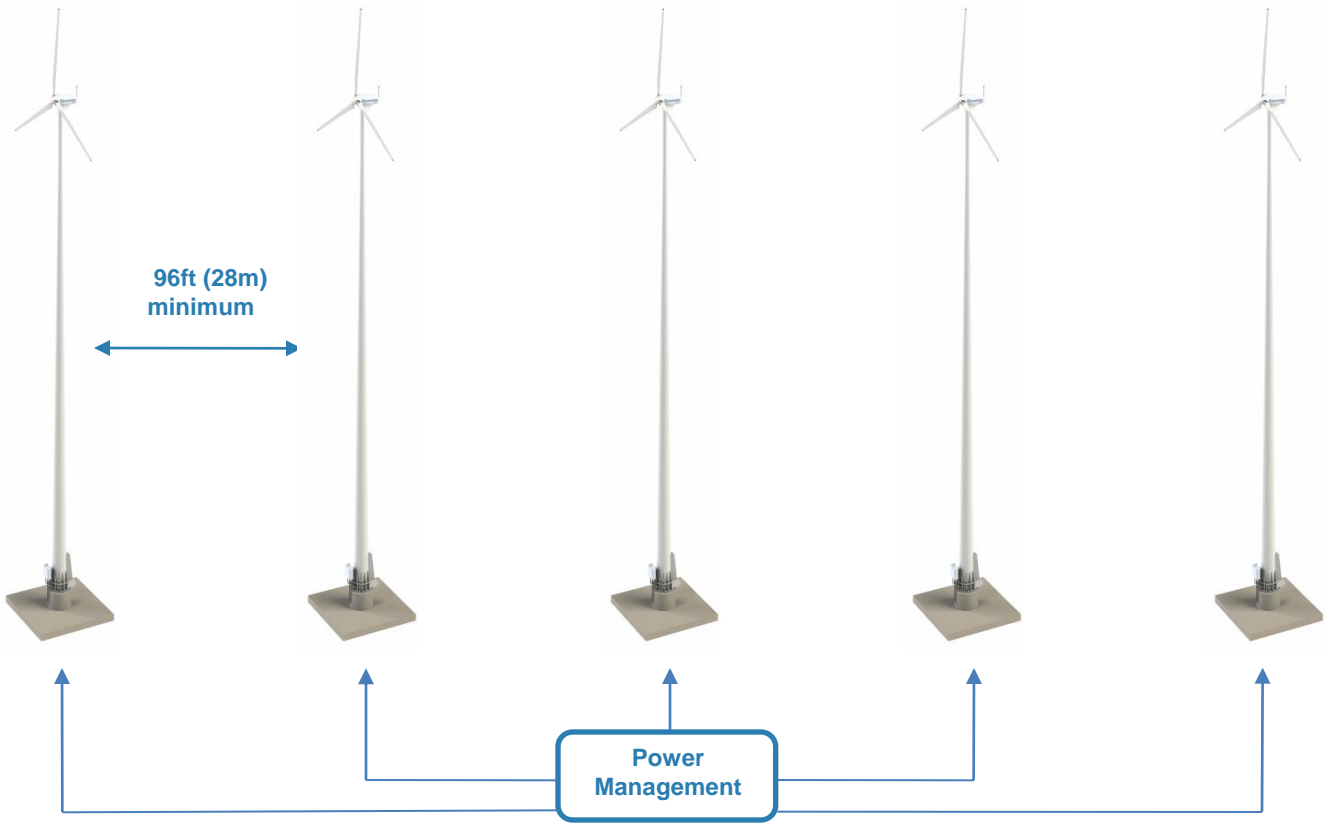


Approximately 8 to 10 minutes to raise or lower the VP-20

Note: The hydraulic cylinders and power supply shown are used for installation and service events. They are not included in the standard package; however, may be purchased separately.

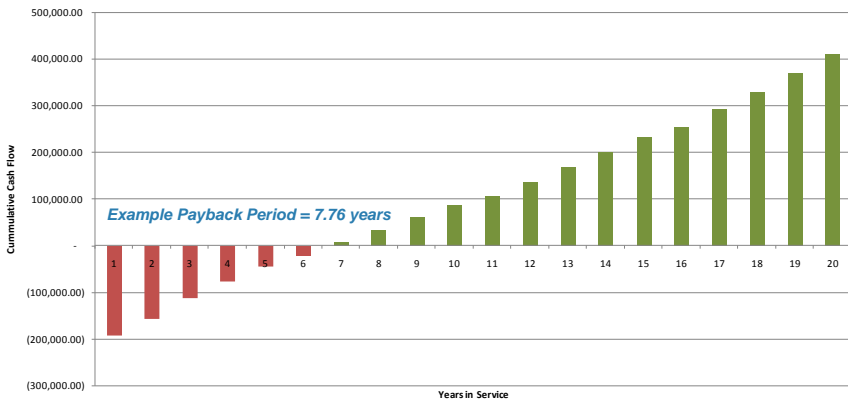


# Economics of a 100 kW installation

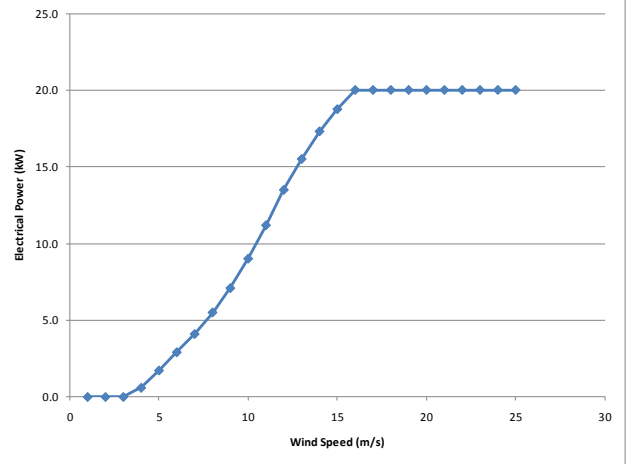


## 100kW Financial Analysis

Cumulative Cash Flow



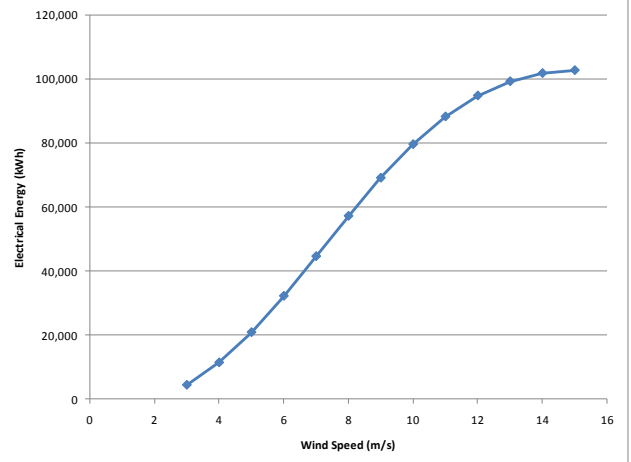
VP-20 Power Curve



Annualized Cash Flow



VP-20 Estimated Annual Energy Production



Assumptions used:

- 6.0 meter per second average wind speed
- 2011 electricity cost of \$0.105 per kWh (with 4.0% annual escalation)
- RECS valued at \$20 per Megawatt-hour
- Insurance cost of \$1.50 per \$1,000 of coverage
- Operating and maintenance costs of \$0.01 per kWh
- Corporate tax rate of 35%
- Incentives estimated at 30% federal and 20% state (note incentives vary by state, locality, utility, and zoning – contact Renewegy for more information)

# Turn Key - Easy as 1-2-3

## Learn

### Friendly Sales Staff

Light commercial wind power is new to our businesses and communities. Many people are excited about the possibility of wind power; however, they have questions and concerns that must be addressed. Whether you would like to learn about incentives, permits, or the steps to installation, our Renewegy staff is ready and willing to help explain wind power in general and specifically how the VP-20 generates clean, renewable energy.



## Install

### Doing it Right the First Time

Starting with a site plan layout of your facility, the Renewegy team will help you through the process of installing your turbine(s). Renewegy can act as your General Contractor to ensure the quality, timeliness, and cost effectiveness of your turbine(s) installation. If you prefer, we can work directly with your designated concrete and electrical contractors. The entire process can happen in as little as six weeks.



## Commission

### Tip Up and Make Clean Power

Twenty Eight (28) days after your concrete foundation is installed, the Renewegy installation team will arrive at your site to assemble your tower, attach your turbine head, and erect and commission your turbine(s). The entire process typically takes less than one day per turbine. Once commissioning is complete, your turbine(s) will immediately begin making clean power for your facility and will be monitored 24-7 by the Renewegy team.

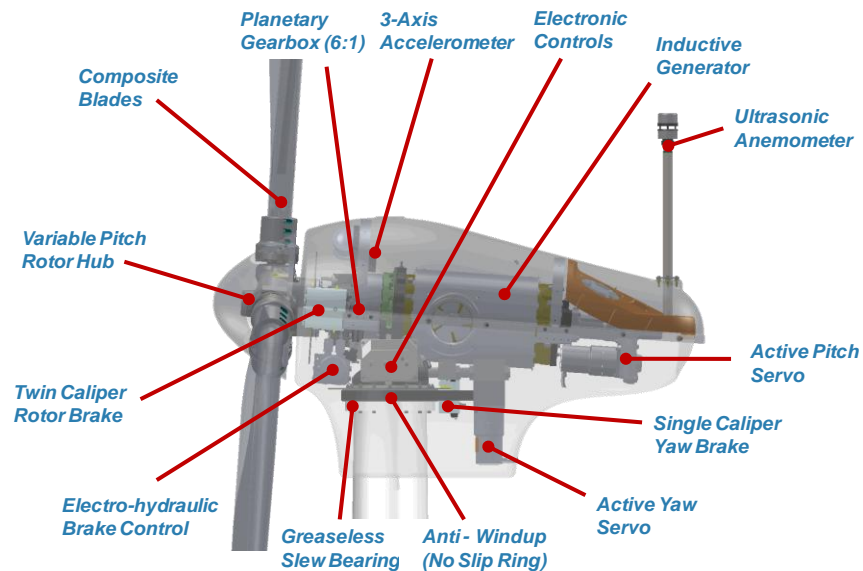


# Leading the Light Commercial Market

## Optimal

### Electronic Pitch Control

The VP-20's electronic Variable Pitch (VP) control system is unique in the Light Commercial market. Why is Variable Pitch important? Every wind turbine needs a way to control and optimize its performance over the wide range of wind speeds and environmental conditions. Like its Utility scale counterparts, the VP-20 actively controls the pitch of each blade within 1/100<sup>th</sup> of a degree while pitching at speeds up to 15 degrees per second. This unique capability allows the VP-20's control system (seven microcomputers working in unison) to optimize the turbine's performance while ensuring safety and reliability.



## Safe

### Three Axis Accelerometer

What if Renewegy could put an engineer on top of every one of our VP-20 products to ensure the safety and performance of the turbine? Well – that's probably a little impractical; however, we've done the next best thing. Each VP-20 turbine head comes standard with an electronic 3-Axis Accelerometer to measure the key vibrations from your turbine head. This information is processed 10 times per second by the VP-20's master controller to ensure that your turbine is operating safely under all conditions. If anything abnormal is detected, a warning is triggered. If the condition worsens, the master controller will automatically shut the turbine down until a service technician can evaluate the situation.



## Smart

### Internet Connectivity – Remote Monitoring

Like its larger counterparts, each VP-20 turbine is connected to the internet. Not only can you monitor the performance of your turbine through any web browser (like the screen to the right), but Renewegy service technicians can remotely do a deep dive into your turbines systems to monitor and/or diagnose any issues that may arise. Additionally your VP-20 turbine can be remotely setup to analyze itself by acquiring up to 8 Megabytes of data (15 channels of data at up to 10 times per second). Once the data is captured, your VP-20 is smart enough to automatically upload the data to Renewegy's technicians for review.

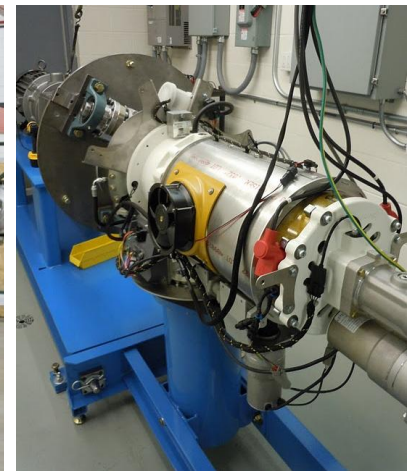
Parameter	Value	Units
Operating Mode	RUN	
Instantaneous Power	19.200	kW
Lifetime Total Energy	4036.130	kWh
Cycle Energy	161.176	kWh
Cycle Time	14:10:40	time (hh:mm:ss)
Wind Speed	17.69	m/s
Wind Direction	305.92	degrees
Pitch Angle	77.68	degrees
Yaw Angle	-62.8	degrees
Air Density	1.115	Kg/m <sup>3</sup>
Air Temperature	0.50	C
Barometric Pressure	87.7	kPa
Generator Speed	654	RPM



# Proudly Designed and Manufactured in the USA



- American Ingenuity → Building USA's clean energy technology
- American Steel → Proud to partner with USA based suppliers
- American Jobs → Manufactured in Oshkosh, Wisconsin



# VP-20 Data Sheet

## Operating

	<u>Standard</u>	<u>Metric</u>
• Rated Power:	27 HP	20 kW
• Rated wind speed:	28 MPH	13.5 m/s
• Cut-in Speed:	6.7 MPH	3.5 m/s
• Cut-out Speed:	55.9 MPH	25.0 m/s

## Rotor

• Number of Blades:	Three	
• Rotor Speed:	100 – 110 RPM	
• Diameter:	31.2 ft	9.5 m
• Swept Area:	763 ft <sup>2</sup>	70.9 m <sup>2</sup>

## Generator

• Type:	Asynchronous Inductive
• Rated Speed:	600 - 660 RPM
• Voltage:	480VAC 3-phase

## Gearbox

• Type:	Single Planetary
• Ratio:	6.00:1

## Control

• Type:	Microprocessor based
• Pitch:	Active closed-loop electric servo control
• Yaw:	Active closed-loop electric servo control
• Algorithm:	Proprietary Synergistic Pitch/Generator Control
• Connectivity:	Cellular, 802.11, wired Ethernet
• Managed:	Master or Slave (wind farm capable)

## Braking System (fail safe)

• Rotor Aerodynamic:	Active blade pitch control (fully feathered)
• Rotor Mechanical:	Dual caliper spring loaded disc brake
• Yaw Mechanical:	Single caliper spring loaded disc brake

## Lightning Protection

• Grounding:	Coherent ground path from turbine to Ufer grounded foundation
• Strapping:	Dedicated braided strapping to ensure low resistance ground path
• Surge:	Standard suppression installed in all electronics

## Tower Options

• Monopole:	30 meter hydraulic tip-down system
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