



**“We Bring  
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to Life”**

# *New Curing Barn Performance Assessment*

*47<sup>th</sup> Tobacco Workers’ Conference*

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*North Carolina State University*

Biological and Agricultural Engineering



# Background

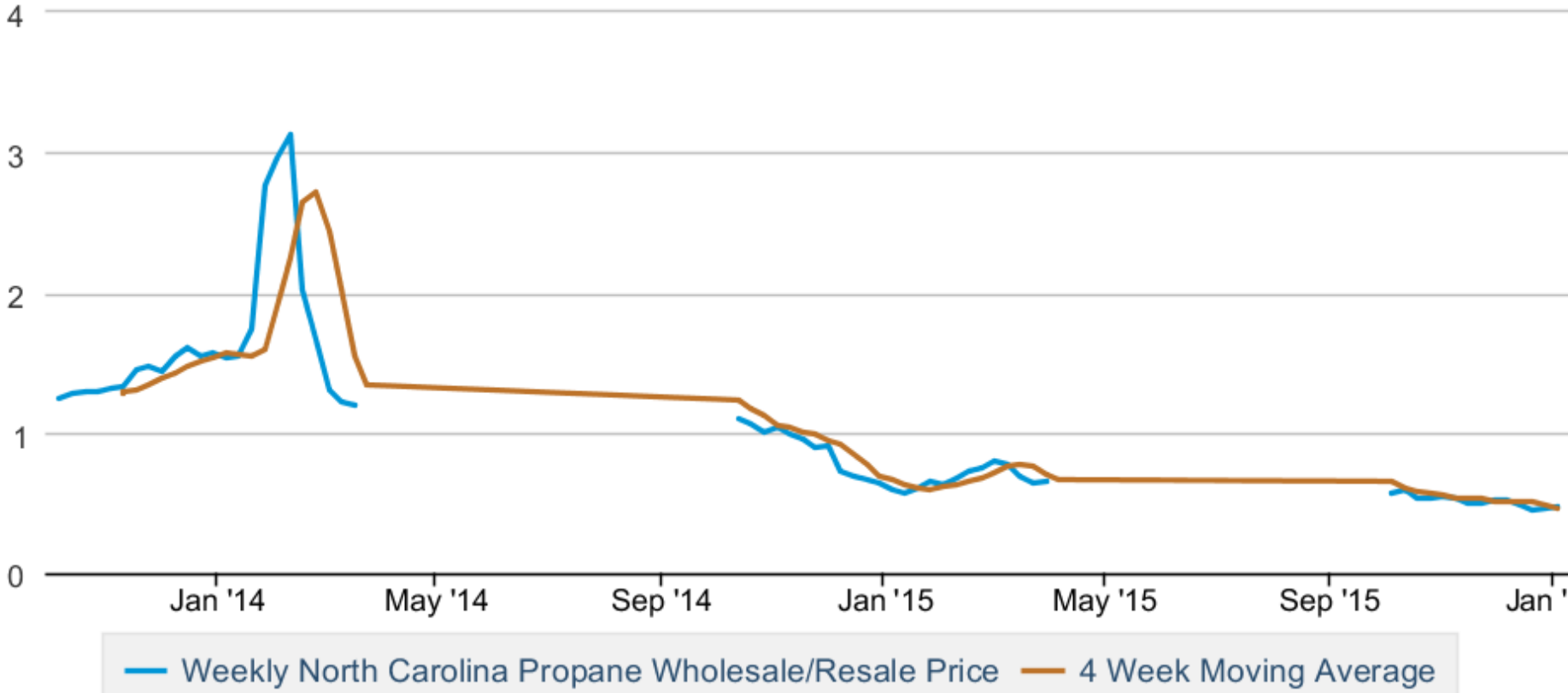
- Energy usage remains a significant input cost
- Considerable price fluctuations of petroleum fuels in recent years and continued uncertainty of future prices
- Growers continue to make energy efficiency improvements to existing infrastructure and replacing older barns
- Approximately 15,000 to 18,000 operational barns in NC
- Provide on-farm independent energy and other performance related information to assist growers with curing infrastructure decisions
  - *Total energy footprint (LP gas and kWh usage)*
  - *Green and cured leaf weights*
  - *Cure duration*
  - *Static pressure (airflow)*
  - *Cured leaf quality, barn curing management (user-friendly)*

# Variables Effecting Energy Consumption

- Barn energy efficiency (insulation, structural air leaks)
- Heat exchanger efficiency
- Burner firing rate (BTU/hr)
- Ambient temperatures
- Curing management
- Quantity of tobacco
- Quality of tobacco
- Curing energy efficiency quantified as pounds cured leaf per unit of fuel (lbs/gal LP)

# Weekly North Carolina Propane Wholesale/Resale Price

Dollars per Gallon



Source: U.S. Energy Information Administration

# New Curing Barns – 2013

## Johnston County, NC



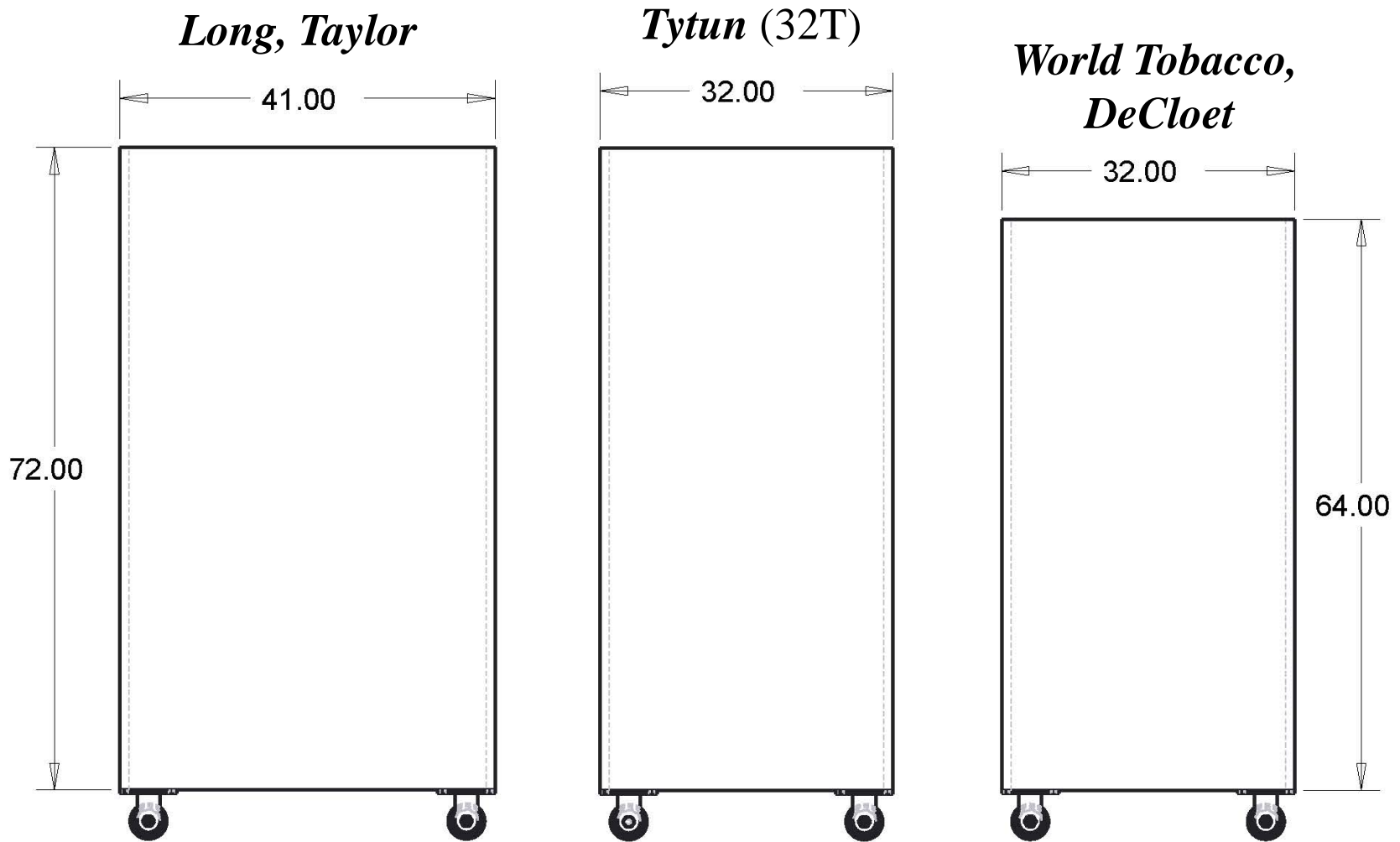
# New Curing Barns – 2014



# New Barn Specifications

- **Long (10-box) – 2013**
    - *Long HEx @ 350,000 Btu/hr*
  - **World Tobacco (15-box) – 2013**
    - *Evans HEx @ 500,000+ Btu/hr*
    - *2" insulated panels*
  - **Tytun (14-box, 32T) – 2013**
    - *Powermatic HEx @ 400,000 Btu/hr*
    - *4" insulated panels*
  - **Long Prototype (10-box) – 2014**
    - *Long HEx @ 400,000 Btu/hr*
  - **World Tobacco Basic (12-box) – 2014**
    - *Evans HEx @ 325,000 Btu/hr*
    - *2" insulated panels*
  - **Tytun (18-box, 32T) – 2014**
    - *Powermatic HEx @ 550,000 Btu/hr*
  - **Taylor (10-box) – 2014**
    - *Evans HEx @ 390,000 Btu/hr*
    - *3" insulated panels*
- Fan motors 10 Hp, except **Tytun** 18-box and **Long Prototype** (15 Hp)
  - All barn pads insulated
  - Automatic ventilation control on all barns

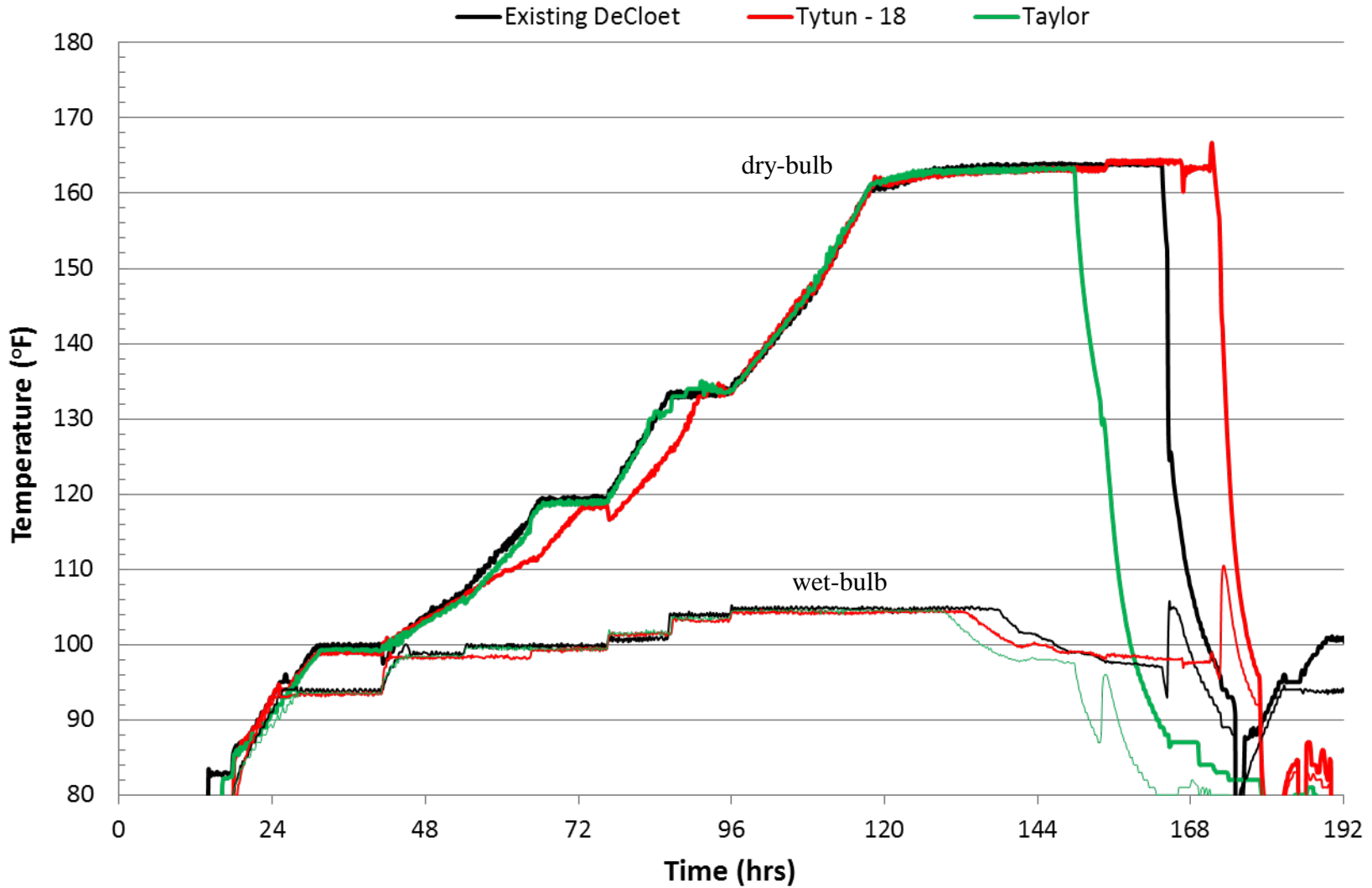
# Box Size Comparison



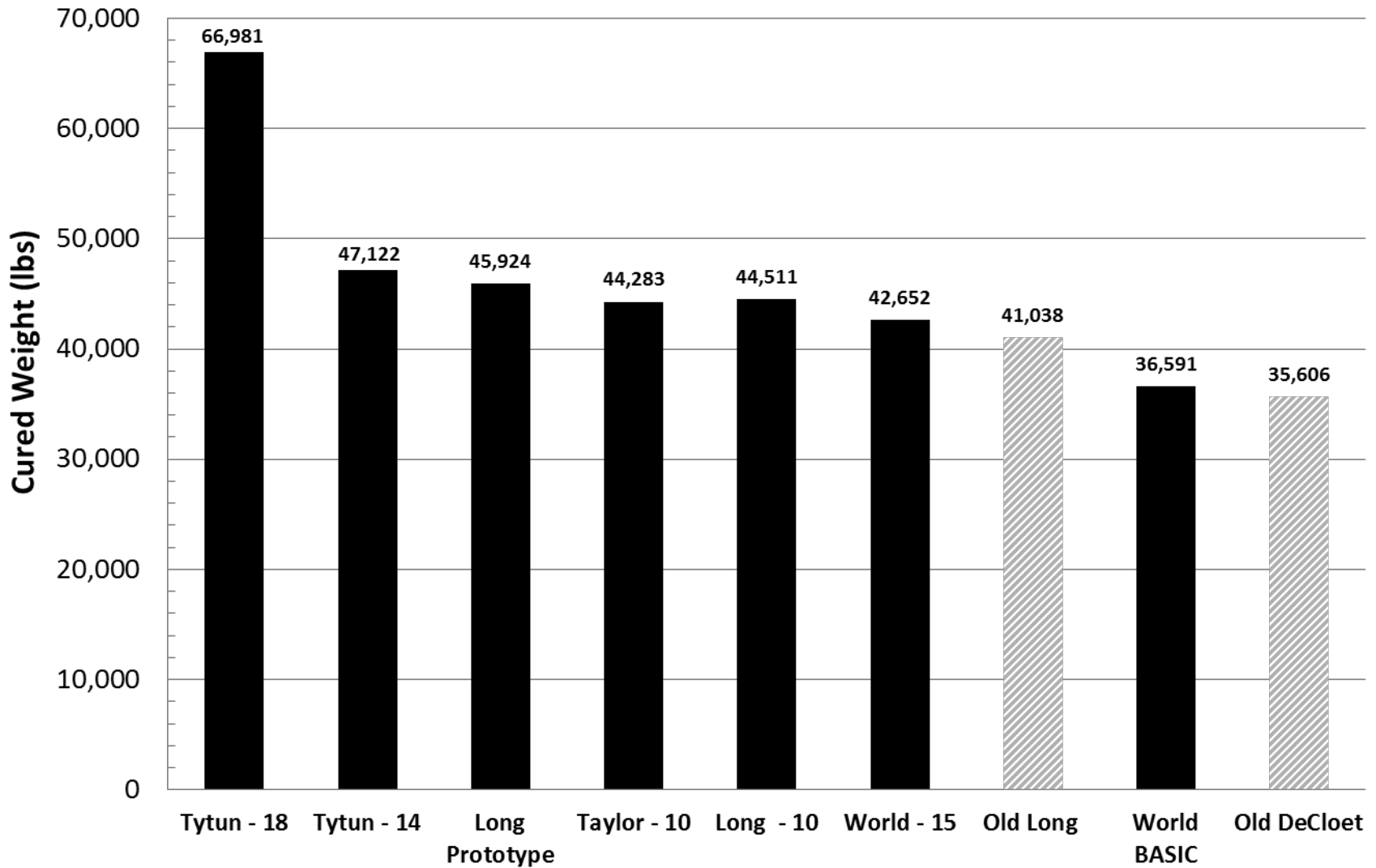
*\* All dimensions are approx.*



# Temperature Profiles – Cure 8, 2014



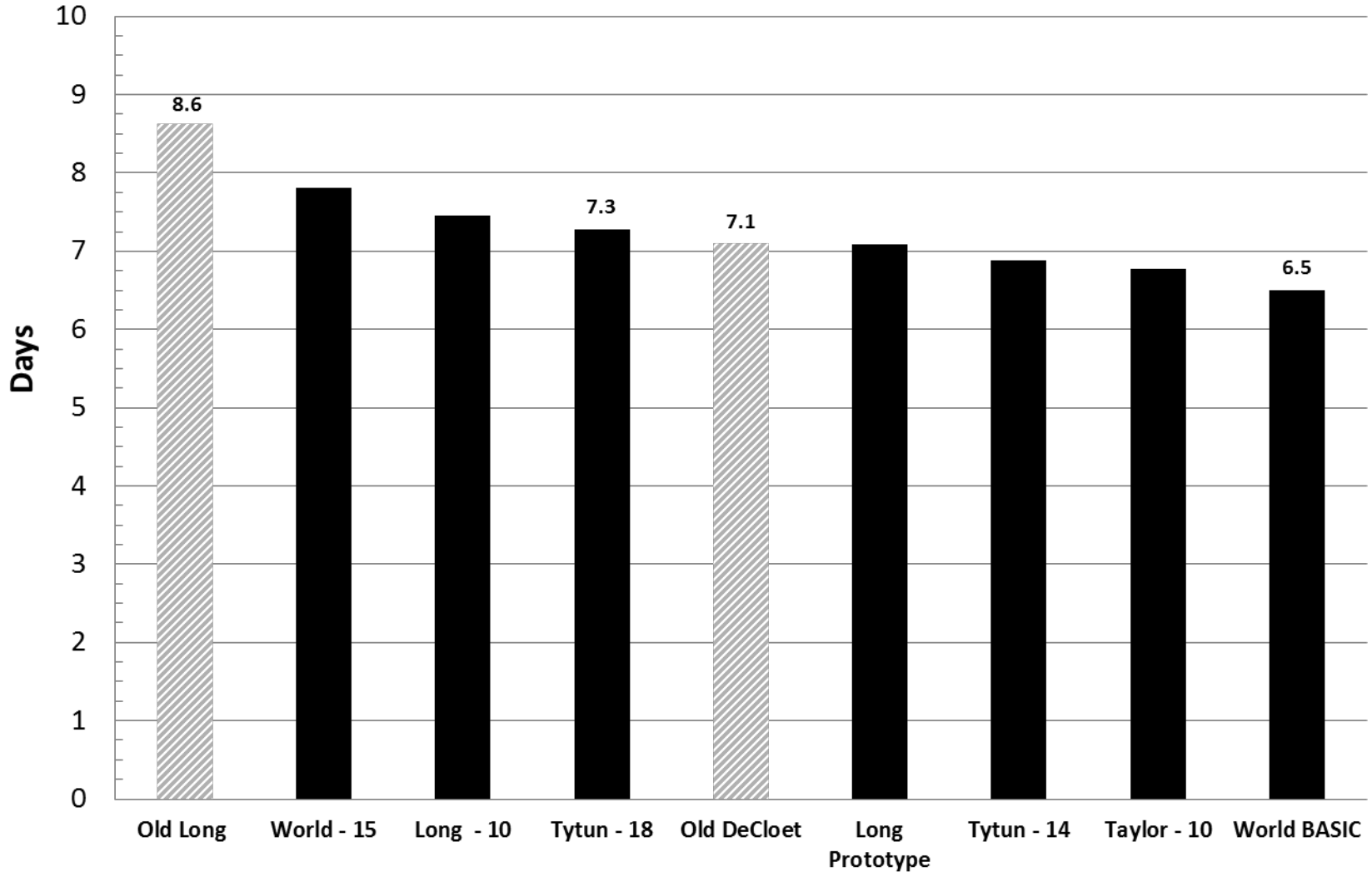
# Total Cured Weight – 10 Cures, 2014



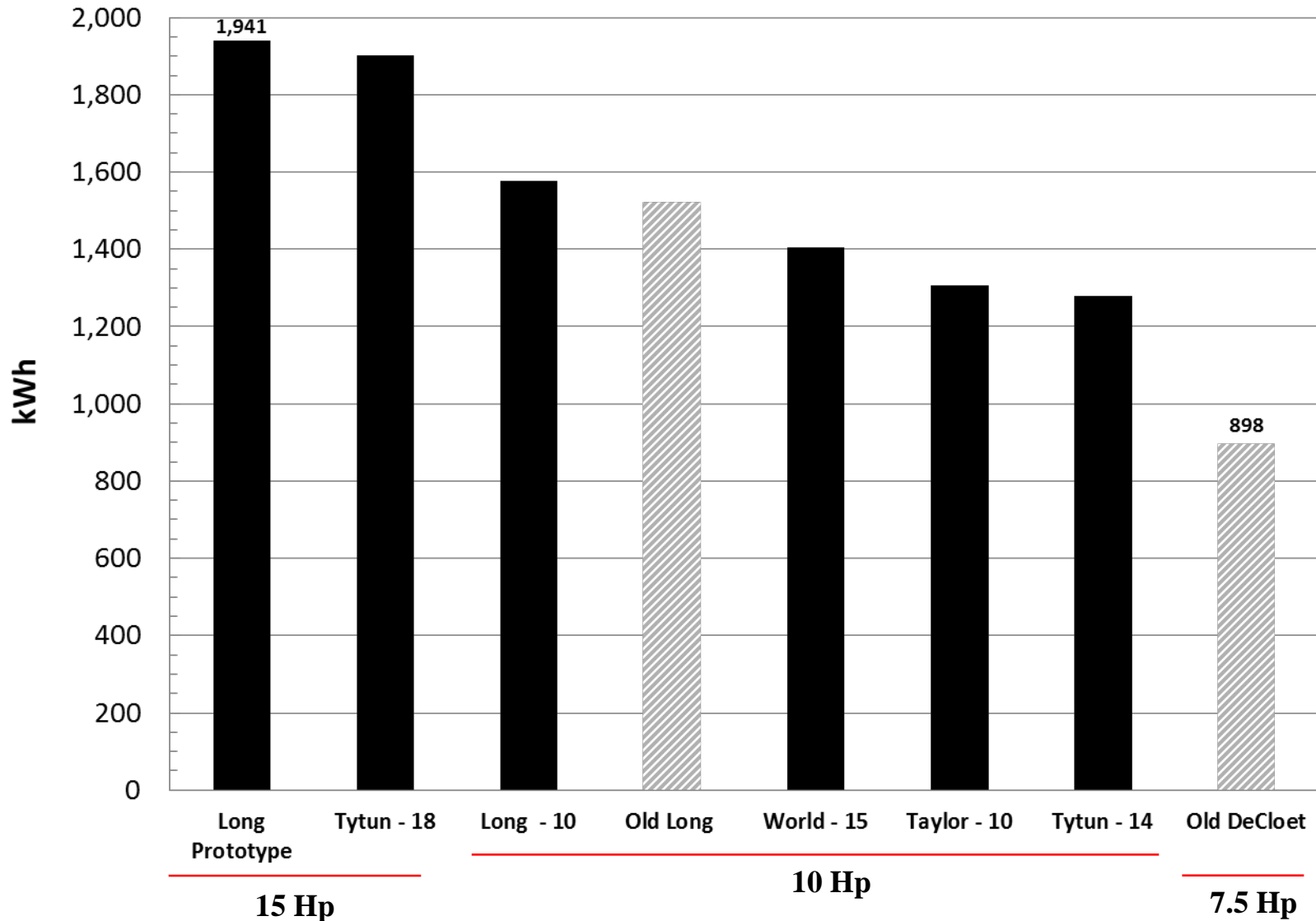
# Estimated Barn Capacity Comparison – 2014 Results

Average Yield (lb)	Estimated Barn Capacity (acres) – 8 Cures						
	<i>Existing Long (10-Box)</i>	<i>Existing DeCloet (13-box)</i>	<i>Long (10-box)</i>	<i>Taylor (10-box)</i>	<i>World (15-box)</i>	<i>Tytun (14-box)</i>	<i>Tytun (18-box)</i>
2,000	16.4	14.2	17.8	17.7	17.1	18.8	26.8
2,200	14.9	12.9	16.2	16.1	15.5	17.1	24.4
2,400	13.7	11.9	14.8	14.8	14.2	15.7	22.3
2,600	12.6	11.0	13.7	13.6	13.1	14.5	20.6
2,800	11.7	10.2	12.7	12.7	12.2	13.5	19.1
3,000	10.9	9.5	11.9	11.8	11.4	12.6	17.9
3,200	10.3	8.9	11.1	11.1	10.7	11.8	16.7
3,400	9.7	8.4	10.5	10.4	10.0	11.1	15.8

# Season Average Cure Duration, 2014

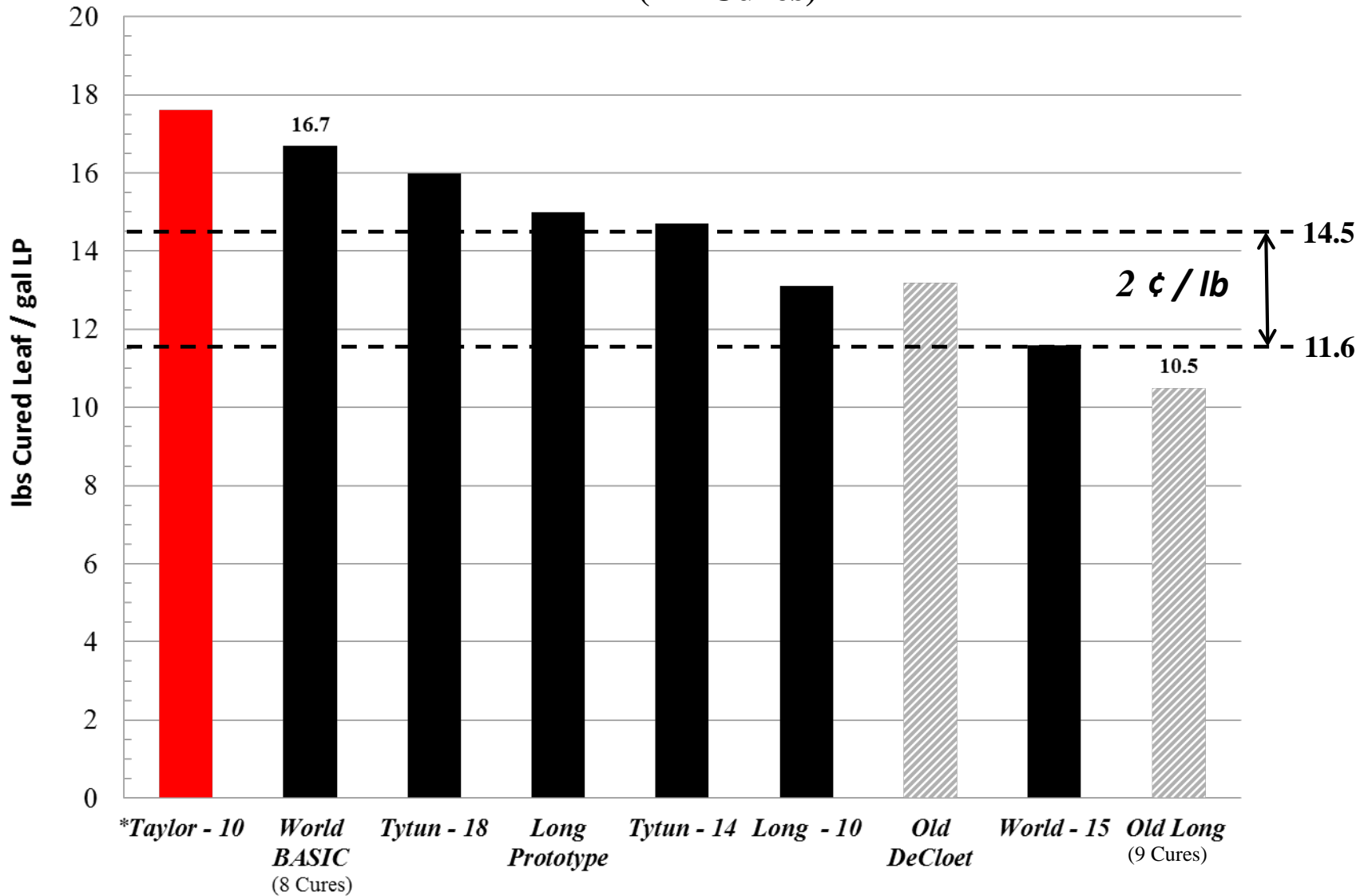


# Season Average Electrical Energy Usage, 2014



# Season Average Fuel Efficiency Comparisons, 2014

(All Cures)



\* No lower-stalk cures included

# Summary

- Approximately 25% increase in curing efficiency averaged over the season
- Increased capacity and faster curing time
- No cured leaf quality or barn management differences observed
- 6 barn manufacturers made and sold barns in 2014
- Energy performance alone is not the single justification for purchasing a given barn make, but remains an important factor
  - *New barn cost*
  - *Resale value*
  - *Material handling capacity*
  - *Existing barn infrastructure*
  - *Existing material handling system*
  - *Serviceability and maintenance costs*
- Independent performance information can help manufacturers with developing and implementing technologies to improve overall barn design

# Acknowledgements

- Lake Wendell Farming Co. LLC.
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- Alliance One International
- Japan Tobacco International
- Philip Morris International