

# Bats & Wind Energy Development

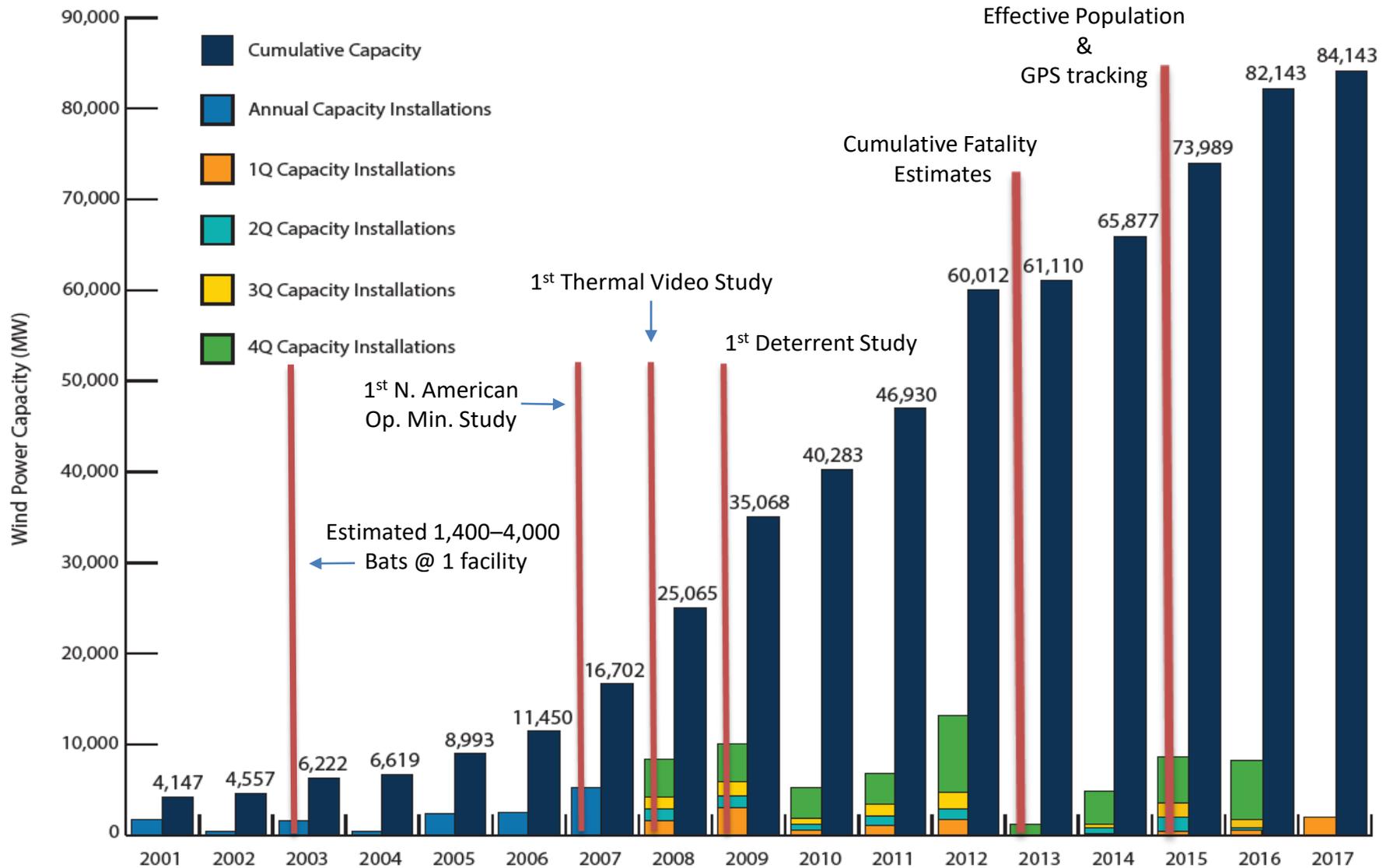
## NWCC Webinar



Cris Hein, BCI

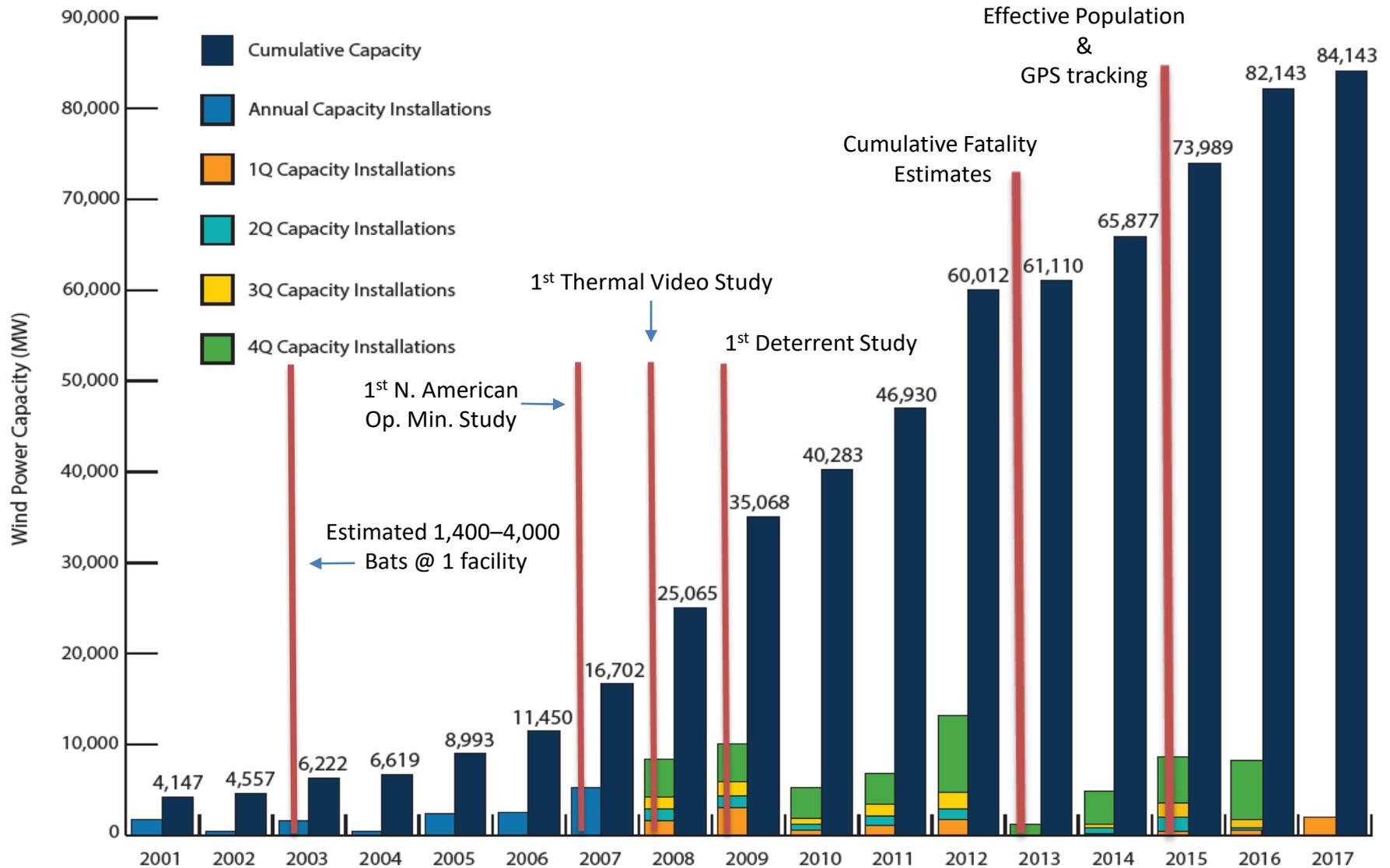
18 July 2017

# U.S. Annual and Cumulative Wind Power Capacity Growth



Note: Utility-scale wind capacity includes installations of wind turbines larger than 100-kW for the purpose of the AWEA U.S. Wind Industry Quarterly Market Reports. Annual capacity additions and cumulative capacity may not always add up due to decommissioned and repowered wind capacity. Wind capacity data for each year is continuously updated as information changes.

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# Population-level Impacts

- Difficult to collect population & demographic data for bats
- Bats have low reproductive rate, typically having 1 to 2 pups/year, and require high adult survivorship to avoid population declines (*Barclay & Harder 2003*)
- Effective population size for bats varies (*Pylant et al. 2016*)
  - Hoary bats  $\sim 10^3$ – $10^4$
  - Eastern red bats  $\sim 10^5$ – $10^6$  (similar to *Vonhoff & Russell 2015*)
- Hoary bat populations could decline by 90% in next 50 years (*Frick et al. 2017*)

# Detering Bats from Wind Turbines

- 5 projects awarded funding by U.S. DOE (EERE)
  - 2 nacelle-mounted deterrents (BCI & GE), 2 blade-mounted devices (Frontier Wind & Univ Massachusetts), & 1 textured coating on tower surface (TX Christen Univ)
  - <https://energy.gov/eere/wind/wind-energy-technologies-office>
- BCI is working with NRG Systems on 3 projects
  - Multiple wind energy partners & turbine manufacturers
  - Different species assemblages & environmental conditions
  - 1 study comparing deterrents vs. feathering up to 5.0 m/s

# Refining Operational Minimization

- Using temperature + wind speed (*Martin et al. 2017*)
- Wind Wildlife Research Meeting XI Proceedings
  - <https://www.nationalwind.org/wp-content/uploads/2017/05/WWRM-XI-Proceedings-May-2017.pdf>
  - Peak fatality analysis (*Huso & Maurer 2016*)
  - Criteria to control turbine operations (*Schirmacher et al. 2016*)
  - Acoustic & weather data to predict bat risk (*Peterson 2016*)
  - Real-time acoustic data trigger operational minimization (*Sutter 2016*)

# Post-construction Fatality Monitoring

- Generalized Estimator (*Hein et al. 2016*)
  - Accurate & precise estimate for bird & bat fatality
  - Accommodate all assumptions from previous estimators
  - Comparable results among studies
  - Draft version tested during a workshop in early September
- Fall distribution of bats
  - Indication that bats fall farther from wind turbines at higher wind speeds
  - Implications for studies using relatively small search plots
- Estimating fatality from road & pad searches
  - Implications for cost-effective monitoring

# Behavior of Bats at Wind Turbines

- Thermal video (*Horn et al. 2008, Cryan et al. 2014, Gorresen et al. 2016*)
  - Provides specific timing & conditions of interactions
  - Need for paired acoustic & video data
  - Refine software to efficiently & effectively ID targets
  - Advance 3D processing
  - Implications for impact reduction strategies
    - Where to place & orient deterrent devices
    - Whether bats are echolocating near wind turbines
    - Refine operational minimization
- Workshop to consolidate findings/methods

# Species Distribution Models

## Understand variation in fatality rates of hoary bats

- AWWI initiative to characterize ecogeographical features associated with variation in fatality rates
- Given migratory bats can move  $>50$  km/night, travel decisions may be based on regional ecogeographical features rather than site-specific characteristics
  - Landcover, Elevation, Distance to water, Distance to forest, Degree of artificial light
- Use models to inform siting decisions

# Bat Activity & Movement Patterns

- Bat Acoustic Monitoring Portal (BatAMP)
  - Track bat activity over space & time using long-term acoustic recording stations
  - <http://batamp.databasin.org>
- Tracking bat movement patterns
  - Radio-telemetry (*Roby & Gumbert 2016*)
    - Aerial & ground tracking to follow 11 Indiana bats between 2009–2016
    - Timing & duration of migration
  - GPS tags & Data Loggers (*Castle et al. 2015, Weller et al. 2016*)
    - New technique for attaching tags for long-term data collection
    - Movement & activity patterns of hoary bats during migration
  - MOTUS-automated radio telemetry arrays
    - Nanotags broadcast signals-detected by automated stations 24/7/365
    - <https://motus.org/>

# BWEC Science Meeting

- 21 members (agency, industry, NGO, academia)
- BWEC Science Meetings held ~3 years
- Establishes priorities for bats & wind energy research
- 2012 & 2015 meetings held early January
- Decided to hold off until June 2018
  - Likely will not have deterrent results by January
  - May be difficult to discuss priorities without results

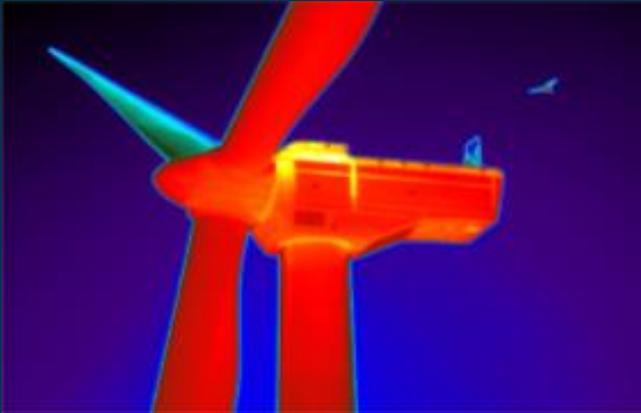
# Land-based Collaborative

- NREL initiative funded by U.S. DOE (EERE)
- Collaborators include AFWA, AWWI & BWEC
- Increase communication among organizations
- Limit redundancies/overlap among collaborators
- AFWA outreach to state agencies & workshops
- AWWI oversight of NWCC
- BCI conduct BWEC-priority research

# Research Needs

- Consistency among studies
- Transparency
- Cumulative estimates
- Basic bat biology & ecology
- Risk assessment & siting
- Cost-effective impact reduction strategies
- Methodologies for offshore monitoring
- Funding

# Thank you!



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