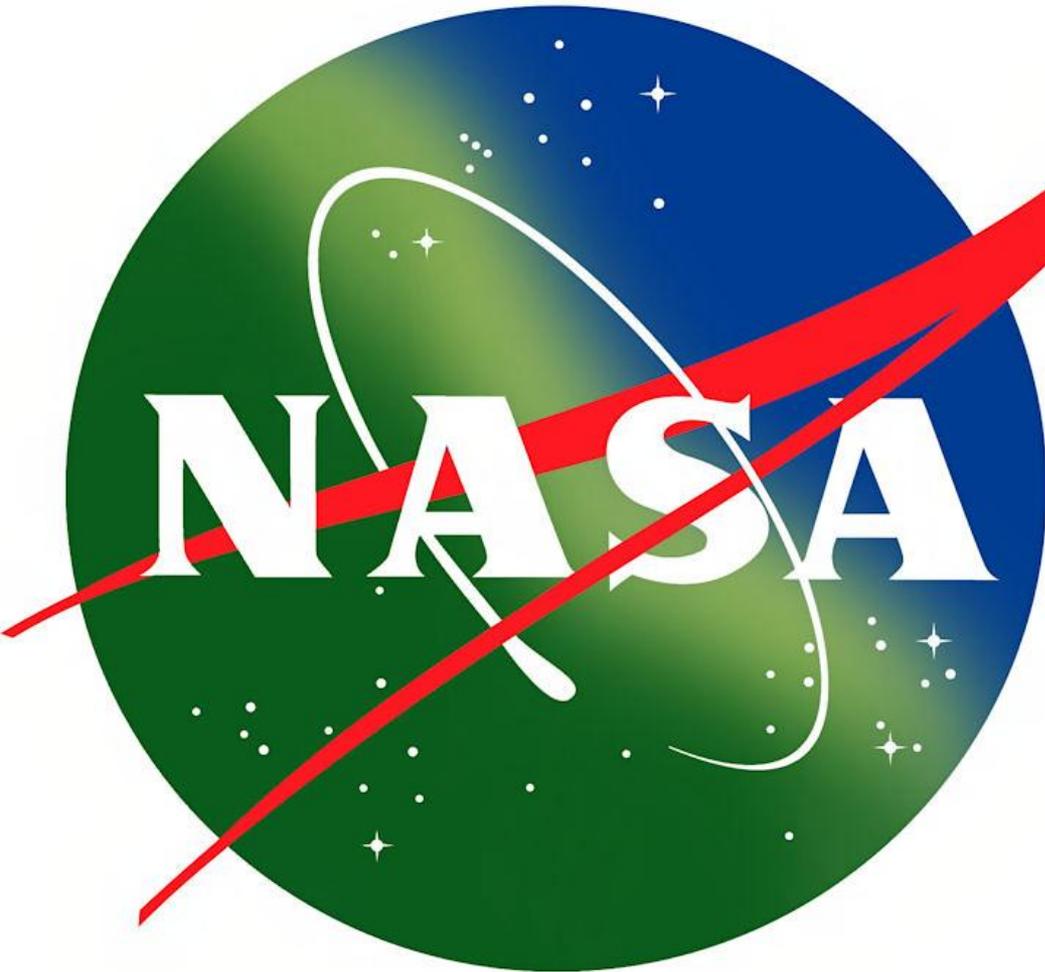


Energy and Water Management at NASA



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Agenda

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NASA Sustainability Policy

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NASA Implementation of Energy and Water Strategy

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Resources and Tools



NASA Center Locations





NASA's Sustainability Policy

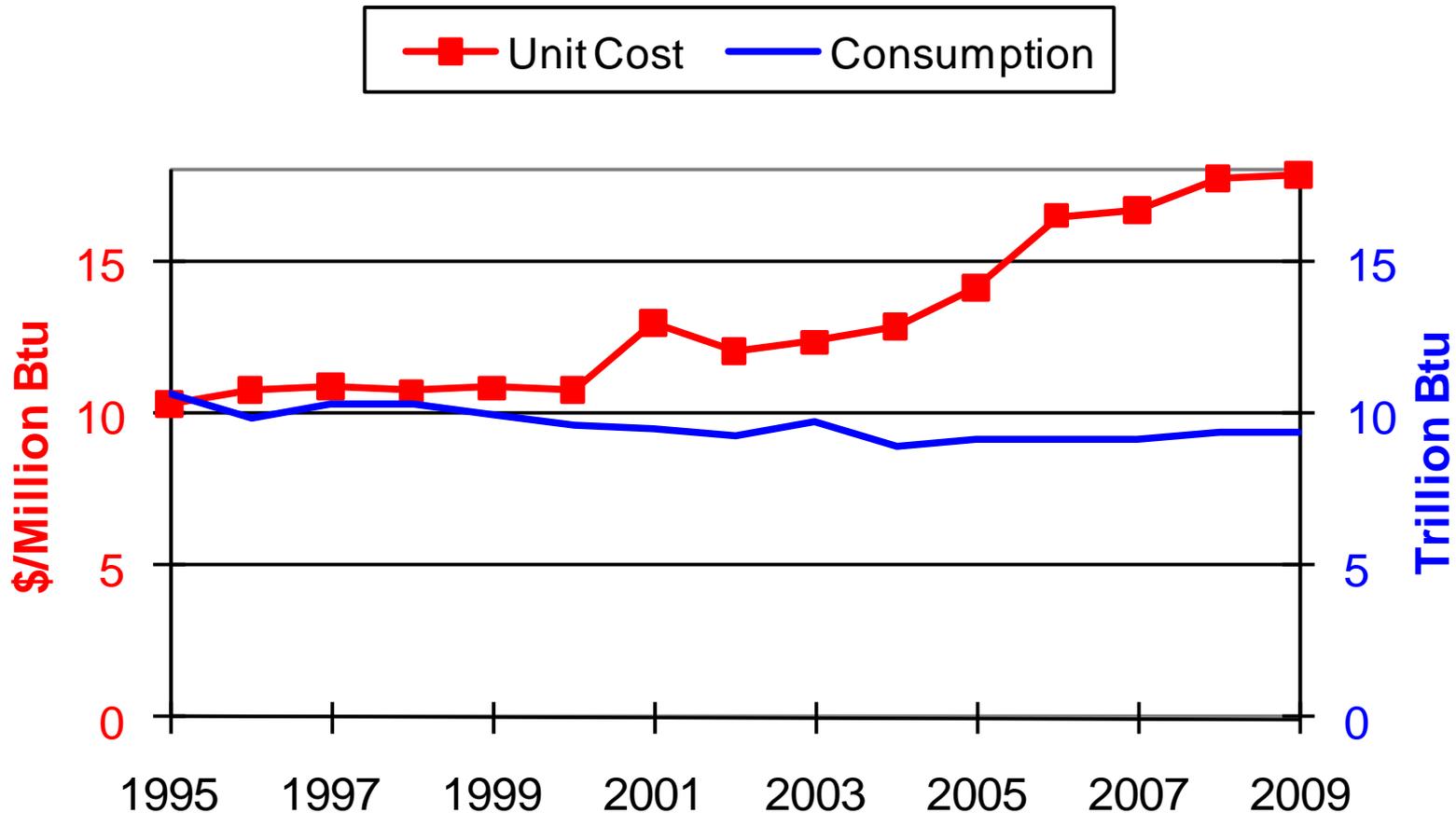


NASA's sustainability policy is to execute NASA's mission without compromising our planet's resources so that future generations can meet their needs.



Internal and External Drivers

- Rising energy unit costs eroding mission funding
 - \$168M NASA facility energy cost in FY 2009





Internal and External Drivers

- **Utility expenditures erode scarce CM&O funding**
 - \$179M NASA facility energy/water utility cost FY 2009
 - Energy unit costs increasing average of 7.2% annually
- **Administration priority and statutory requirement**
 - Energy is a NASA HPPG – OMB and public visibility
 - External requirements, on average, change annually

date	external requirement
8/05	Energy Policy Act of 2005
9/05	Presidential Memo, Energy and Fuel Conservation
1/07	EO 13423--Strengthening Federal Environmental, Energy, and Transportation Management
12/07	Energy Independence and Security Act of 2007
10/09	EO 13514--Federal Leadership in Environmental, Energy, and Economic Performance



NASA Strategy Revised

- **Program Management is divided into Policy (EMD) and Utility/Ops (FED)**
- **Historically the program requirements were pushed to the Centers**
 - Most of the low hanging fruit projects have been done
- **EMD conducts Energy & Water Management Functional Reviews at 1/3 of Centers annually**
 - Assessment of mission support and compliance
- **Policy update of NPR 8570, Energy Efficiency and Water Conservation currently in draft (Spring 2011)**



NASA Strategy Revised

- **Current plans**

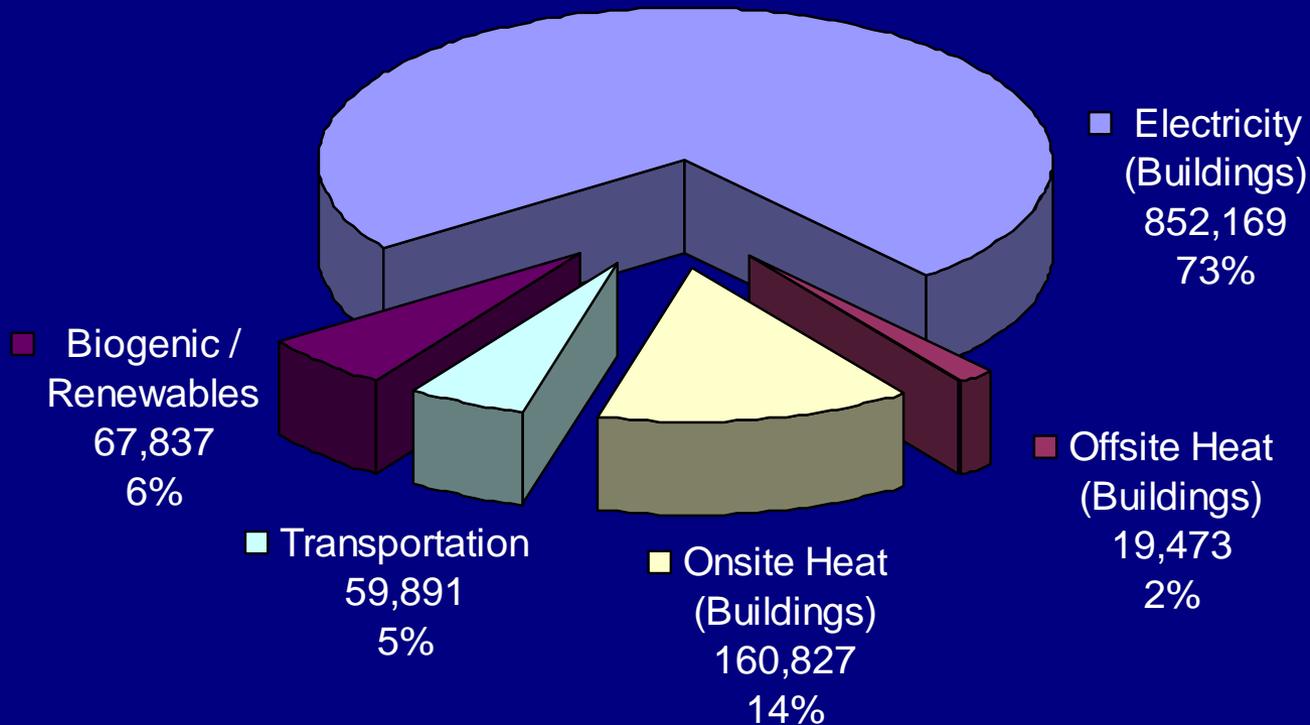
1. Continue to install metering through centralized projects
2. Perform comprehensive audits/benchmarking at Centers
3. Analyze/Implement results of Agency wide water assessment
4. Analyze/Implement Agency wide renewable energy review
5. Identify best reduction opportunities for Agency and invest in energy efficiency and renewable energy projects
6. Identify large projects in areas such as HVAC, LED lighting (exterior, parking lots), EMCS evaluation, EMCS training, integrate solar panels (roof/ground) and other renewable technology, Cool roofs, Green technology advancements in energy efficiency applications
7. Sustainable Design to include small renewable options to achieve Net-Zero buildings



NASA Implementation

Accomplishing NASA's mission while maintaining a healthy environment

NASA CY2008 GHG Emissions (MTCO₂e) By Source Type



Source: NASA greenhouse gas emissions inventory, EMD, 2008



NASA Implementation

Share of NASA facilities assets under 40 years old





NASA Implementation

- **Three-prong approach to mitigating energy/water risk:**
 - Construct new and renovate with life-cycle in mind
 - Operate and maintain considering efficiency and cost
 - Buy and generate utilities from renewable sources



MSFC Building 4600 rooftop PV



Sustainability Base Ames research Center



NASA Implementation

•Construction and renovation incorporating sustainability at various Centers

•21 projects pursued Leadership in Energy and Environmental Design (LEED) certification during FY 2009

5 projects earned LEED® Gold Rating FY 2009/2010

- JPL Building 321, Flight Projects Center
- GSFC Building 34, Exploration Sciences Building
- MSFC Building 4601, Office Building
- SSC Building 8000, Emergency Operations Center
- JSC Source Evaluation Board Facility

Level of LEED in 2010	Complete Projects	Under Review	Registered to be certified	In Design
Platinum			2	2
Gold	5	1	2	
Silver	5	2	10	3
Certified	2			
Total	12	3	14	5



NASA Implementation



MSFC Building 4601, Office Building - Gold



GSFC-GB Building 34, Exploration Sciences Building - Gold



WSTF Columbia Health and Fitness Center - Silver



JPL Building 321, Flight Projects Center, LEED® Gold



NASA Implementation

- **Operate and maintain considering cost and efficiency**
 1. Replacement of old with energy efficiency equipment
 - Buy Energy Star and FEMP List
 - Track energy efficiency upgrades
 2. Installation of metering to identify energy usage and water leaks
 - Develop load profile and manage peak demand load
 - Repair/replace leaking water lines
 3. M&O is facing challenges with new sustainable buildings
 - Amount of data to handle from smart meters, trained engineers
 - Maintenance of new technology without effective training
 - Understand and operate new Energy Management Control Systems
- **Buy and generate renewable energy**
 1. Generate on site
 2. Buy from renewable sources
 3. Buy Renewable Energy Credits



NASA Implementation



KSC 0.95 MW PV System



NASA Implementation



KSC landfill PV

WSTF – 54KW PV Solar Parking



JSC Gilruth Center Daylight Harvesting Fixtures

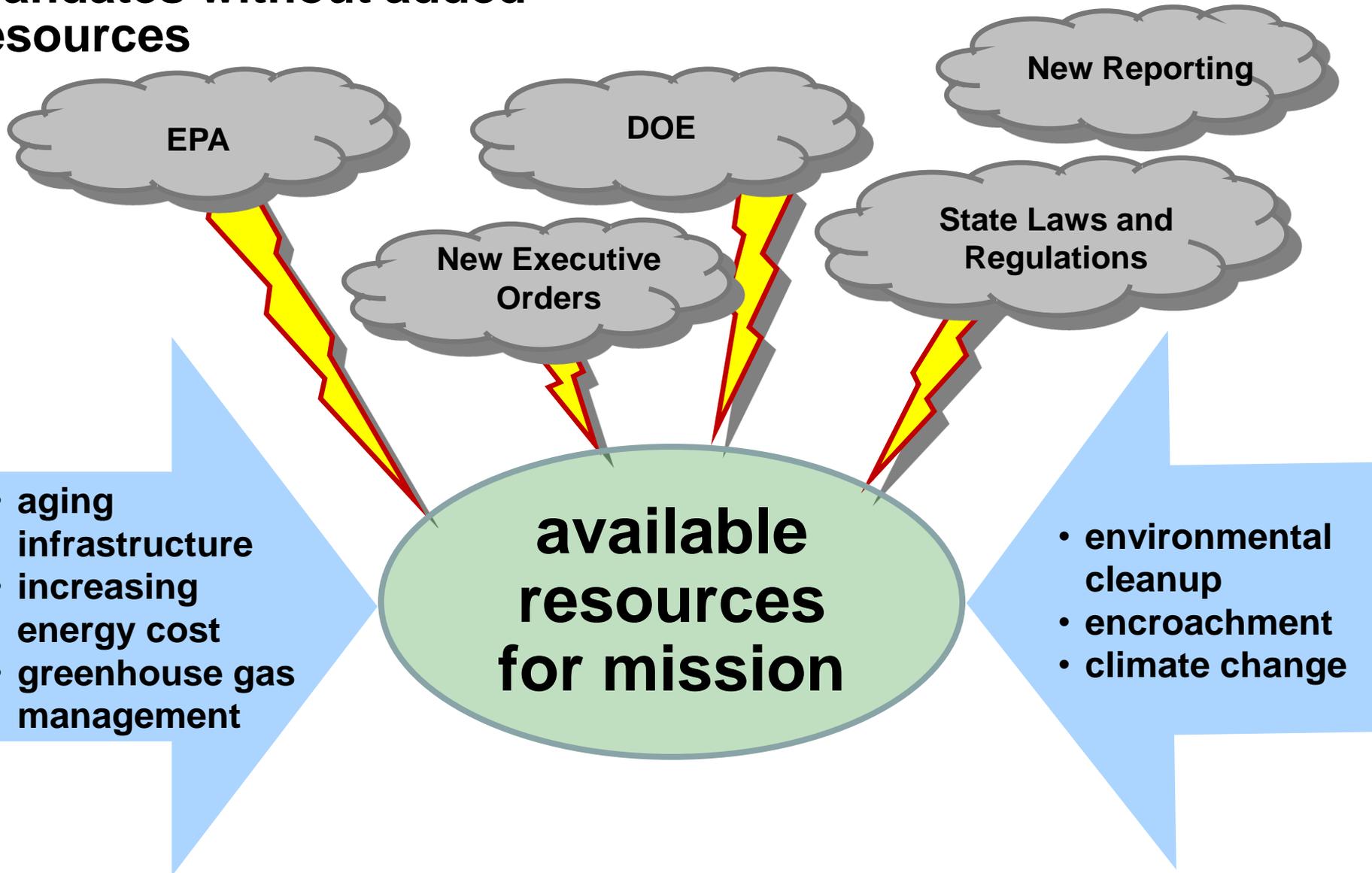


KSC Film Storage Building solar thermal



Resources and Tools

mandates without added resources





Resources and Tools

- **Investment Options**

- Strategic Institutional Investments (SII) phase out
- Alternative Financing (ESPC/UESC)
- Third Party Investors for large scale renewable projects
 - Pursue Enhanced Use Lease with in-kind consideration (Congress)
- Enhanced Use Lease revenue HQ portion funds energy projects
- Construction of Facilities
 - Funds only facility systems facing high risk of failure
 - Discerning factors encourage sustainable practices
- Recapitalization
 - New construction, Revitalization, Demolition
- CM&O
- Establish NASA Energy Reinvestment Account
 - Establish process to track savings although rising utility costs may eliminate savings



Resources and Tools

- **Develop Agency level investment plan**
 - Based on Centers Implementation Plans
 - Identify resource requirements to meet performance goals
 - Develop a realistic schedule to meet the goals based on resources available
 - Communicate the new plan to NASA and externally
- **Data sharing across HQ databases to have up-to-date information and generate management tools**
 - Researching potential tools/mechanisms
- **Quarterly Dashboard**
- **Energy Use/Cost Forecasting Tool**
 - In verification phase
- **Renewable Energy Investment Tool**



Resources and Tools

- **Communication**

- Awareness (Center Competition)
- Successes, energy usage, savings, projects
- Environmental, energy, facility engineering/design, master planning, mission
- Community of Practice interaction (Energy, Water, Master planning, ECIC, OMFIT, etc)



Resources and Tools

- **Awards**

- **You Have The Power – Energy Champions**

- Twenty-First Century Leadership is being advanced by Ken Kono, Ron Thompson, and Steve Frankel who, by leading NASA Ames Research Center's partnership with the City of Sunnyvale to utilize reclaimed water for landscape irrigation, enabled conservation of 60 million gallons of potable water and cost avoidance of \$300,000 annually.

- **Federal Energy and Water Award Winner 2010**

- **Water Efficiency – Small Group**

- Steve Frankel, Ken Kono, Ron Thompson, John West
 - NASA Ames Research Center
 - Moffett Field, California
 - *Water Conservation Project*

