
Panel Session –
Measuring Sustainability
3 November 2010

## Panel Session – Measuring Sustainability


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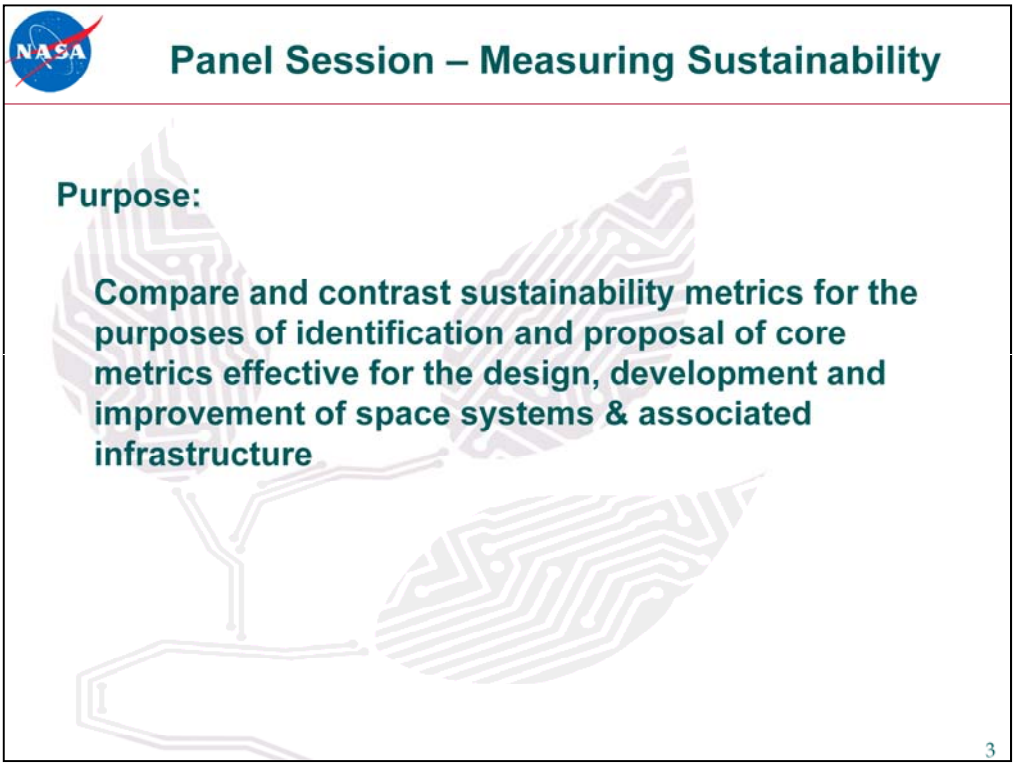
Panel Session – Measuring Sustainability
Purpose:
Compare and contrast sustainability metrics for the purposes of identification and proposal of core metrics effective for the design, development and improvement of space systems & associated infrastructure
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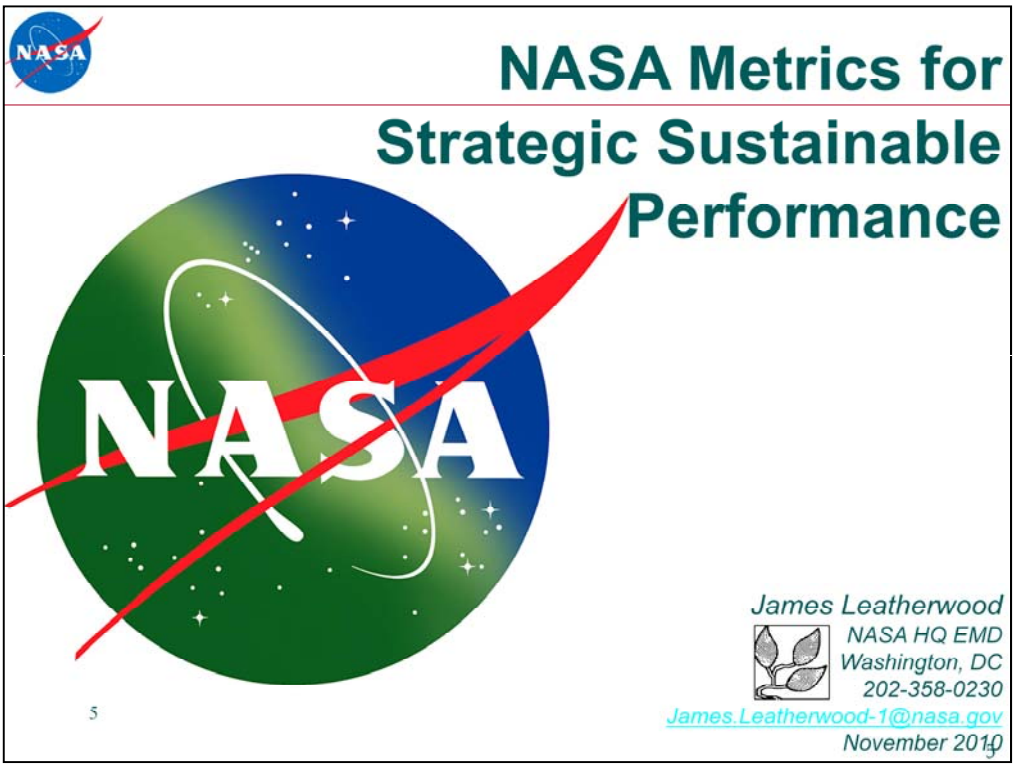
## Panel Session – Measuring Sustainability

### Panel Members:

- **James Leatherwood**
  *National Aeronautics and Space Administration*
- **Nathalie Meusy**
  *European Space Agency*
- **John Dilliot**
  *University California San Diego*


NASA Metrics for
Strategic Sustainable
Performance
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November 2010
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# Agenda

- Purpose
- Internal and External Drivers
- NASA's Strategic Sustainability Performance Plan
- NASA's Sustainability Metrics
- Recommended Core Metrics

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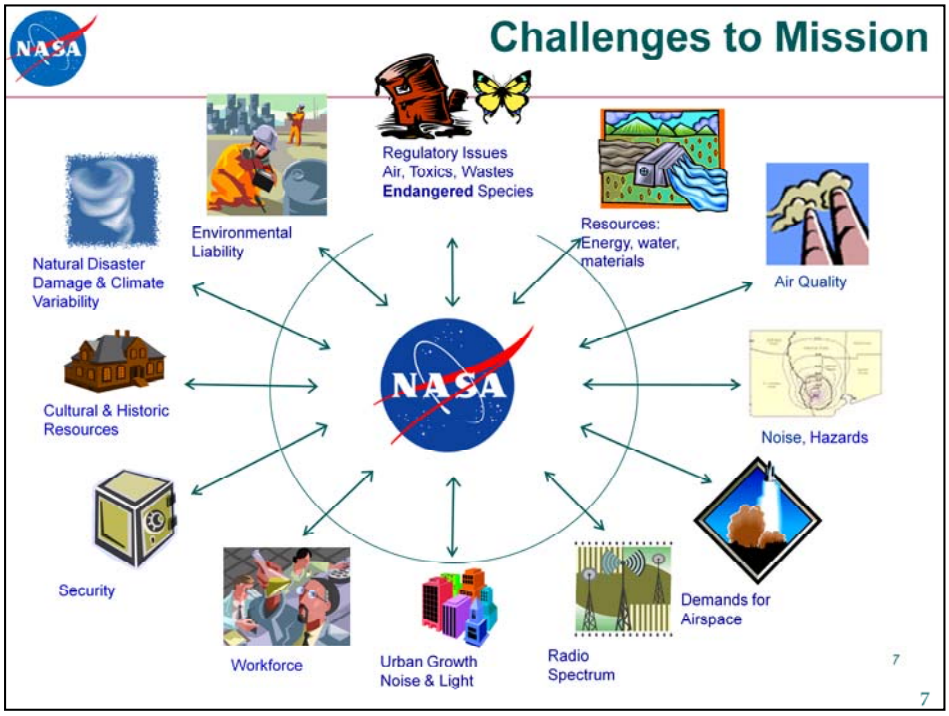
Challenges to Mission
Regulatory Issues
Air, Toxics, Wastes
Endangered Species
Environmental Liability
Resources: Energy, water, materials
Air Quality
Natural Disaster Damage & Climate Variability
Cultural & Historic Resources
Noise, Hazards
Security
Demands for Airspace
Workforce
Urban Growth Noise & Light
Radio Spectrum
7
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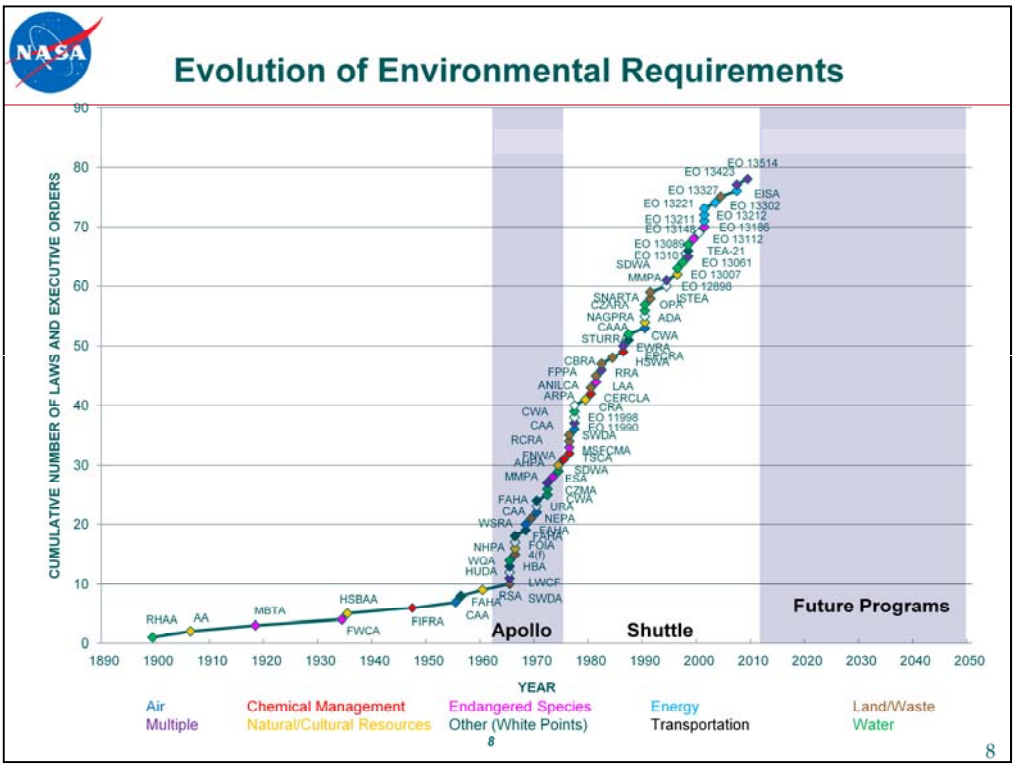
Evolution of Environmental Requirements
CUMULATIVE NUMBER OF LAWS AND EXECUTIVE ORDERS
YEAR
Apollo
Shuttle
Future Programs
RHAA
AA
MBTA
HSBAA
FWCA
FIFRA
FAHA
CAA
RSA
SWDA
LWCF
HBA
HUDA
WQA
NHPA
FOIA
WSRA
NEPA
URA
CWA
CZMA
ESA
MMPA
SDWA
AHPA
TSCA
MSFCMA
RCRA
SWDA
EO 11990
EO 11988
CAA
CWA
ARPA
CERCLA
LAA
RRA
FPPA
CBRA
HSWA
EECRA
EWRA
STURRA
CAAA
ADA
NAGPRA
OPA
CZARA
SNARTA
ISTEA
EO 12898
MMPA
EO 13007
EO 13061
SDWA
TEA-21
EO 13112
EO 13186
EO 13148
EO 13211
EO 13212
EO 13302
EO 13221
EISA
EO 13327
EO 13423
EO 13514
Air
Multiple
Chemical Management
Natural/Cultural Resources
Endangered Species
Other (White Points)
Energy
Transportation
Land/Waste
Water
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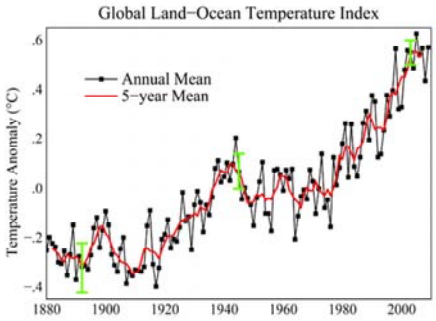
# Climate Change




This graph illustrates the change in global surface temperature relative to 1951-1980 average temperatures. The green error bars represent the uncertainty on measurements. Source: NASA

## Pedersen Glacier


•920: Photograph by unknown photographer in the collection of the National Snow and Ice Data Center/World Data Center for Glaciology. Public domain by virtue of age. [1]
•August 8th, 2005: Photograph by Bruce F. Molnia of the USGS, in the collection of the National Snow and Ice Data Center/World Data Center for Glaciology. Public domain as a work of the US government. [2]

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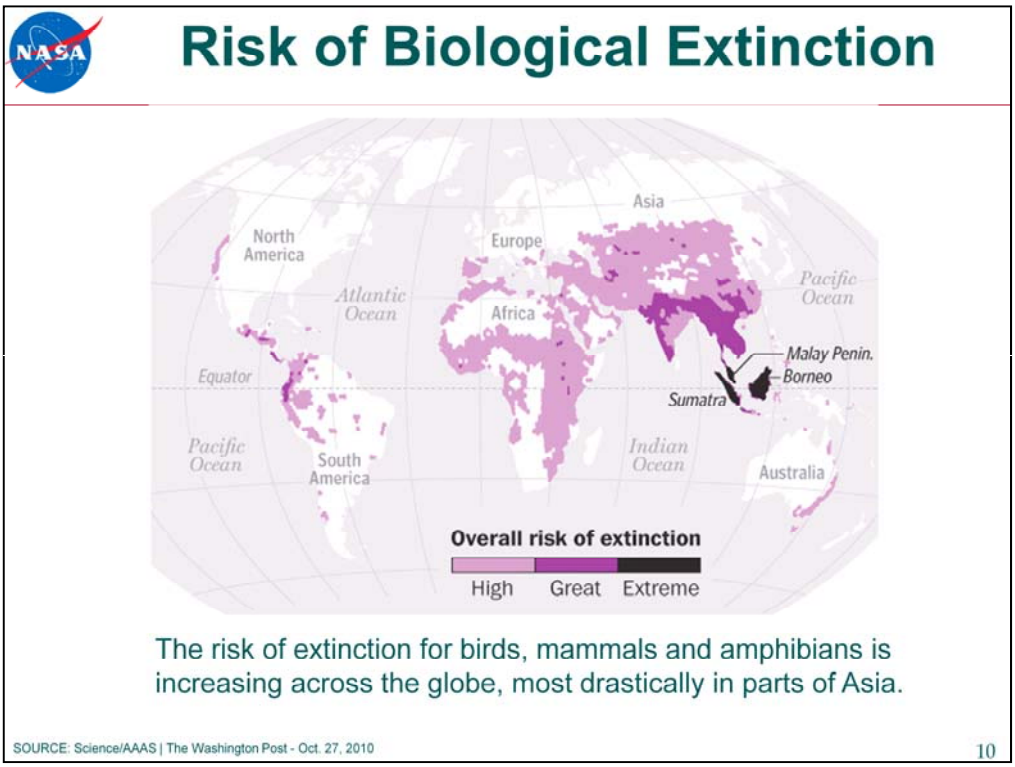


Creatures could disappear from the earth, with one-fifth of all vertebrates and as many as a third of all sharks and rays now facing the threat of extinction

Forces such as habitat destruction, over-exploitation and invasive competitors move 52 species a category closer to extinction each year, according to the research, published online Tuesday by the journal Science. At the same time, the findings demonstrate that these losses would be at least 20 percent higher without conservation efforts now underway.


- GSFC buys landfill methane
  - First in U.S. government
- MSFC and LaRC buy steam from waste-to-steam plants

# NASA Strategic Sustainable Performance Metrics

**NASA Environmental Policy:**

**…support NASA's mission, protect mission resources and mitigate environmentally driven risks to mission, while maintaining environmental stewardship of assets, meeting environmental responsibilities, and maintaining compliance with applicable legal and other requirements.**

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## The Big Goal within EO 13514

EO 13514 and sustainability go far beyond energy and GHG reductions.

**To establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies….**

**Create a clean energy economy that will:**

- **increase our Nation's prosperity**
- **promote energy security**
- **protect the interests of taxpayers**
- **safeguard the health of our environment**

**AND**

**The Federal Government must lead by example!**

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# NASA's New Senior Sustainability Officer

Olga Dominguez – AA for Office of Strategic Infrastructure

**New Responsibilities:**

- **Prepare targets for agency-wide greenhouse gas emissions reductions**
- **Prepare and submit NASA's multi-year Strategic Sustainability Performance Plan** (SSPP) to CEQ and OMB
- **Coordinate with appropriate agency offices and organizations** in the preparation of the SSPP
- **Monitor & report NASA's performance and progress in implementing the SSPP**, and
- **Report annually to the NASA Administrator** on the adequacy and effectiveness of the agency's SSPP

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## NASA is Required to…

**NASA shall:**

- increase energy efficiency
- measure, report, and reduce their greenhouse gas emissions from direct and indirect activities
- conserve and protect water resources through efficiency, reuse, and stormwater management
- eliminate waste, recycle, and prevent pollution
- leverage agency acquisitions to foster markets for sustainable technologies and environmentally preferable materials, products, and services
- design, construct, maintain, and operate high performance sustainable buildings in sustainable locations
- strengthen the vitality and livability of the communities in which NASA facilities are located
- inform NASA employees and contractors about these goals and objectives and involve them in their achievement

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# 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.**

Sustainability also involves taking action now to provide a future where the environment and living conditions are protected and enhanced and in that future NASA will have the resources it needs to perform its Mission.

NASA is committed to the intent of Executive Order 13514.

NASA is integrating sustainability principles and methods into existing systems, processes and decision-making, influencing both long-term planning and short-term actions.

**Sustainability will gradually become part of NASA culture.**

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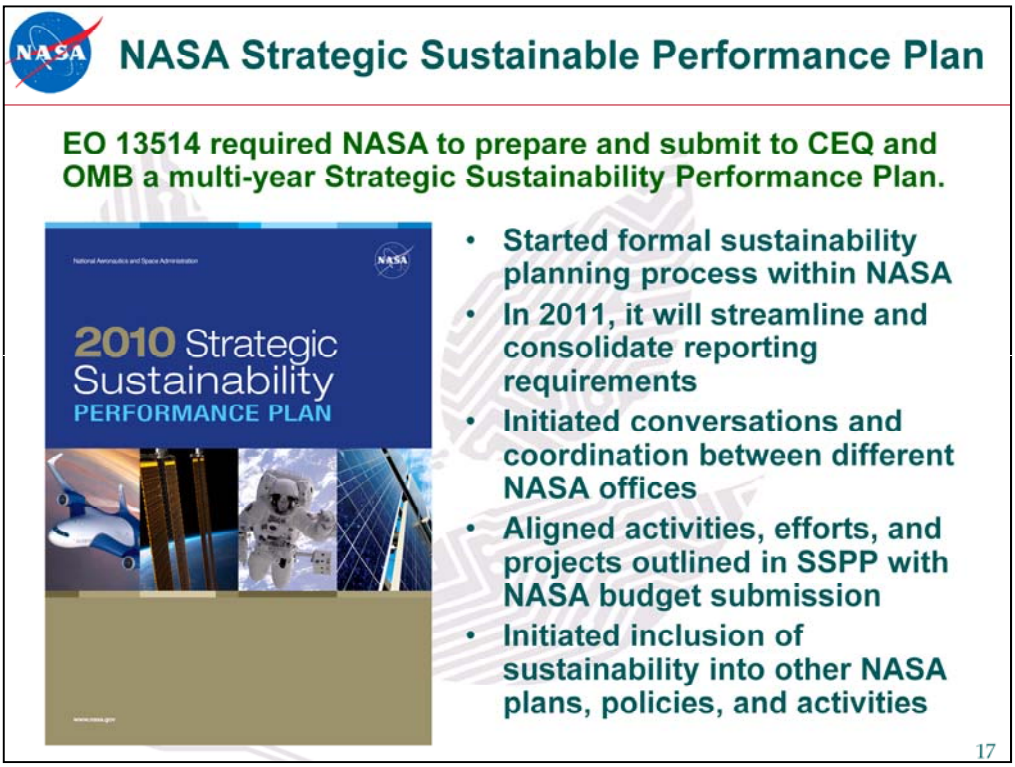



**A multi-year strategic plan**

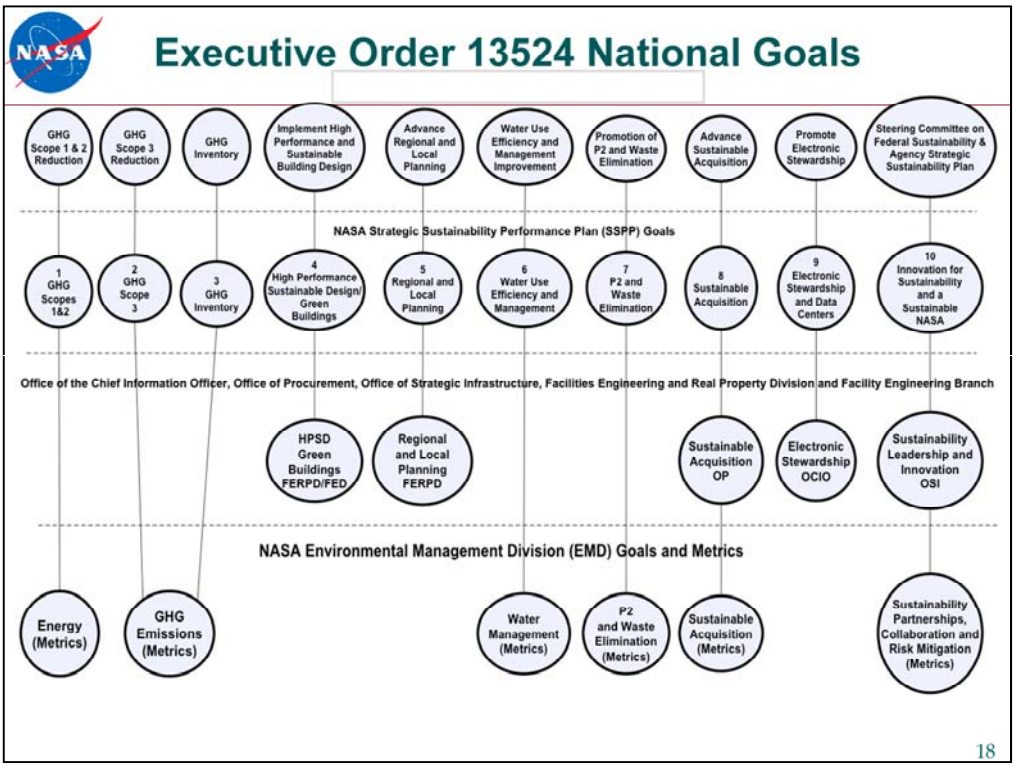
**Includes policy statement** committing NASA to compliance with environmental and energy statutes, regulations, and Executive Orders

**Identifies existing, relevant agency activities, policies, plans, procedures, and practices** needed to meet sustainability goals and targets

**Documents new or revised policies, plans, procedures, and practices**, when necessary

**Includes sustainability goals and targets** (from external requirements), including greenhouse gas reduction targets

**Identifies specific agency goals, a schedule, milestones, and approaches for achieving results, and quantifiable metrics**


Executive Order 13524 National Goals
GHG Scope 1 & 2 Reduction
GHG Scope 3 Reduction
GHG Inventory
Implement High Performance and Sustainable Building Design
Advance Regional and Local Planning
Water Use Efficiency and Management Improvement
Promotion of P2 and Waste Elimination
Advance Sustainable Acquisition
Promote Electronic Stewardship
Steering Committee on Federal Sustainability & Agency Strategic Sustainability Plan
NASA Strategic Sustainability Performance Plan (SSPP) Goals
1 GHG Scopes 1&2
2 GHG Scope 3
3 GHG Inventory
4 High Performance Sustainable Design/ Green Buildings
5 Regional and Local Planning
6 Water Use Efficiency and Management
7 P2 and Waste Elimination
8 Sustainable Acquisition
9 Electronic Stewardship and Data Centers
10 Innovation for Sustainability and a Sustainable NASA
Office of the Chief Information Officer, Office of Procurement, Office of Strategic Infrastructure, Facilities Engineering and Real Property Division and Facility Engineering Branch
HPSD Green Buildings FERPD/FED
Regional and Local Planning FERPD
Sustainable Acquisition OP
Electronic Stewardship OCIO
Sustainability Leadership and Innovation OSI
NASA Environmental Management Division (EMD) Goals and Metrics
Energy (Metrics)
GHG Emissions (Metrics)
Water Management (Metrics)
P2 and Waste Elimination (Metrics)
Sustainable Acquisition (Metrics)
Sustainability Partnerships, Collaboration and Risk Mitigation (Metrics)
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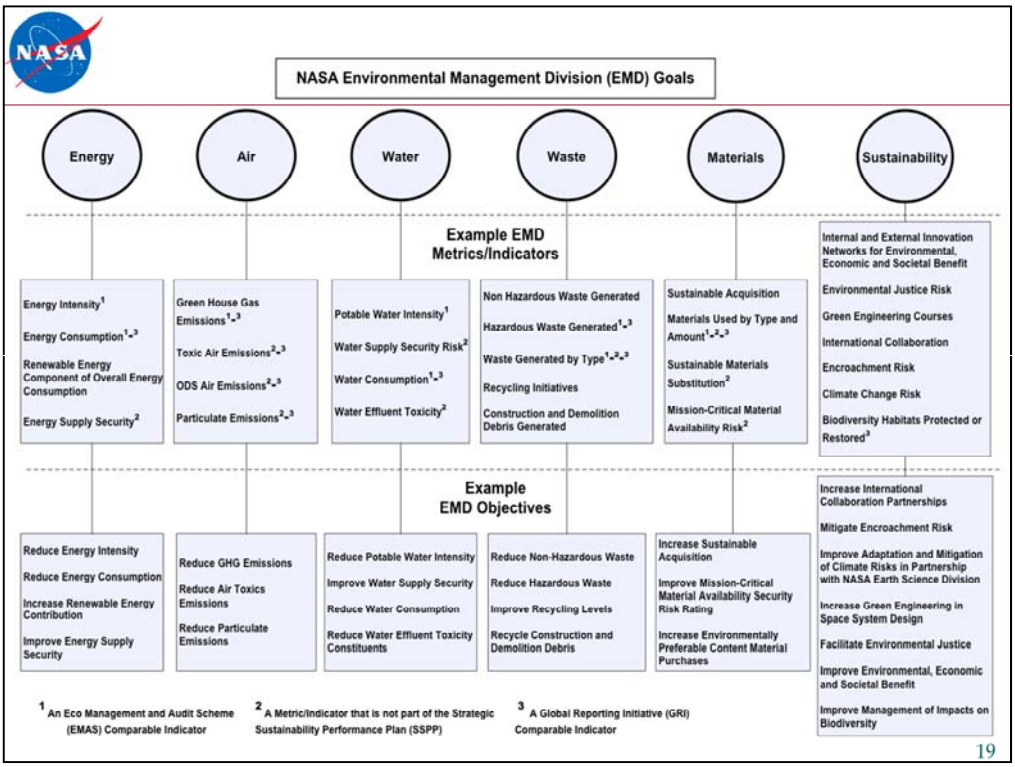
NASA Environmental Management Division (EMD) Goals
Energy
Air
Water
Waste
Materials
Sustainability
Example EMD Metrics/Indicators
Energy Intensity[1]
Energy Consumption[1-3]
Renewable Energy Component of Overall Energy Consumption
Energy Supply Security[2]
Green House Gas Emissions[1-3]
Toxic Air Emissions[2-3]
ODS Air Emissions[2-3]
Particulate Emissions[2-3]
Potable Water Intensity[1]
Water Supply Security Risk[2]
Water Consumption[1-3]
Water Effluent Toxicity[2]
Non Hazardous Waste Generated
Hazardous Waste Generated[1-3]
Waste Generated by Type[1-2-3]
Recycling Initiatives
Construction and Demolition Debris Generated
Sustainable Acquisition
Materials Used by Type and Amount[1-2-3]
Sustainable Materials Substitution[2]
Mission-Critical Material Availability Risk[2]
Internal and External Innovation Networks for Environmental, Economic and Societal Benefit
Environmental Justice Risk
Green Engineering Courses
International Collaboration
Encroachment Risk
Climate Change Risk
Biodiversity Habitats Protected or Restored[3]
Example EMD Objectives
Reduce Energy Intensity
Reduce Energy Consumption
Increase Renewable Energy Contribution
Improve Energy Supply Security
Reduce GHG Emissions
Reduce Air Toxics Emissions
Reduce Particulate Emissions
Reduce Potable Water Intensity
Improve Water Supply Security
Reduce Water Consumption
Reduce Water Effluent Toxicity Constituents
Reduce Non-Hazardous Waste
Reduce Hazardous Waste
Improve Recycling Levels
Recycle Construction and Demolition Debris
Increase Sustainable Acquisition
Improve Mission-Critical Material Availability Security Risk Rating
Increase Environmentally Preferable Content Material Purchases
Increase International Collaboration Partnerships
Mitigate Encroachment Risk
Improve Adaptation and Mitigation of Climate Risks in Partnership with NASA Earth Science Division
Increase Green Engineering in Space System Design
Facilitate Environmental Justice
Improve Environmental, Economic and Societal Benefit
Improve Management of Impacts on Biodiversity
1 An Eco Management and Audit Scheme (EMAS) Comparable Indicator
2 A Metric/Indicator that is not part of the Strategic Sustainability Performance Plan (SSPP)
3 A Global Reporting Initiative (GRI) Comparable Indicator
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# NASA Strategic Sustainable Performance Metrics

**ENVIRONMENTAL STEWARDSHIP SCORECARD**
**National Aeronautics and Space Administration**

| | CURRENT STATUS (As of January 1, 2010)[1] | | PROGRESS | | COMMENTS |
|---|---|---|---|---|---|
| **ENVIRON-MENTAL STEWARDSHIP**<br><br>**Senior Official:**<br><br>Olga M. Dominguez, Assistant Administrator, Office of Infrastructure and Administration<br><br>**Lead EOP Analysts:**<br>Cyndi Vallina and Dana Arnold | Green ↑ | • EMS report card :<br>_X_ ≥80% green & ≤5% red on EMS metrics (G)<br>__ <10% red on EMS metrics (Y)<br><br>• Green purchasing:<br>_X_ Agency has affirmative procurement program (APP) for all green products and services, demonstrates & monitors compliance, develops corrective actions if applicable, and conducts training (G)<br>__ Agency has APP and representative acquisitions for all covered areas (Y)<br><br>• Sustainable design/green bldgs[2]:<br>_X_ Implements Guiding Principles and is on track to meet the 15% goal by 2015 (>3 percent sustainable) (G)<br>___ Implements Guiding Principles on all new building projects & leased space (>1.75 percent sustainable)(Y)<br><br>• Electronic stewardship (ES):<br>_X_ Acquires ≥ 95% EPEAT-registered electronics; enables power mgmt features on 100% of eligible PCs laptops & monitors; strives to extend life to ≥4 years & uses sound disposition practices (G)<br>__ Has ES plan & on track to implement goal by Dec 2010 (Y) | Green | Actions taken since January 1, 2010:<br>• Implemented corrective actions at Centers with a "Yellow" EMS status; 13/16 facilities are addressing sustainability through their EMSs.<br>• Issued task order to update environmental training to include sustainable practices and will release update in agency training system.<br>• Audited APP at >10% of facilities.<br>• Provided >20 representative contracts.<br>• Implemented SBIP & ES milestones.<br>• Achieved LEED certification for 3 additional buildings.<br>• Submitted draft Data Center Consolidation Plan & initial inventory.<br><br>Planned actions for next six months:<br>• Submit all required energy, FRPP & environmental reporting by due dates.<br>• Address sustainable practices through EMSs at remaining 3 facilities.<br>• Conduct green purchasing monitoring & corrective action; review ≥5% applicable FY11 Q1 contract actions to demonstrate compliance with 95% sustainable acquisition goal.<br>• Re-bid ODIN contract, with increased emphasis on EPEAT, power management, end-of-life management, & improved data reporting requirements.<br>• Implement planned actions for SSPP Goal 4 on Sustainable Green Buildings.<br>• Implement planned actions for SSPP Goal 9, Electronic Stewardship & Data Centers.<br>• Finalize agency data center consolidation plan per the FDCCI. | • NASA Progress remains Green as it completed all planned actions.<br><br>• **OMB approves NASA's Sustainability Plan (SSPP), which displays an outstanding leadership commitment, agency-wide integration, tracking, accountability, and communication.**<br>• NASA's partnering internally to solve mutual risk, improving system design and use of communities of practices initiatives are exemplary.<br>• To strengthen its SSPP for 2011, NASA should include: a statement that directly links sustainability to mission; more detailed information to support acquisition goal; and identification of resources for electronic stewardship. |

[1] Status will be updated annually to reflect performance data collected at the end of each fiscal year. Progress will be assessed twice annually (Jan/July).
[2] Each agency is required to ask GSA to institute sustainable design in contracts and leases on its behalf.

**July 2010**

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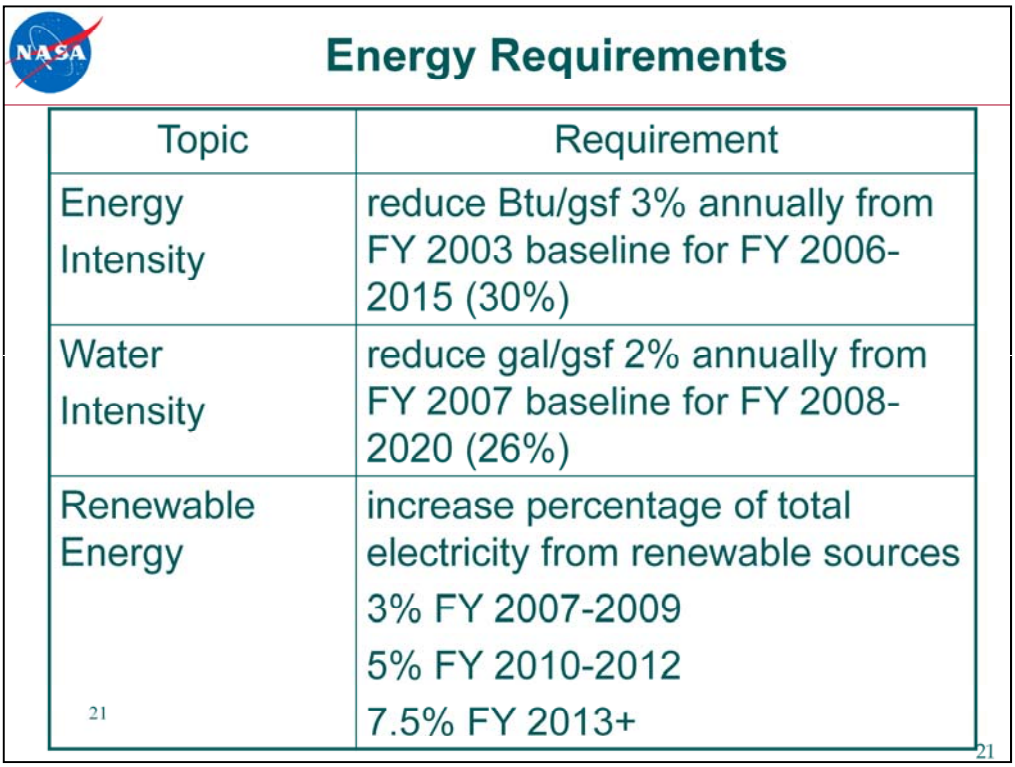



a. Energy intensity (BTU/gsf): energy intensity reductions of 3% a year from a 2003 baseline (30% by 2015). FY 2010: 15%
b. Water Intensity (gal/gsf): water intensity reductions of 2% a year from a 2007 baseline (16% by 2015). FY 2010: 6%
c. Renewable electricity requirement (%): 3% of electricity consumption through FY 2009; 5% FY 2010-2012; 7.5% thereafter.

Additional metering of federal buildings required:

a. Electricity by FY 2012
b. Natural Gas and Steam by FY 2016

•Federal Agencies are very energy dependent due the nature of our missions

•Rising costs and the volatile political environment in oil rich nations are risks to our energy supplies

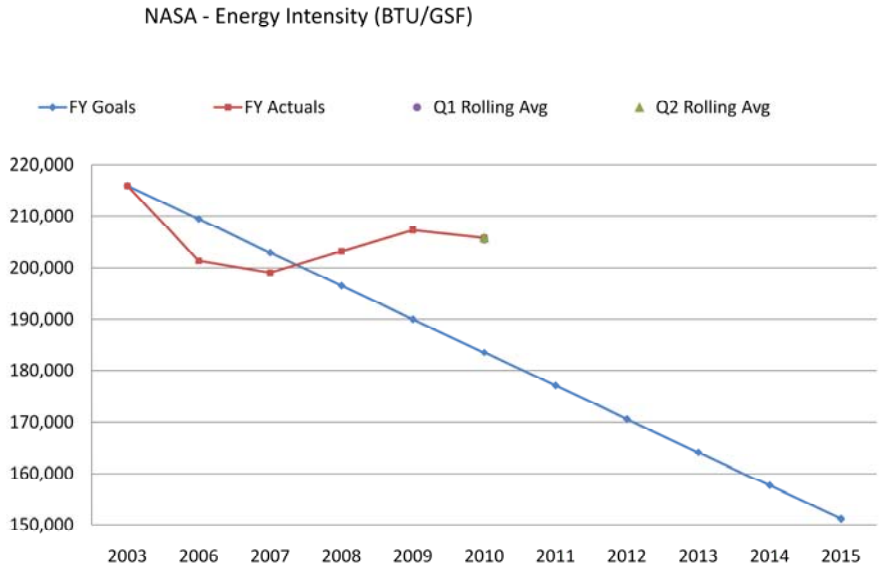
•An aging electrical grid infrastructure both internally at our facilities and externally in the community posses a risk because energy may not be available at critical times

•Because of these reasons and because it saves $'s and helps our Nation become energy independent, we the Federal Government need to:

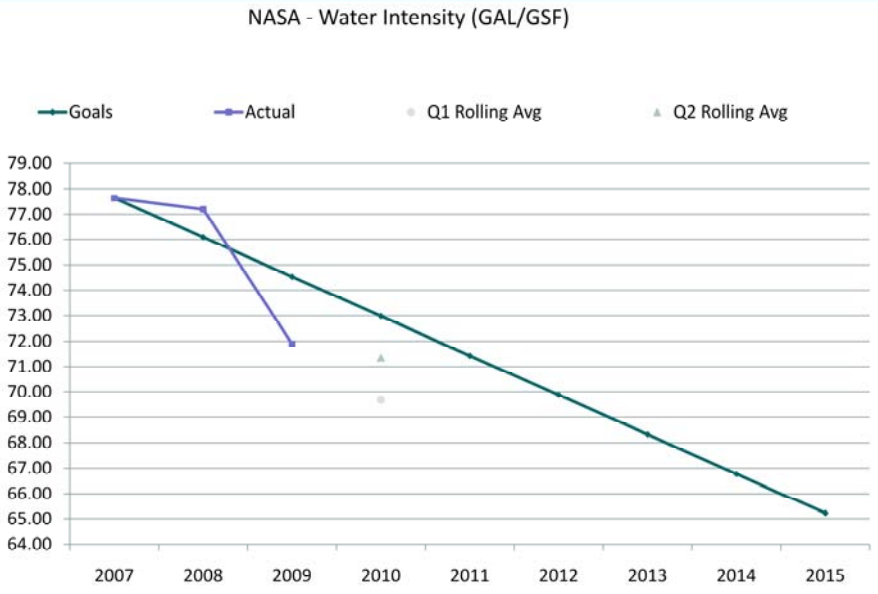
***Conserve energy, become more efficiency and use alternative energy***

Reduces cost of operation
Provides more maneuverability
Releases the US from foreign dependency
Reduces Mission Risks and
Increases Opportunities
Protects our Future

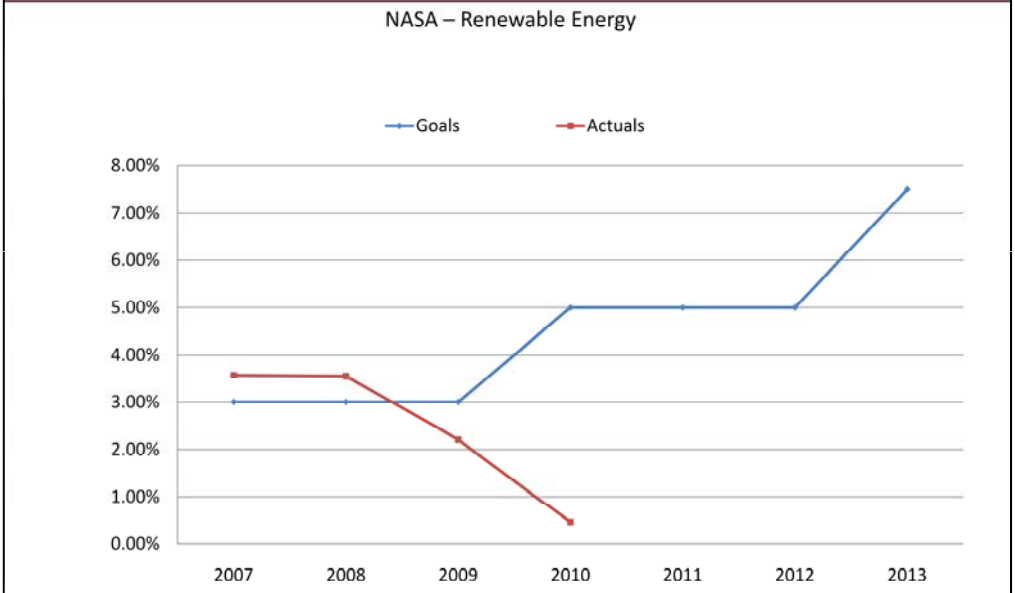
# NASA Strategic Sustainable Performance Metrics



# NASA Strategic Sustainable Performance Metrics



# NASA Strategic Sustainable Performance Metrics



# Core Strategic Sustainability Performance Metrics

## Recommended Common Core Metrics

- Energy Intensity
- Renewable Energy Usage
- Water Intensity

## Possible Additional Core Metrics

- Solvent Usage
- Green House Gases
- Solid Waste Recycling
- Hazardous Material Use Reduction
- Conflict Minerals

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# Conflict Minerals

- Finance Reform Bill signed July 2010
- Companies must publically disclose what they are doing to prevent conflict minerals from being used
- Must report to Securities Exchange Commission whether products contain "conflict materials" from Democratic Republic of the Congo or one of the nine surrounding Countries.

(Credit - AP)

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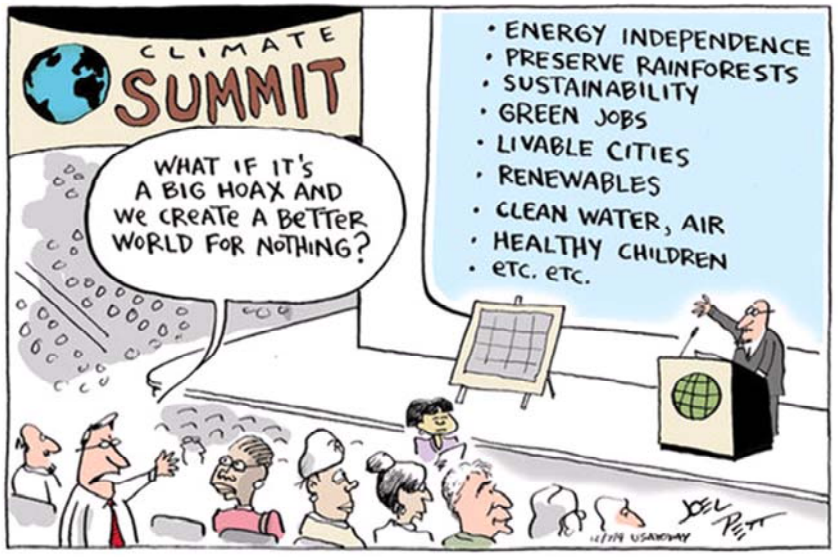
## Panel Session – Measuring Sustainability

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Paul Robert
Environmental Requirements
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paul.robert-1@nasa.gov

# Websites

**Environmental Management Division**
http://oim.hq.nasa.gov/oia/emd/index.html

**Technology Evaluation for Environmental Risk Mitigation**
http://teerm.nasa.gov/

**FedCenter (Government Environmental Portal)**
http://www.fedcenter.gov/

**Clean Joint Group on Pollution Prevention**
http://www.jgpp.com/index.html

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## NASA Strategic Sustainable Performance Metrics

# Backup Slides

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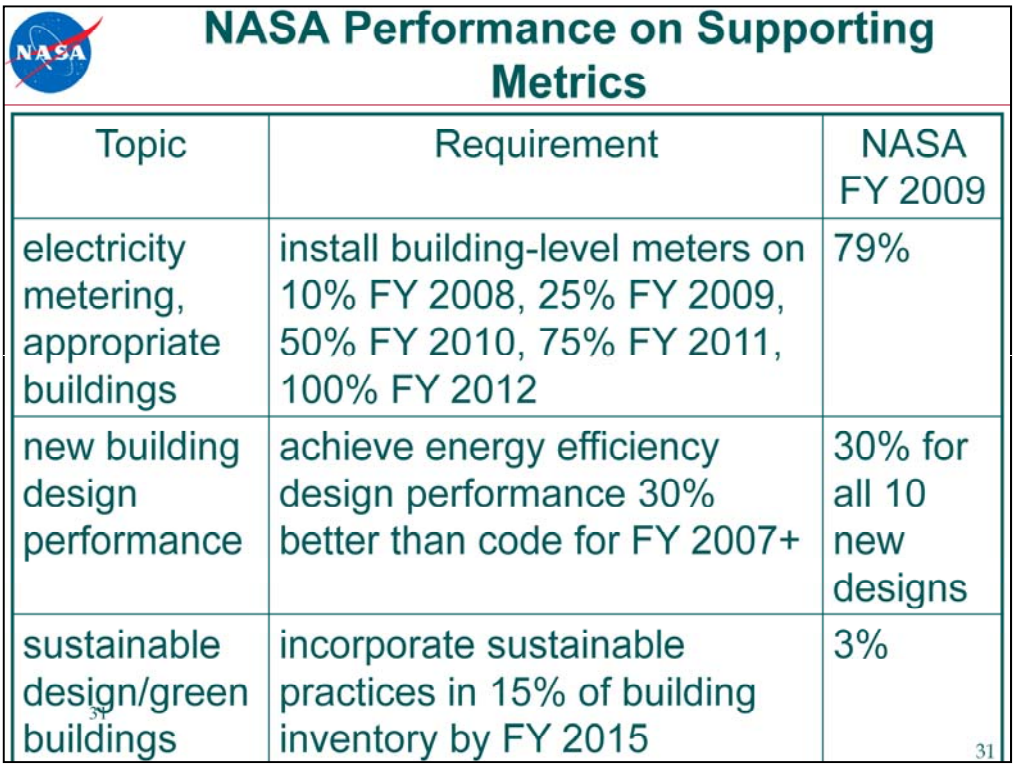

## NASA Performance on Supporting Metrics

| Topic | Requirement | NASA FY 2009 |
|---|---|---|
| electricity metering, appropriate buildings | install building-level meters on 10% FY 2008, 25% FY 2009, 50% FY 2010, 75% FY 2011, 100% FY 2012 | 79% |
| new building design performance | achieve energy efficiency design performance 30% better than code for FY 2007+ | 30% for all 10 new designs |
| sustainable design/green buildings | incorporate sustainable practices in 15% of building inventory by FY 2015 | 3% |

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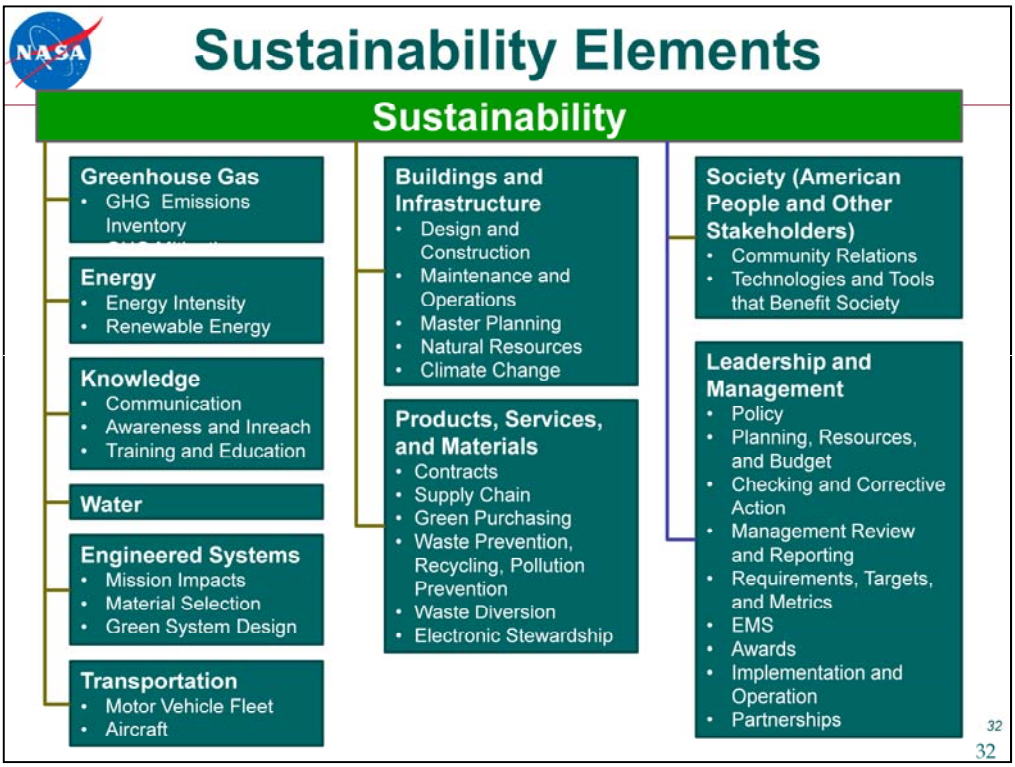
•Will briefly summarize NASA-wide performance on 3 enabling metrics from statutory and Executive Order requirements that contribute to performance on key metrics:

- Install building-level electricity meters on 10% of appropriate buildings by FY 2009; NASA actual 79%--better than goal. 25% FY 2009, 50% FY 2010, 75% FY 2011, 100% FY 2012

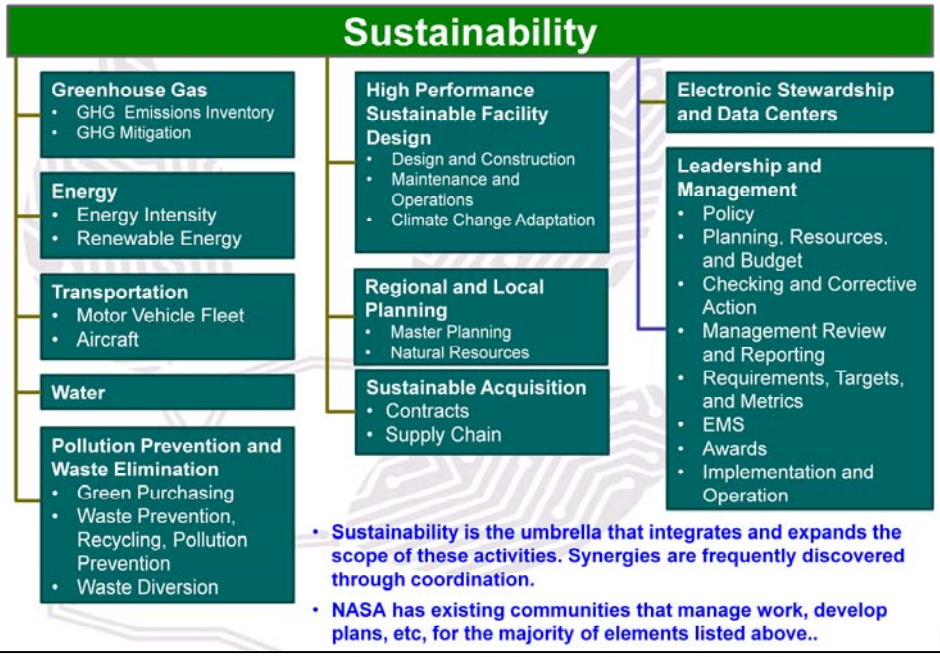
- For new building designs started in FY 2007 and beyond, achieve energy efficiency design performance 30% better than code; NASA actual all 10 new building designs expected to achieve 30% better than code--matches goal.

- Incorporate sustainable practices in 15% of building inventory by FY 2015; NASA actual 3%. Performed sustainable buildings survey in conjunction with annual deferred maintenance survey.




Note from Christina - in the draft SSPP outline that we've further flushed out and you will see soon, this element category might contain different subelements.

# Integrating NASA groups creates value




- **Sustainability is the umbrella that integrates and expands the scope of these activities. Synergies are frequently discovered through coordination.**
- **NASA has existing communities that manage work, develop plans, etc, for the majority of elements listed above..**

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# NASA Strategic Sustainable Performance Metrics

| EMD Goal | Indicator Type | EMD Core Indicators (1=EMAS & 2=GRI Comparable) | Metric |
|---|---|---|---|
| Energy | Core | Energy Intensity[1] (Effciency) | Energy Consumption per Gross Square Foot (# MW) |
| | | Energy Consumption[1,2] | # Total (MW or GJ) |
| | Additional | Renewable Energy Contribution | % Renewable Energy |
| | | Energy Supply Security Risk | Center Energy Supply Risk Score # |
| Air | Core | Green House Gas Emissions[1,2] | # Million Tons CO2 Equivalent (MTCO2e) |
| | | Toxic Air Emissions[1,2] | # Tons |
| | | ODS Air Emissions[1,2] | # Tons |
| | | Particulate Air Emissions[1,2] | # Tons |
| Water | Core | Potable Water Intensity[1] (Efficiency) | # Gallons per Gross Sq/Ft |
| | | Water Consumption[1,2] | # Mm Gallons or $M^3$ |
| | Additional | Water Effluent Toxicity | # Pounds Toxics |
| | | Water Supply Security Risk | Water Supply Risk Score # by Center |
| Waste | Core | Waste Generated by Type[1,2] | Type by # Tons |
| | | Hazardous Waste[1,2] | # Tons |
| | Additional | Recycling Initiatives | Recycling Success Score # |
| | | Non-Hazardous Waste | # Tons |
| | | Construction and Demolition (C&D) Debris | # Tons |

# NASA Strategic Sustainable Performance Metrics

| EMD Goal | Indicator Type | EMD Core Indicators (1=EMAS & 2=GRI Comparable) | Metric |
|---|---|---|---|
| Materials | Core | Materials Used by Type and Amount[1,2] | # Tons by Type |
| | Additional | Sustainable Acquisition | Contract "Green Procurement" Success Score (4 or 5 out of 5) |
| | | Sustainable Materials Substitution | # Tons/lbs/Gallons Environmentally Preferable Materials |
| | | Mission-Critical Material Availability Risk | Mission-Critical Material Availability Security Risk Score # |
| Sustainability | Additional | Internal and External Innovation Networks for Environmental, Economic and Societal Benefit | % of Networks that include consideration of Agency effects on EE&S |
| | | Environmental Justice Risk | Environmental Justice Risk Score at each Center |
| | | Green Engineering Courses | Participant Course Rating Score Average of 4 |
| | | International Collaboration | # of Active International Partnerships |
| | | Encroachment Risk | Center Encroachment Risk Rating Score |
| | | Climate Change Risk | Center Climate Change Risk Rating Score |
| | | Biodiversity Habitats Protected or Restored | # acres of Habitat Protected or Restored |
| Core Indicator: Indicator that is comparable across organizations and boundaries. | | | |