



Importance of Certification to Sustainable Development

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09-01-11



- **The Technical Institute**
- **Sustainability**
- **Sustainable Design**
- **Quality Process**
- **PCI Sustainable Plant Program**
- **Summary**



THE TECHNICAL INSTITUTE



- **Structure**

- Legally Chartered
- Clearly Stated Purpose
- Rational Membership Requirements
- Established Governance
- Perpetual Commitment



- **Functions**

- Develop and Advance Technology
- Set Technical and Professional Standards
- Provide Information Exchange Forum
- Maintain Industry “Body of Knowledge”
- Promote Industry Growth



- **Stature**

- Recognized Inside Industry as Principal Knowledge Authority
- Recognized Outside Industry as Primary Industry Representative
- Preferred Association for Industry Professionals

• Knowledge Process





- **Quality Process**
 - Accreditation
 - Personnel Certification Program
 - Fabrication Process Quality Standards
 - Independent Audits
 - Feedback and Recourse Process



SUSTAINABILITY

“Humanity has the ability to make development sustainable:

To ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.”

— Report of the 1987 World Commission on Environment and Development: “Our Common Future”

UNITED NATIONS

A



General Assembly

Distr.
GENERAL

A/42/427
Annex
14 April 1987
No. 1
ORIGINAL: ARABIC/CHINESE/ENGLISH/
FRENCH/RUSSIAN/SPANISH

Item 33 (e) of the provisional agenda*

DEVELOPMENT AND INTERNATIONAL ECONOMIC CO-OPERATION: ENVIRONMENT

Report of the World Commission on Environment and Development

Note by the Secretary-General

1. The General Assembly, in its resolution 38/161 of 19 December 1983, *inter alia*, welcomed the establishment of a special commission that should make available a report on environment and the global perspective by the year 2000 and recommend the measures to be taken to meet the needs of development. The commission later reported the work of its commission on environment and development. In the same resolution, the Assembly decided that, on matters within the mandate and purview of the United Nations Environment Programme, the report of the special commission should in the first instance be considered by the Governing Council of the Programme, for transmission to the Assembly together with its comments, and for use as basic material in the preparation, for adoption by the Assembly, of the Environmental Perspective to the Year 2000 and Beyond.

2. At its fourteenth session, held at Nairobi from 2 to 10 June 1987, the Governing Council of the United Nations Environment Programme, and its session 14/14 of 10 June 1987, entitled "Report of the World Commission on Environment and Development" and, *inter alia*, decided to transmit the Commission's report to the Assembly, together with the draft resolution annexed to the decision for consideration and adoption by the Assembly.

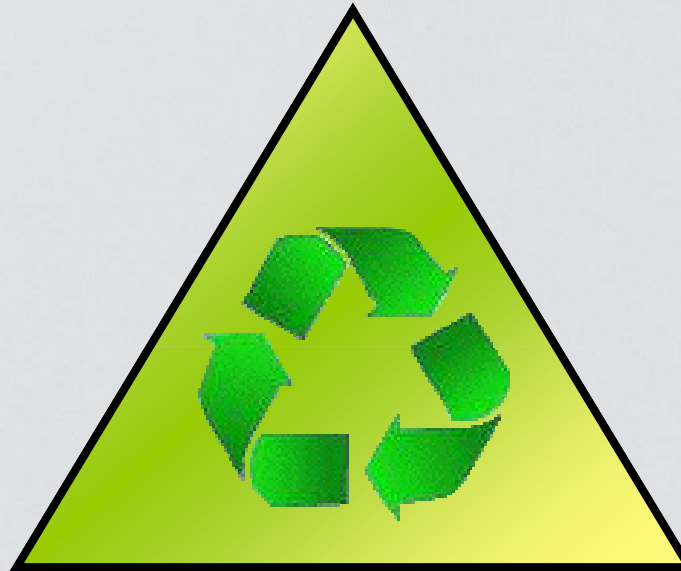
3. The report of the World Commission on Environment and Development, entitled "Our Common Future", is hereby transmitted to the General Assembly. Decision 14/14 of the Governing Council, the proposed draft resolution and the comments of the Governing Council on the report of the Commission can be found in the report of the Governing Council on the work of its fourteenth session. 1/

* A/42/150.

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1...

Ecological



Economic

Social

Scope of Value



- **Economic**

- Follow best practices
- Strive for continuous improvement
- Offer equal opportunity
- Preserve investment diversity
- Practice good management of financial capital



- **Ecological**

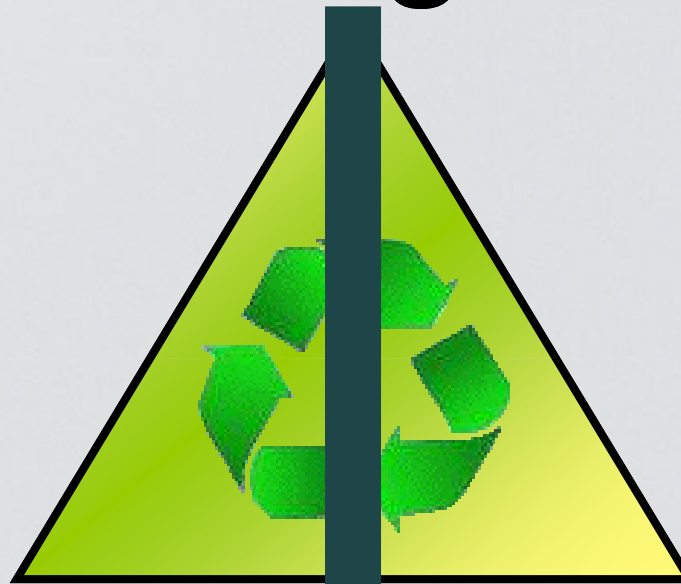
- Value, appreciate, and restore nature
- Preserve natural diversity
- Practice good stewardship of natural capital



- **Social**

- Ensure inter-generational equity
- Offer equal opportunity
- Preserve social diversity
- Practice good governance of human capital

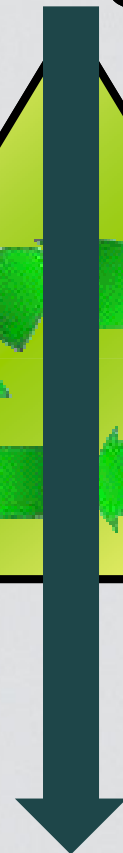
Ecological



Economic



Social



“Triple Bottom Line”

- **Conceptual**

- Recognize expanded “Perspective Range” of time and space within which solution applies
- Consider ecological, social, and economic dimensions
- Consider risk, uncertainty, and irreversibility



Sustainability





SUSTAINABLE DESIGN

"It should be the highest ambition of every American to extend his views beyond himself, and to bear in mind that his conduct will not only affect himself, his country, and his immediate posterity; but that its influence may be co-extensive with the world, and stamp political happiness or misery on ages yet unborn."

— George Washington,
letter to the Pennsylvania Legislature, September 5, 1789





- **Worldwide:**
 - People use 20% more resources than can be regenerated
 - Buildings (construction + operation) use 40% of all raw materials (3 billion tons annually)



- **In US:**
 - Most resources consumed per capita
 - Buildings account for:
 - 65% of all electricity
 - 36% of all primary energy
 - 12% of all potable water
 - 30% of all greenhouse gas emissions



- **Resource Consumption**
 - Raw Materials
 - Energy
- **Environmental Impact**
 - Chemical
 - Biological
 - Thermal
 - Carbon cycle



- **Construction**
 - One-time materials consumption
 - For Buildings, 10% of lifetime energy consumption
 - Both can be partly reinvested through recycling



- **Operation**
 - Continuing materials consumption
 - For Buildings, 90% of lifetime energy consumption
 - Difficult to replenish



- **Recycling**

- Can the design re-use invested materials and resources?
- Can the design reclaim invested energy?
- Not part of today's typical analysis



- **Regeneration**

- Can the structure be designed to be repurposed?
- Can components be designed to be reused?
- Not part of today's typical analysis

- **Specific Impacts: Raw Materials**
 - Wood: Forests
 - Steel: Iron ore
 - Concrete: Limestone, aggregates



- **Specific Impacts: Energy**
 - Wood: Planting, harvesting, milling
 - Steel: Ore grinding, furnace heat
 - Concrete: Mining, grading & preparation, clinker production, grinding

- **Specific Impacts: Environmental**
 - Wood: Deforestation (if not managed), preservation, CO₂
 - Steel: Toxins, particulates, slag, CO₂
 - Concrete: Toxins, particulates, CO₂

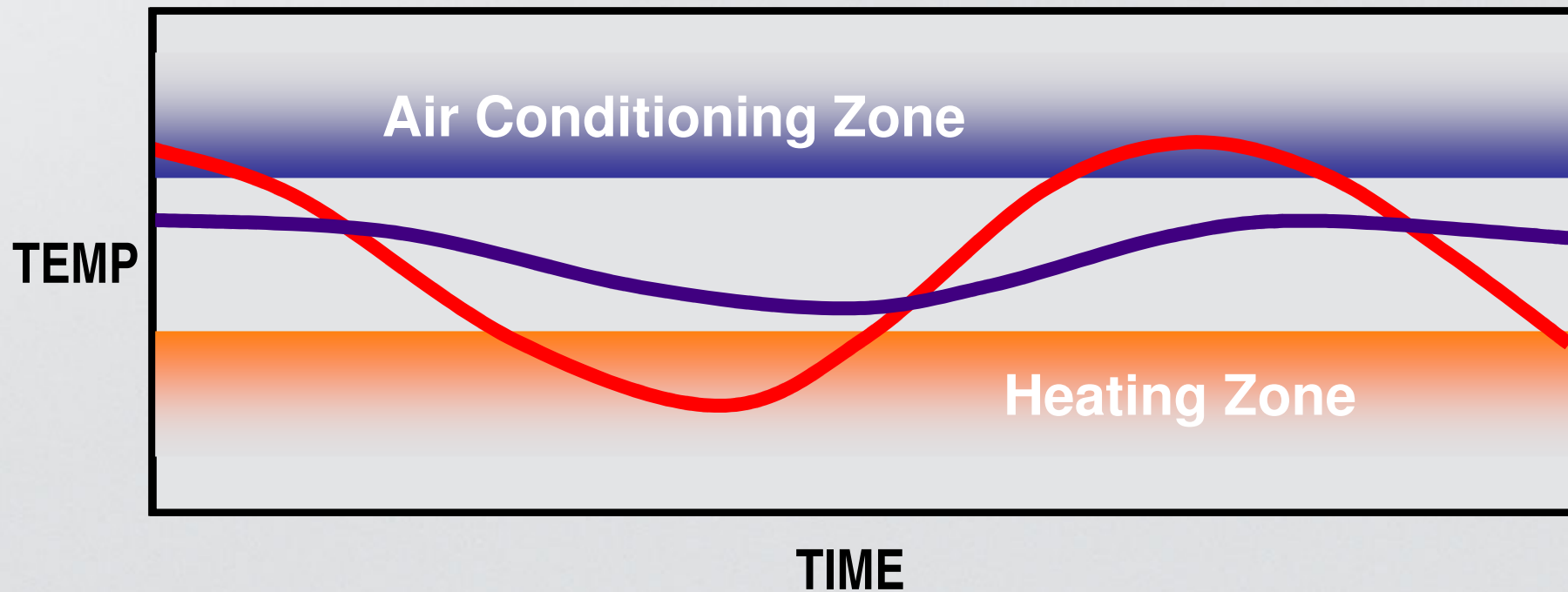


- **Sustainable Concrete**
 - Abundant local materials
 - Flexibility, adaptability
 - Fire and natural-disaster resistance
 - Thermal performance
 - Durability



- **Sustainable Concrete**
 - Low air infiltration
 - Indoor environmental quality
 - Minimum urban heat-island effect
 - Noise resistance
 - Bio-resistance

THERMAL MASS



- Outside Air
- Structure = Inside Air



- **Sustainable Precast**
 - Enhanced thermal performance
 - Integrated insulation: R-Values 20-25
 - Energy optimization
 - Thermal mass effectiveness
 - Lowest air infiltration



- **Sustainable Precast**
 - Minimal site disruption
 - Can be recycled at element level



Sustainable Design

AIR INFILTRATION

(cfm/ft² @ 0.3 in. H₂O)

1.0 in. (25 mm) expanded polystyrene	1.0
Uncoated concrete block	0.4
0.47 in. (12 mm) fiberboard sheathing	0.3
Uncoated brick wall	0.3
Breather type building membranes (avg)	0.005
Closed cell foam insulation	0.0002
6 mil (0.15 mm) polyethylene	0.0000
Precast concrete sandwich wall panel	0.0000

- **US Concrete Industry**
 - Concrete Joint Sustainability Initiative
 - MIT Concrete Sustainability Hub
 - <http://web.mit.edu/cshub>





- **Precast Industry**

- *fib* Sustainability Initiative

- 1988: Commission 3 (Safety and Performance Concepts) established
 - Sustainability proactively considered by all Commissions, in guidance documents
 - Collaboration sought with other organizations



- **Precast Industry**
 - PCI Sustainability Council
 - Sustainable Plant Program Committee
 - Life Cycle Assessment Committee
 - Green Codes Committee
 - Information & Education Committee
 - Work with all PCI groups
 - Drive innovation within Industry



- **Evolving the Design Process**
 - Classical “Divide, Solve, Re-integrate” methodology not adequate
 - Analogy: Masonry building
 - Need overarching organizational system: true Integrated Design



- **Evolving the Design Process**
 - Implementing true Integrated Design requires:
 - Unprecedented interdisciplinary collaboration
 - Coordinated construction
 - Monitoring and validation
 - Advanced tools (e.g. BIM)



Beyond Sustainability

**Beyond Sustainable,
structures can also be
Protective and Beautiful**



Beyond Sustainability: Protective

- **Protective Against:**
 - Hurricanes, Tornadoes
 - Floods, Excessive Humidity
 - Earthquakes
 - Solar Damage
 - Noise
 - Chemicals, Radiation



Beyond Sustainability: Beautiful

- **Beautiful due to:**
 - Design flexibility
 - Broad range of colors and finishes
 - Maintains appearance with age

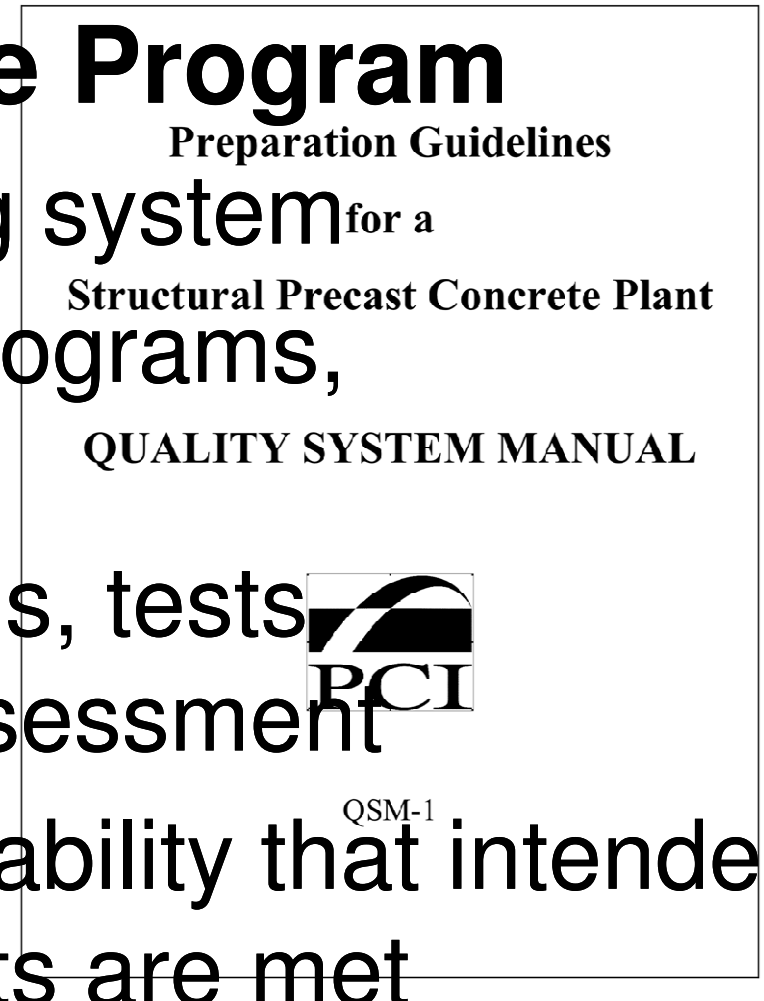


QUALITY PROCESS



- **Complete Quality Process:**
 - Quality Assurance Program
 - Quality Control Activities
 - Certification Program

- **Quality Assurance Program**
 - Integrated, ongoing system for a
 - Includes people, programs, knowledge
 - Includes inspections, tests, documentation, assessment
 - Provides high probability that intended design requirements are met





Quality Process

- **Quality Control**
 - Operational activities to verify quality requirements
 - Testing, inspection documentation
 - Part of QA Program





Quality Process

- **Certification**
 - Ensures QA Program components are present and functioning properly
 - Provides highest probability of a successful project
 - Vital component of QA, but is not QA in itself





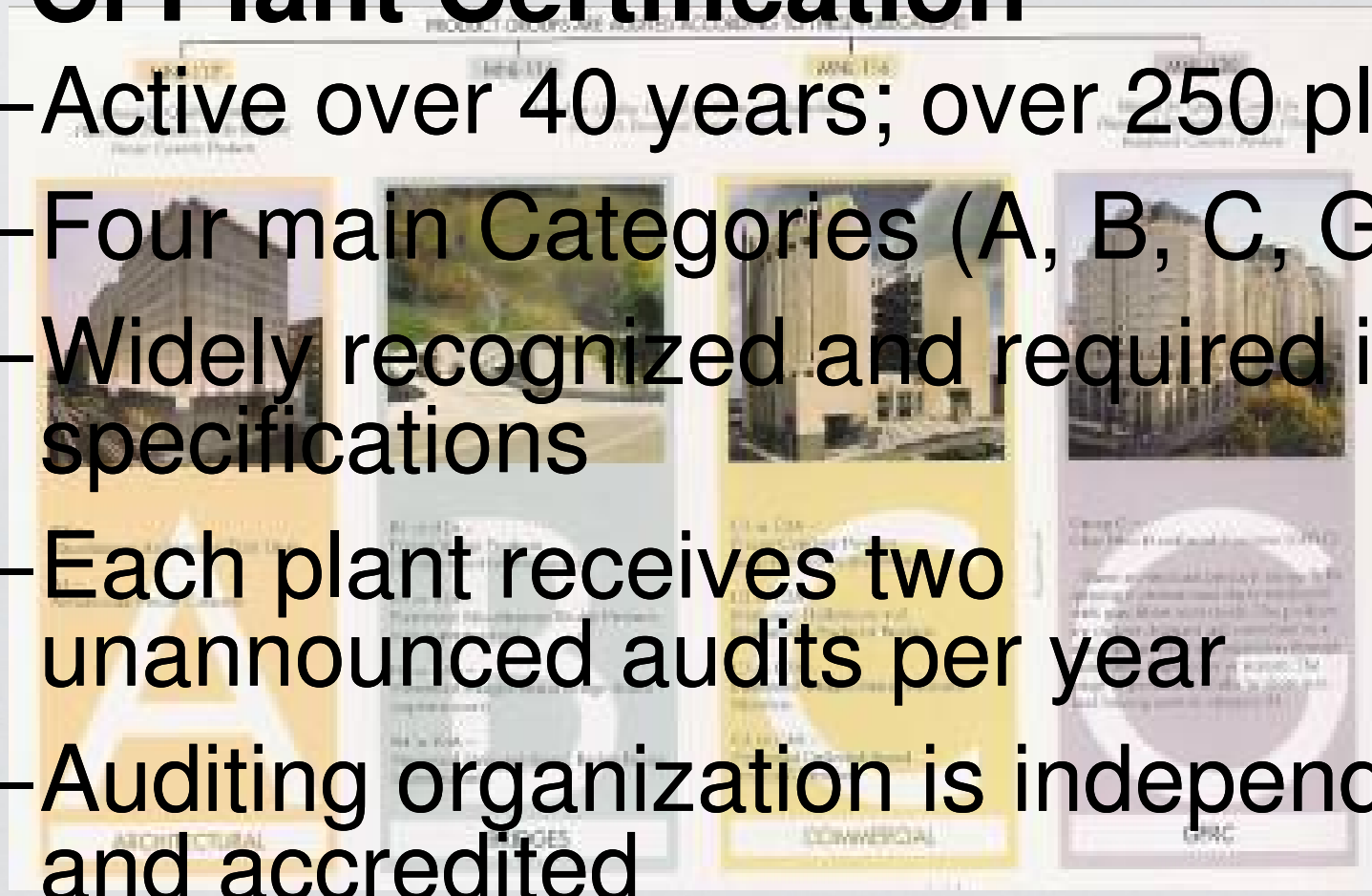
- **PCI Certification Programs**
 - Personnel Certification
 - Plant Certification
 - Erector Certification



- **PCI Personnel Certification**
 - QC personnel training since 1974
 - 3 distinct certification levels (I, II, III)
 - ACI certification prerequisite
 - Requires written exam
 - Every PCI-Certified plant must employ at least one PCI-certified QC person

- **PCI Plant Certification**

- Active over 40 years; over 250 plants
- Four main Categories (A, B, C, G)
- Widely recognized and required in specifications
- Each plant receives two unannounced audits per year
- Auditing organization is independent and accredited





- **PCI Erector Certification**
 - Active 5 years;
over 120 firms
 - 3 Categories
(S1, S2, A)
 - Includes
“Qualified” Level





- **Evolving the Quality Process**
 - Essential Goal: Fidelity to the Design
 - Design irrelevant if not accurately followed in fabrication and construction
 - More important now that we recognize greater impact of design



- **Evolving the Quality Process**
 - Evolution began with most critical attributes and moved outward
 - Life safety
 - Basic durability
 - Future evolution must embrace expanded Perspective Range



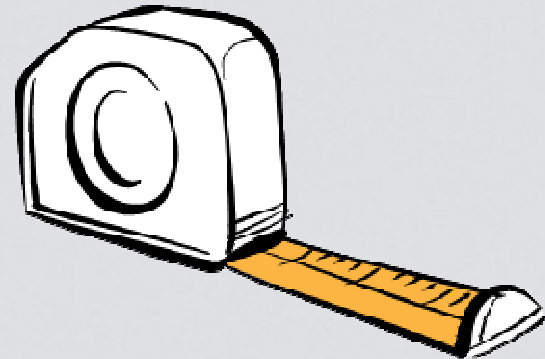
PCI SUSTAINABLE PLANT PROGRAM



Sustainable Plant Program

- **Purpose**

- Introduce performance measurements and benchmarks for Sustainability in production
- Address increasing specifier demand





Sustainable Plant Program

- **Concept**
 - Voluntary program
 - Plants measure energy & environmental performance
 - Data initially forms baseline
 - Sets stage for future guidelines



Sustainable Plant Program

- **Benefits**

- Provides education and guidance
- Improves plant energy & environmental performance
- Lowers operating costs
- Identifies key measurable indices and benchmark data



Sustainable Plant Program

- **Benefits**

- Instills culture of sustainability
- Provides a new level of transparency
- Supports competitive positioning in marketplace



Sustainable Plant Program

- **Structure**

–Stage I: October 2011 → I

–Stage II: 2013 → II

–Stage III: 2014 → III



Sustainable Plant Program

- **Structure**

- Stage I (plant only):

- Energy Consumption
 - Waste Management
 - Recycling
 - Water Management
 - Cement & SCM Utilization



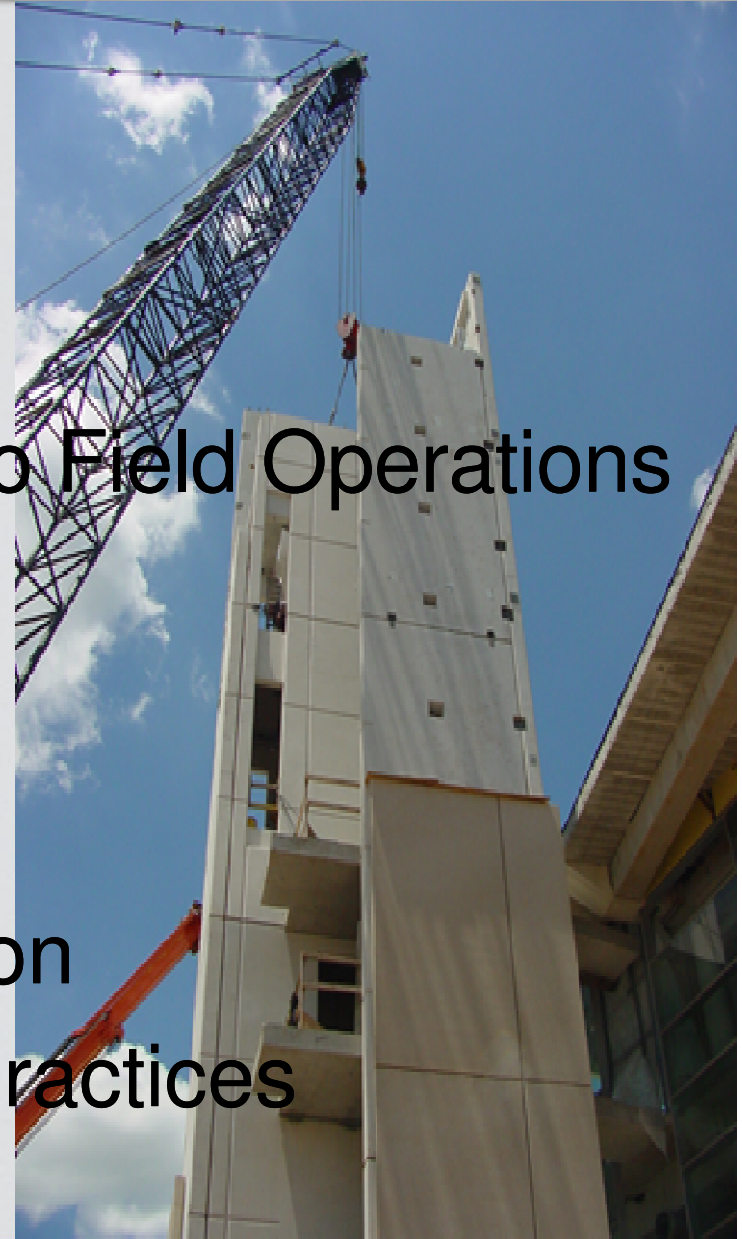


Sustainable Plant Program

- **Structure**

- **Stage II:**

- Stage I items applied to Field Operations
 - Safety
 - Transportation
 - Materials Acquisition
 - Mix Design Optimization
 - Identification of Best Practices





Sustainable Plant Program

- **Structure**

- Stage III:

- Enhancements to Stages I and II
 - Social Responsibility
 - Enhanced Monitoring and Reporting
 - Additional Supply Chain Management

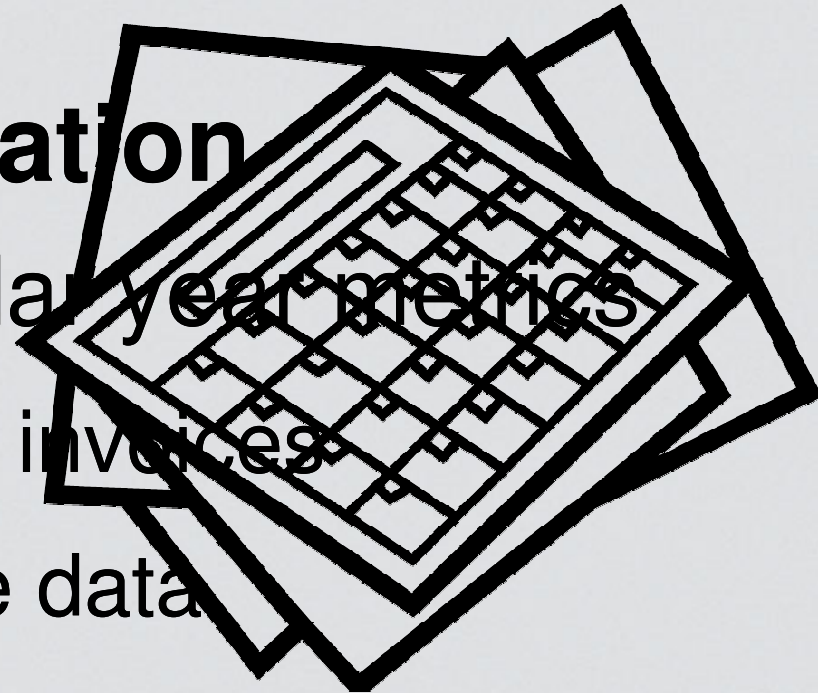


Sustainable Plant Program

- **Stage I Implementation**

- Plant reports calendar year metrics

- Information often on invoices
- Establishes baseline data
- Enables 'Before and After' comparisons



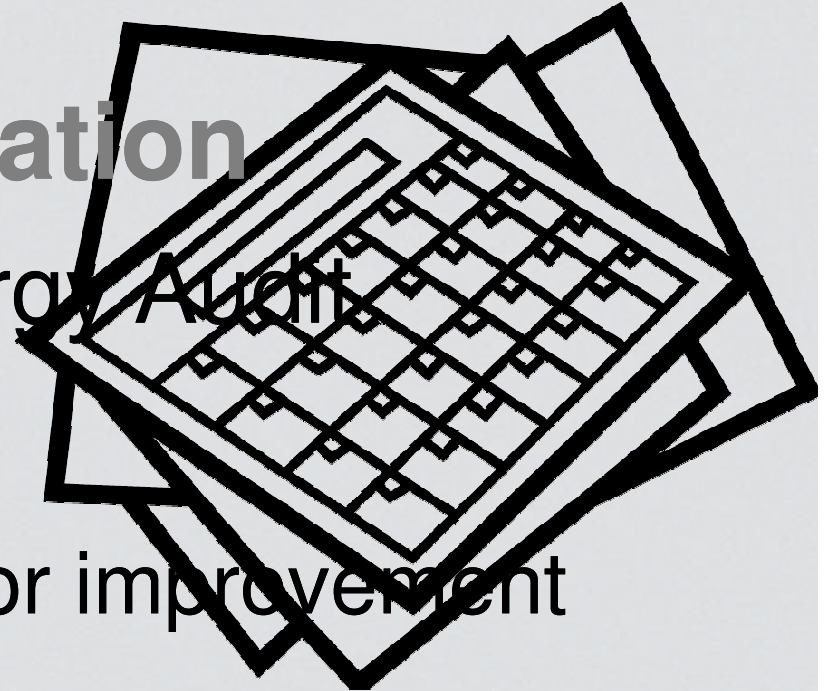


Sustainable Plant Program

- **Stage I Implementation**

- Plant conducts Energy Audit

- Often low or no cost
- Provides roadmap for improvement
- Documented starting point for energy use





Sustainable Plant Program

• Stage I Implementation

– PCI develops standard Tracking Tool



• Data input can be performed by administrative or clerical personnel

• Detailed guidance document provides data entry instructions

Sustainable Plant Tracking tool - Recycling											PCI Producer Name:		KY# Request				
Recycling	Plant Production Operations					Yard Operations				Office/Admin							
	Wood (CY)	Metals (CY)	Cardboard (CY)	Plastics (CY)	Concrete (CY)	Other (CY)	Food (CY)	Metals (CY)	Cardboard (CY)	Plastics (CY)	Concrete (CY)	Other (CY)	Paper waste	Cubic yards	Trucks/bottles - cubic yards	-Waste # IT items	Other
Fiscal Year 2010																	
January Volume																	
February Volume																	
March Volume																	
April Volume																	
May Volume																	
June Volume																	
July Volume																	
August Volume																	
September Volume																	
October Volume																	
November Volume																	
December Volume																	
Totals																	



Sustainable Plant Program


- **Support to Participants**
 - Listing of incentive programs to offset capital upgrade expense
 - Federal
 - State
 - County
 - Local power authorities

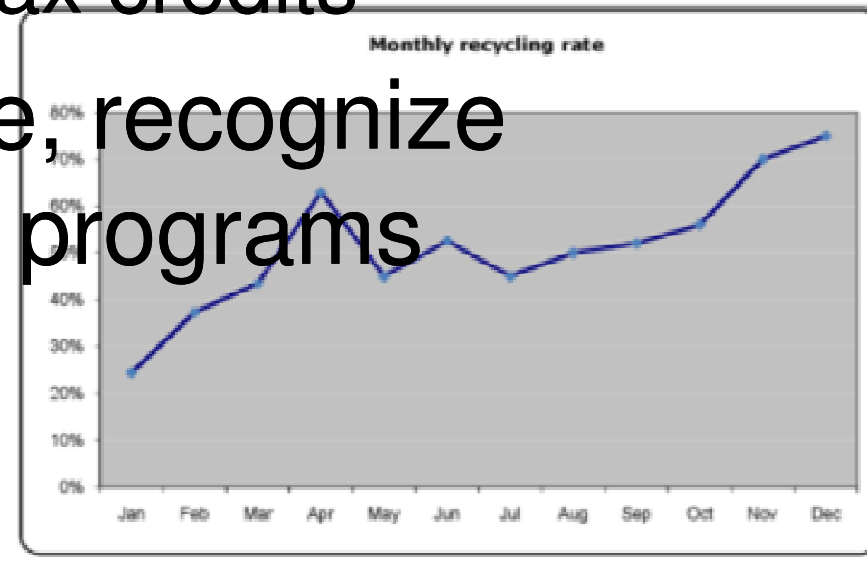


Sustainable Plant Program

- Support to Participants
 - Web links and guidance for:

Client: Cassroad Mig
Location: USA
Description: Main Production facility
Year: 2009

YTD Recycling Figures	
	Tons Recycled ###
	Costs ###
	Savings ###
	Recycling Rate ###



- Applying for grants
- Understanding tax credits
- Identify, publicize, recognize successful plant programs



SUMMARY

- **The Technical Institute**
 - Develops and Advances Engineering Methods and Technology
 - Sets and Validates Quality Standards
- **Sustainable Design**
 - The Next Step in Evolution of Design
 - Needs New Tools and Methods
 - Needs New Approach to Engineering



Beyond Sustainability: Quality

- **Role of Quality**

- Design Without Quality is Useless
- In Other Words:

As the impact of design becomes greater and more far-reaching, it is of greater importance that the finished structure adhere to the design.



- **Therefore:**

***It Is the Duty of the
Engineering Profession
and the Technical Institute to
Advance Sustainable Design***



THANK YOU !

