



Department of  
**Environment &  
Conservation**

# What Gets Measured, Gets Improved

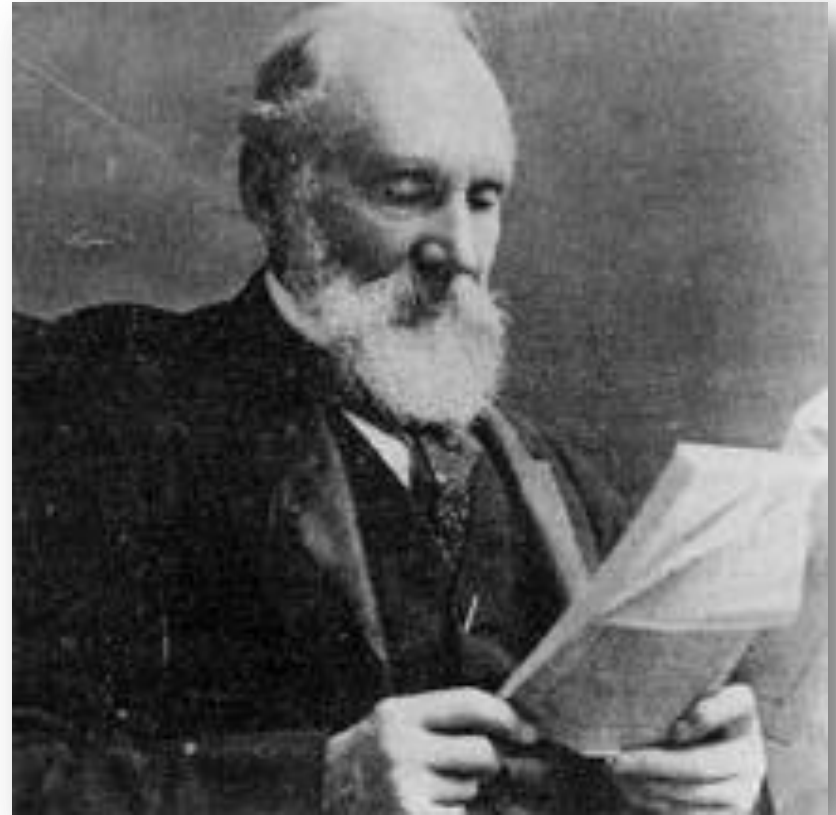
## Measuring Progress



Arkansas Recycling Coalition Conference  
Measuring Success Concurrent Session  
October 1, 2019

# William Thomson, 1<sup>st</sup> Baron of Kelvin

"If you can not measure it,  
you can not improve it."



# Discussions

- Why We Measure
- What and How We Measure
- Ways to Improve Measurement
- National State Measurement Project (SMP)



**Why We Measure**

# Measurement

- Aside from the regulatory and statutory requirements to collect data, we measure:
  - **To Know Where** we are
  - **To Know Where** we came from
  - **To Know Where** we want to go...

*“Only three things happen naturally in organizations: friction, confusion, and underperformance. Everything else requires leadership.”*

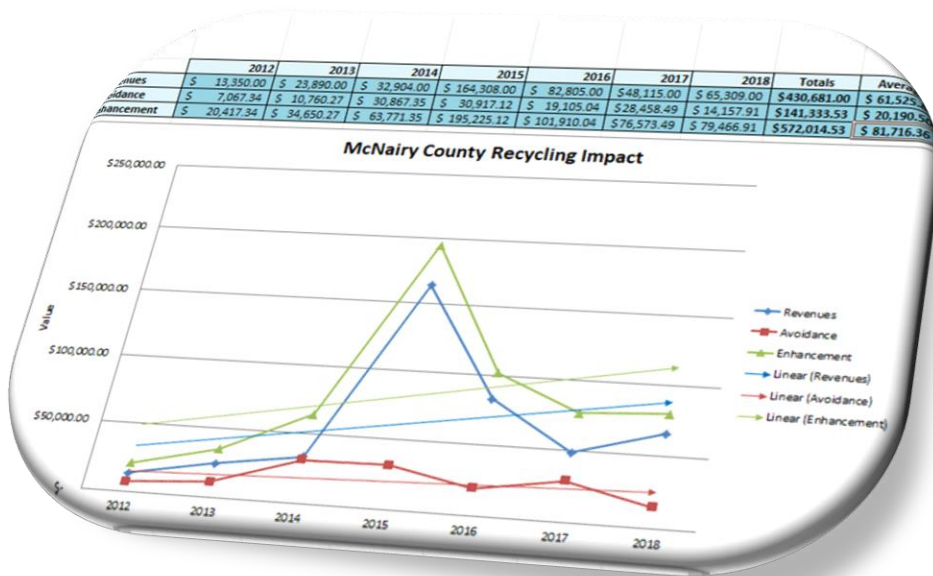
*Peter Drucker*

# Where We Are...

**Benchmarking** is comparing one's business processes and performance metrics to industry bests and best practices from other companies. In project management **benchmarking** can also support the selection, planning and delivery of projects.



# Where We Came From...



**Historical Trending** For most of humanity's history, advances in technology, productivity, and real income per capita came very slowly and sporadically. But with the development of modern science in the 17th century and the quickening of technological innovation that it sparked, the stage was set for significant improvements in productivity. The gains remained modest until the latter part of the 19th century.

# Where We Are Going...

**Forecasting** is a technique that uses historical data as inputs to make informed estimates that are predictive in determining the direction of future trends.





**What And How We  
Measure**

# Tennessee Measures

- Disposal
- Diversion
  - Recycling
  - Composting
  - Anaerobic Digestion
  - Waste To Energy
  - Beneficial Use
- Economic Benefit
- Origin
- Materials Types



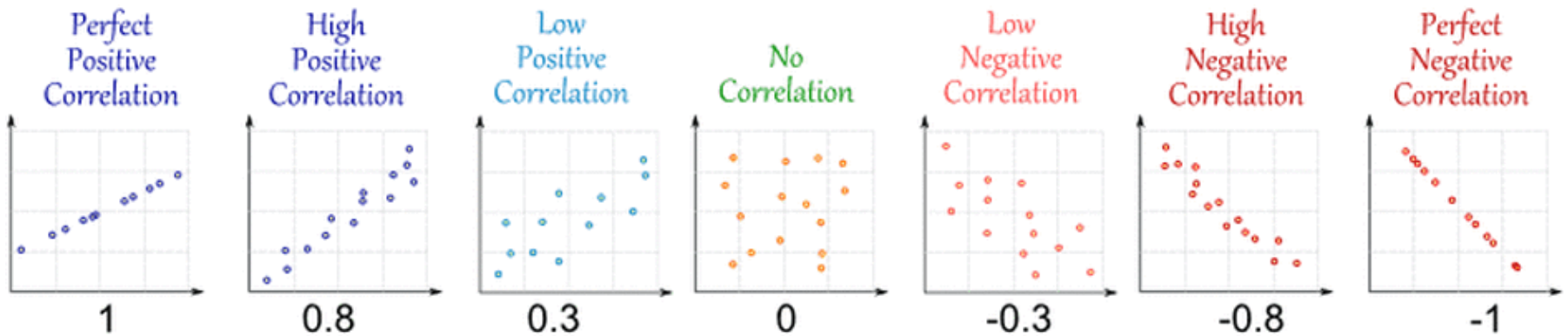
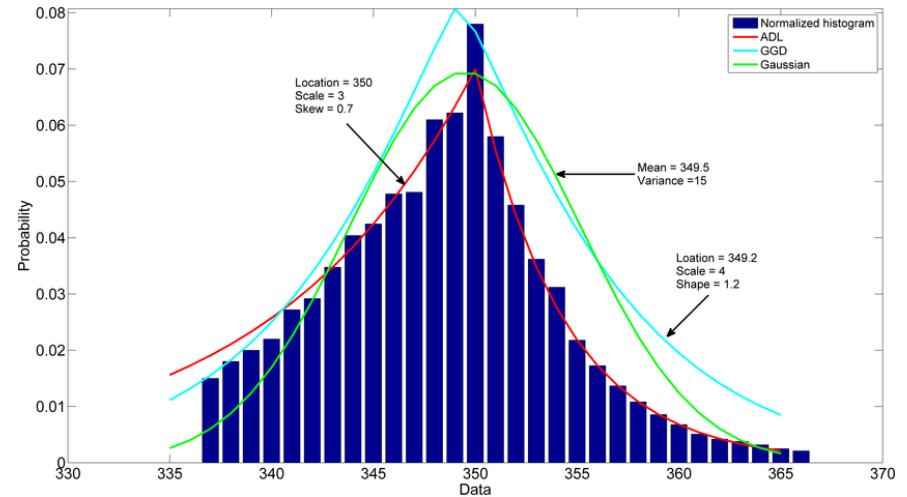
# Tennessee Measures



- Exportation/Importation
- Grant Funding
- Progress to Goal
- Qualitative Factors
- Demographics

# Data Improvement Project

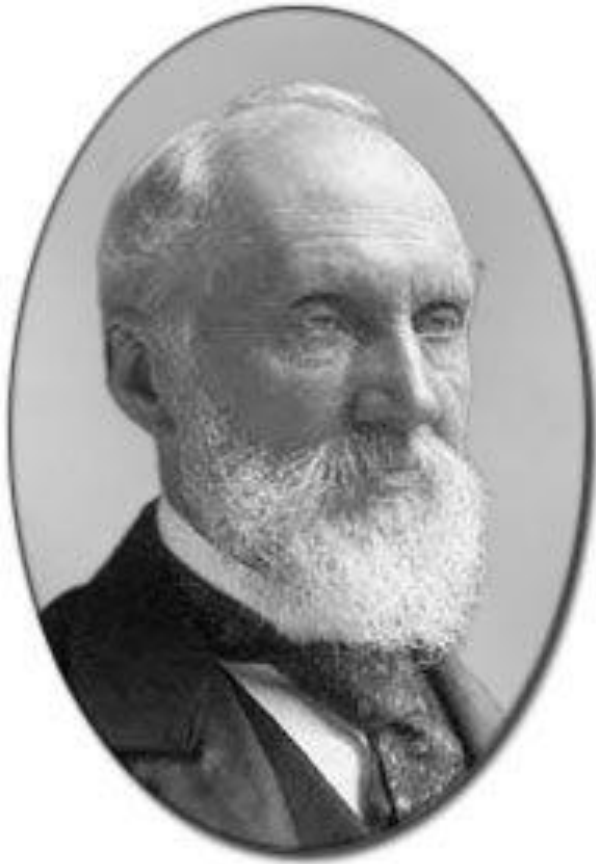
- Hired an Intern
  - Astrophysics Data Manager from Carnegie-Mellon
- Normalized Data
- Created Scripts for Data Review
- Applied Tools to Historic Data





# Ways to Improve Measurement

# William Thomson, 1<sup>st</sup> Baron of Kelvin

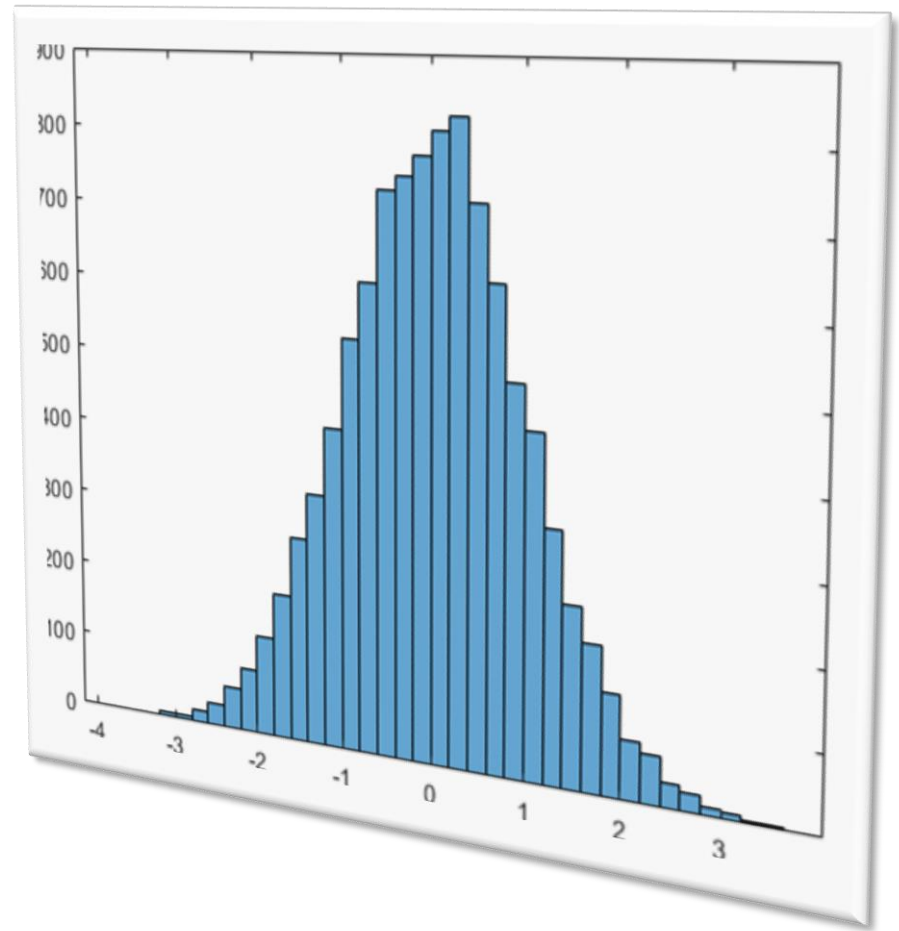


Lord William Thomson Kelvin  
(1824-1907)

"Can you measure it? Can you express it in figures? Can you make a model of it? If not, your theory is apt to be based more upon imagination than upon knowledge." - Lord Kelvin

# Normalize Data

- Apples to Apples Comparison
  - Per Capita
  - Per Household
  - *Per Industry (NAICS Code)*
  - *Per Customer*
  - *Per Census Tract*
  - *Per School, Institution, etc.*
- Histogram Distribution
  - Quickly identifies outliers

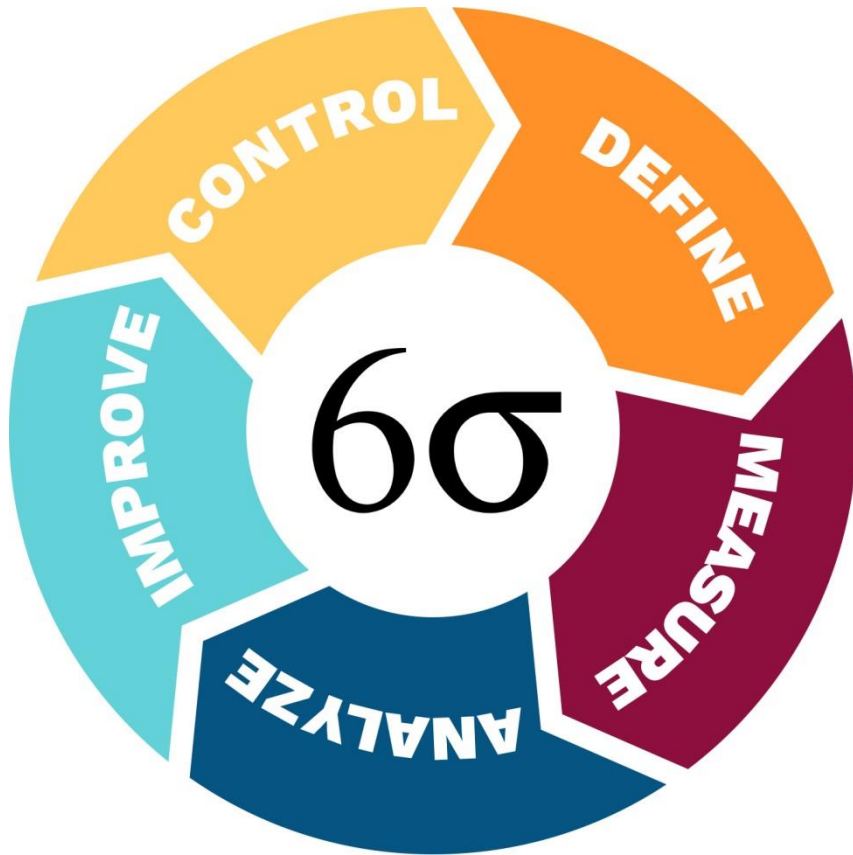


# Data Quality – Simple Six Step Process

- Definitions
- Assessment
- Analysis
- Improvement
- Implementation
- Control Processes  
(Verification of consistency)



# Six Sigma



- Improve the quality of the output of a process by identifying and removing the causes of defects and minimizing variability
- Apply to program data to insure quality – Basis in accreditation

# What's Needed Nationally?

- Interest in Collaboration
- Consistent Methodologies
- Focus on the Raw Data
- Let Technology Work
- Independent 3<sup>rd</sup> Party Measurement Organization
- Accreditation
- Standard



# What Should Be Acted Upon?



Logo Owned By \*Emerge Knowledge  
Design

- Definitions
- Measurement Standards
- Local Government Sampling Methodologies
  - Municipal Measurement Program\*
- Consistency of Reporting
- Quality of Submissions

# Drop Our Perfectionist Attitude

- Measurement Will **NOT** Be Perfect...
  - ... At Least In the Beginning
- The More We Learn The Better It Becomes
- Though We Want to Be Unique, We All Do The Same Things

IF YOU WAIT FOR  
**PERFECT**  
CONDITIONS, YOU WILL  
**NEVER GET**  
ANYTHING DONE

# Other Ideas

- Larger Samples Equal Better Data
- No Decimal Points For Statewide Data (Significant Digits)
- Public Data The Strongest → Focus Here
- Use a Market Based Identification For Materials Collected (ISRI)
- More Statistical Quality Checking





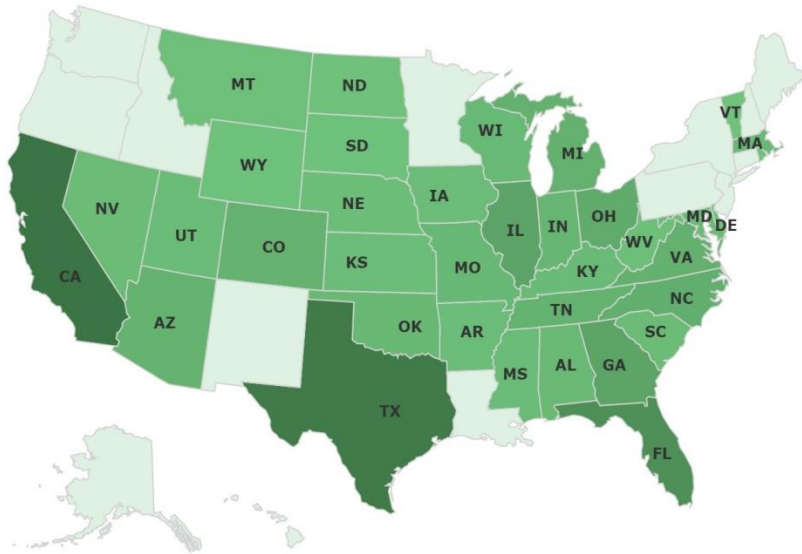
# National State Measurement Project

# 100% Participation Goal

- 37 States

State Measurement Program (2017)

MSW Disposal Tonnages (by State)



- 50 States

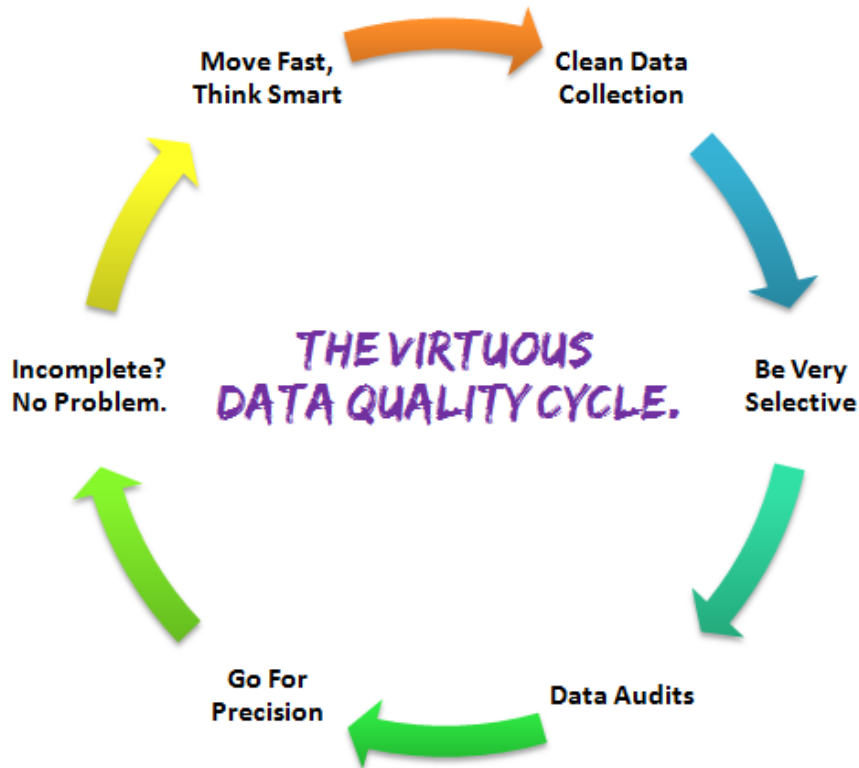


Participation: 43 of 50  
States Since Inception

# Participation by Region

| Region | # States In SMP 2012-17 | States in Re-TRAC      | States in 2017 Template (37)       | States in 2016 Template (37)       | States in 2015 Template (32)   | States in 2014 Template (29)   | States in 2013 Template (32)   | States in 2012 Template (20)   |
|--------|-------------------------|------------------------|------------------------------------|------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| 1      | 6 of 6                  | MA, VT                 | NH, MA, RI, VT, CT                 | ME, MA, RI, VT                     | MA, ME, VT                     | MA, ME, VT                     | CT, ME, RI                     | None                           |
| 2      | 0 of 2                  | NY                     |                                    |                                    |                                |                                |                                | None                           |
| 3      | 5 of 5 + DC             | PA                     | DE, MD, VA, WV, +DC                | DE, MD, VA, WV, +DC                | MD, VA, WV, +DC                | DE, MD, VA, WV                 | MD, VA, WV +DC                 | MD, PA, VA                     |
| 4      | 8 of 8                  | AL, FL, GA, MS, SC, TN | AL, FL, GA, KY, MS, NC, SC, TN     | AL, FL, GA, KY, MS, NC, SC, TN     | AL, FL, GA, KY, MS, NC, SC, TN | AL, FL, GA, KY, MS, NC, SC, TN | AL, FL, GA, KY, MS, NC, SC, TN | AL, FL, GA, KY, MS, NC, SC, TN |
| 5      | 6 of 6                  | IN, MI, MN, OH         | IL, IN, MI, MN, OH, WI             | IL, IN, MI, MN, OH, WI             | IL, IN, MI, OH, WI             | IL, IN, MI, OH, WI             | IL, IN, MI MN, OH, WI          | IL, IN, MI MN, OH, WI          |
| 6      | 3 of 5                  | TX/TCEQ                | AR, OK, TX                         | AR, TX                             | AR, TX                         | AR, TX                         | AR, TX                         | AR, OK                         |
| 7      | 4 of 4                  | MO                     | IA, KS, MO, NE                     | IA, MO, NE                         | IA, KS, MO, NE                 | IA, NE                         | IA, KS, NE                     | None                           |
| 8      | 6 of 6                  |                        | CO, MT, ND, SD, UT, WY             | CO, MT, ND, SD, UT, WY             | CO, ND, SD, WY                 | CO, SD                         | CO, ND, SD,                    | CO                             |
| 9      | 3 of 4                  |                        | AZ, CA, NV                         | AZ, CA, NV                         | AZ, CA, NV                     | AZ, CA, NV                     | AZ, CA, NV                     | None                           |
| 10     | 2 of 4                  |                        |                                    | OR                                 |                                |                                | WA                             | None                           |
|        | 43 of 50 +DC            | 16 of 50               | 37 of 50 + DC plus several pending | 37 of 50 + DC LA and KS incomplete | 31 of 50 +DC LA & PA in 2016   | 29 of 50 CT in 2017            | 32 of 50 + DC                  | 20 of 50                       |

# Data Quality



- Time to act is now
- More states report, the better the sample
- Select the level of data all states share and grow
- EPA or 3<sup>rd</sup> party review
- Tighten up sources
- Fill in the gap states

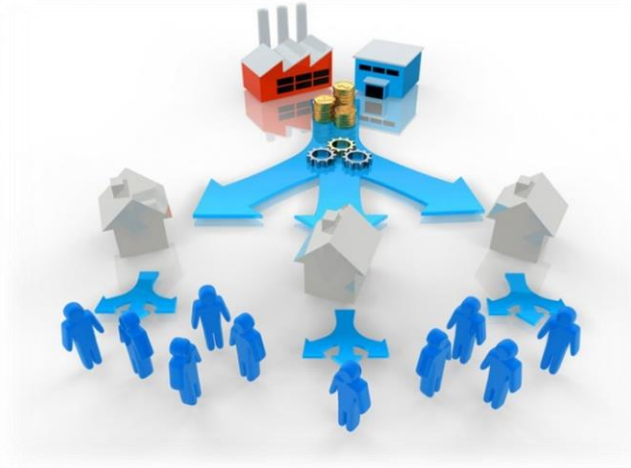
# State Measurement

- Material Disposal and Recovery
- Import/Export
- Facility Throughput
- Economic Impact
- Life Cycle Management Costs
  - Tip Fees
- Demographics
- Qualitative Programs
- Climate Impacts



# Material

- Tangibles (Physically Measureable)
  - Tonnages
  - Volume
  - Costs
  - Full Time Equivalents
  - Participation Rates
- Intangibles (Projections, Modeling, & Expectations)
  - Life Cycle Analysis
  - Carbon Emissions (Equivalents)
  - Capture Rates
  - Qualitative Program Data



# SMP Example

| STATE                                          | TOTAL                 | MSW LANDFILL          | C & D LANDFILL       | BURNED AT WASTE-TO-ENERGY FACILITY | NON-HAZARDOUS INDUSTRIAL LANDFILL | INCINERATOR (WITHOUT ENERGY RECOVERY) |
|------------------------------------------------|-----------------------|-----------------------|----------------------|------------------------------------|-----------------------------------|---------------------------------------|
| Tennessee                                      |                       |                       |                      |                                    |                                   |                                       |
| Municipal Solid Waste                          | 7,116,119.0           | 7,116,119.0           |                      |                                    |                                   |                                       |
| Construction, Demolition & Land Clearing Waste | 1,720,789.0           |                       | 1,720,789.0          |                                    |                                   |                                       |
| <b>TOTAL</b>                                   | <b>8,836,908.0</b>    | <b>7,116,119.0</b>    | <b>1,720,789.0</b>   |                                    |                                   |                                       |
| Texas                                          |                       |                       |                      |                                    |                                   |                                       |
| Only a total MSW disposal number provided      | 34,732,251.0          |                       |                      |                                    |                                   |                                       |
| <b>TOTAL</b>                                   | <b>34,732,251.0</b>   |                       |                      |                                    |                                   |                                       |
| Utah                                           |                       |                       |                      |                                    |                                   |                                       |
| Municipal Solid Waste                          | 3,865,668.0           | 3,765,990.0           |                      | 99,678.0                           |                                   |                                       |
| Construction, Demolition & Land Clearing Waste | 1,373,838.0           |                       | 1,373,838.0          |                                    |                                   |                                       |
| Other Non-hazardous Waste                      | 11,444.0              |                       |                      |                                    |                                   | 11,444.0                              |
| <b>TOTAL</b>                                   | <b>5,250,950.0</b>    | <b>3,765,990.0</b>    | <b>1,373,838.0</b>   | <b>99,678.0</b>                    |                                   | <b>11,444.0</b>                       |
| Vermont                                        |                       |                       |                      |                                    |                                   |                                       |
| Municipal Solid Waste                          | 345,674.0             | 345,674.0             |                      |                                    |                                   |                                       |
| Construction, Demolition & Land Clearing Waste | 294.0                 | 294.0                 |                      |                                    |                                   |                                       |
| Other Non-hazardous Waste                      | 14,851.0              | 14,851.0              |                      |                                    |                                   |                                       |
| <b>TOTAL</b>                                   | <b>360,819.0</b>      | <b>360,819.0</b>      |                      |                                    |                                   |                                       |
| Virginia                                       |                       |                       |                      |                                    |                                   |                                       |
| <b>TOTAL Tons</b>                              | <b>285,647,396.60</b> | <b>136,528,420.00</b> | <b>18,798,842.00</b> | <b>11,596,579.00</b>               | <b>16,194,515.00</b>              | <b>11,960.00</b>                      |

# Accreditation

- Establish Standards
  - Definitions
  - Methodologies
  - Reporting
  - Timing
  - Format
- Tied to:
  - Funding Opportunities
  - Accurate and Valid Data



# Other Work in Industry - SWEEP



- June 9, 2019 National Consensus Committee Releases Ballot on Solid Waste Measurement Standards
- Identifies Key Performance Indicators for Local Governments (KPI's)
- Based on a Point System

# National Institute of Standards and Technology

<https://youtu.be/2j9BGVKbzS4>

## Standards & Measurements

Standards allow technology to work seamlessly and establish trust so that markets can operate smoothly.

They:

provide a common language to measure and evaluate performance, make interoperability of components made by different companies possible, and protect consumers by ensuring safety, durability, and market equity.

# William Thomson, 1<sup>st</sup> Baron of Kelvin

“When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts advanced to the stage of science.”

— William Thomson, 1st Baron Kelvin, (1824-1907)





# Contact Information



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