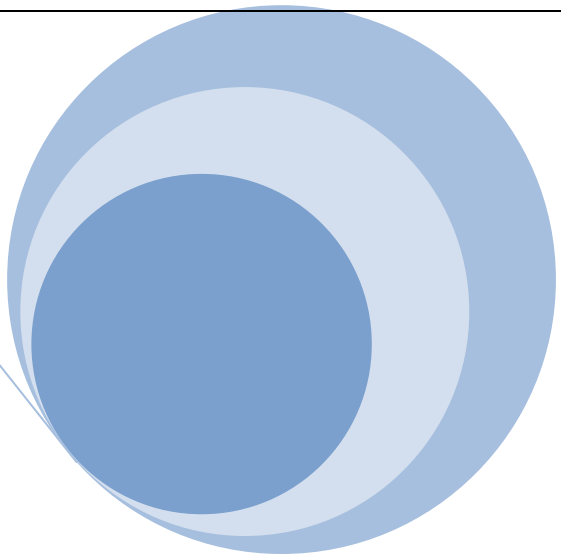
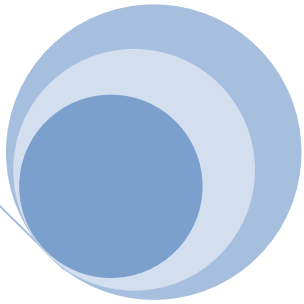
*Clean*Metrics™

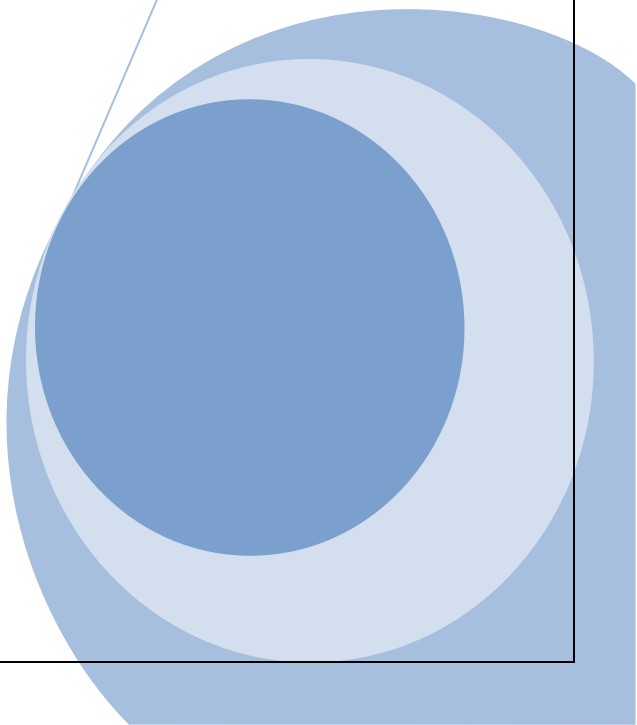




MetaFlowScope™

Product Technical Brief

CleanMetrics Corp.
October 2011



Contents

What is MetaFlowScope?

MetaFlowScope™ is our new business analytics solution for significantly enhancing resource productivity. MetaFlowScope analyzes material and energy flows through an enterprise, facility, plant, process or any other unit of operation – and at any level of detail, ranging from a high-level organizational view to a detailed process view. It quantifies both economic and environmental values of resources used and waste generated, and helps identify profitable opportunities for material substitution, energy substitution, process optimization, waste reduction, material reuse and recycling – so that businesses can save money, increase resource productivity and reduce emissions all at the same time.

MetaFlowScope™ is the first and only business analytics solution to deliver:

- Top-down estimate of material quantities ending up in the waste stream.
- Full economic and life-cycle environmental impacts of material waste.
- Detailed breakdown of waste composition, **prioritized** by economic and environmental opportunities (i.e., cost saving potential, emissions reduction potential, etc.).

Other key benefits of MetaFlowScope™:

- Web-based software application: easy to deploy within your organization.
- Interactive, easy-to-use platform for analyzing complex value chains.
- Corporate scope 3 GHG emissions analysis and reporting – along with scope 1 and scope 2 emissions.

MetaFlowScope™ includes:

- **Analysis of both economic and environmental impacts** of material and energy flowing through an operation – including procurement, production, fulfillment and waste – using our new *flow analysis engine*, based on the principles of material flow analysis and industrial metabolism.
- Our comprehensive standards-compliant product life-cycle assessment (LCA) and corporate value-chain analysis (VCA) engine, covering all life cycle stages from cradle to grave and accounting for all GHG emissions and resource use. Targets the three environmental metrics that are most critical for businesses and consumers: GHG emissions, energy use and water use.
- Our entire life cycle inventory (LCI) database, including the largest set of commercial LCI data for North American food production and processing.

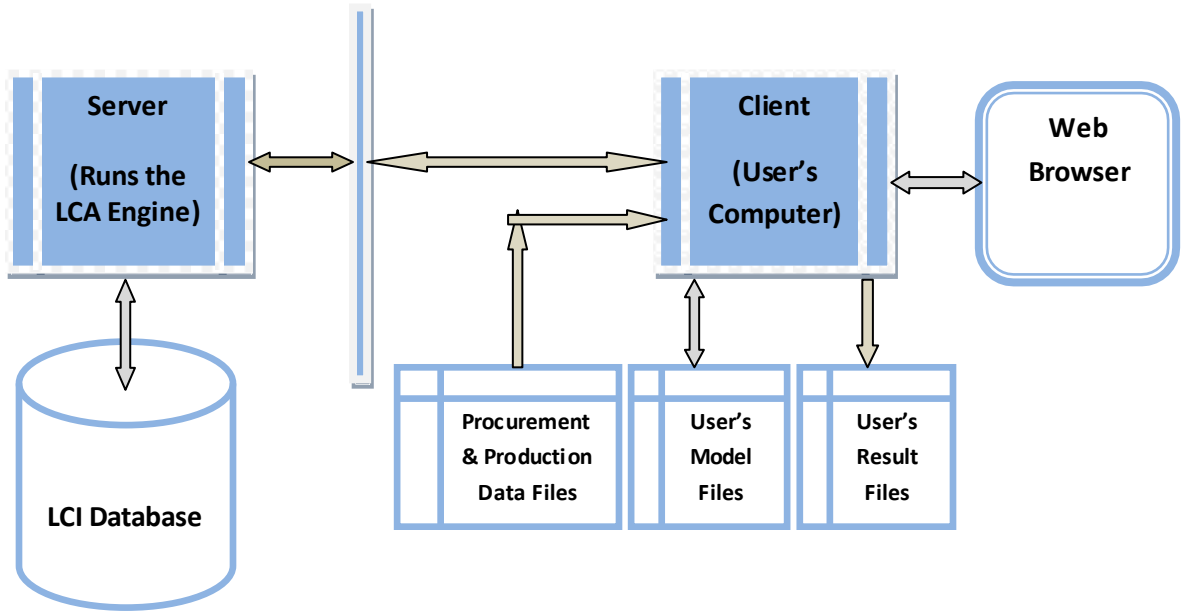
- Data input interface to import procurement and production data from ERP systems – including industry-specific software systems used for purchasing, production management and inventory control.

Who is it for?

MetaFlowScope™ is a business analytics solution has been expertly designed from the ground up to focus on one thing: increasing the efficiency of resource use in any business or operation. It can be used in a broad range of industries, including:

- Manufacturing
- Agriculture
- Food processing
- Food service
- Retail
- Construction

MetaFlowScope™ is not just an environmental sustainability solution, but a full-fledged business efficiency solution. As such, it can be used in operations, procurement, planning, finance, product development, and, of course, sustainability monitoring and reporting.



Applications

Analysis and results from MetaFlowScope™ can be used in a wide variety of applications to increase resource efficiency and positively impact the bottom line:

- **Waste reduction**: produce direct cost savings and lower environmental footprints by reducing the avoidable waste in your operation.
- **Waste diversion**: extract economic value by diverting valuable components of your waste stream to useful applications (either within your operation or elsewhere) and simultaneously reducing disposal costs, while lowering overall environmental footprints.
- **Material substitution**: explore the use of alternative materials (including recycled materials) to reduce cost and/or environmental footprints.
- **Energy substitution**: explore the use of alternative and renewable energy (including on-site energy generation) to reduce cost and/or environmental footprint.
- **Process optimization**: analyze the impacts of more efficient manufacturing and other internal processes.
- **Product redesign**: analyze the projected effects of product redesigns that use alternative materials, lower amounts of materials/energy, and redesigned processes.
- **GHG emissions reporting**: corporate scope 3 GHG emissions across value chains, along with scope 1 and scope 2 emissions.
- **Other environmental reporting**: metrics such as water use, energy use, solid waste, and wastewater – within organizational boundaries and across value chains.

How is MetaFlowScope different from other tools?

MetaFlowScope™ brings a life-cycle perspective to resource management and resource efficiency. It performs rigorous analysis of key environmental metrics (GHG emissions, energy, and water) across the full value chain of an organization, in conjunction with an economic analysis. Business decisions are made first on an economic basis and only then environmental considerations are taken into account. MetaFlowScope™ recognizes this reality and provides decision makers with both economic and environmental metrics in a single framework.

MetaFlowScope™ is a unique solution that pulls together concepts, modeling and algorithms from multiple domains: life cycle assessment, value chain analysis, material flow analysis and industrial metabolism. It is the first and only business analytics solution to deliver a top-down

estimate of material waste, including prioritized opportunities for achieving significantly higher material efficiencies in a broad range of industries and sectors.

MetaFlowScope™ can also be used for detailed corporate GHG emissions reporting (all scopes, including scope 3 value-chain emissions) – this can simply become a byproduct of a larger effort aimed at increasing resource efficiency, rather than a dedicated emissions inventory task.

Standards

MetaFlowScope™ can be used to generate results that are in compliance with current international standards for life cycle assessment, product carbon footprint analysis, value chain (scope 3) emissions analysis, and GHG emissions inventories. Relevant standards include the ISO 14040 series, PAS 2050, GHG Protocol, and IPCC Guidelines for National GHG Inventories.

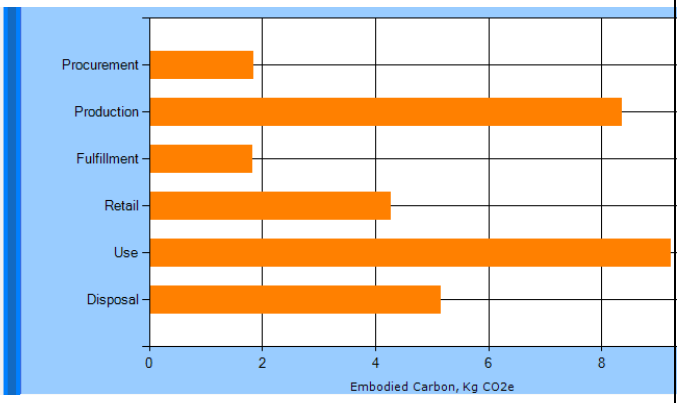
Sample results

MetaFlowScope™ presents the analysis results in multiple forms, some of which are illustrated below.

Results by life cycle stage show the quantity of material at the output of each stage in the value chain along with the embodied energy (primary energy used), embodied carbon (GHG emissions generated) and embodied water (water used) at that stage. Additional details include the emissions contributions from transport, packaging and waste disposal.

Note: All weights in Kg. All carbon in Kg CO2e. Energy in MJ. Water in L. "Embodied" figures are total values for each life-cycle stage. Scaled weight is the actual weight at the output of each life-cycle stage, based on quantities consumed and wasted downstream.

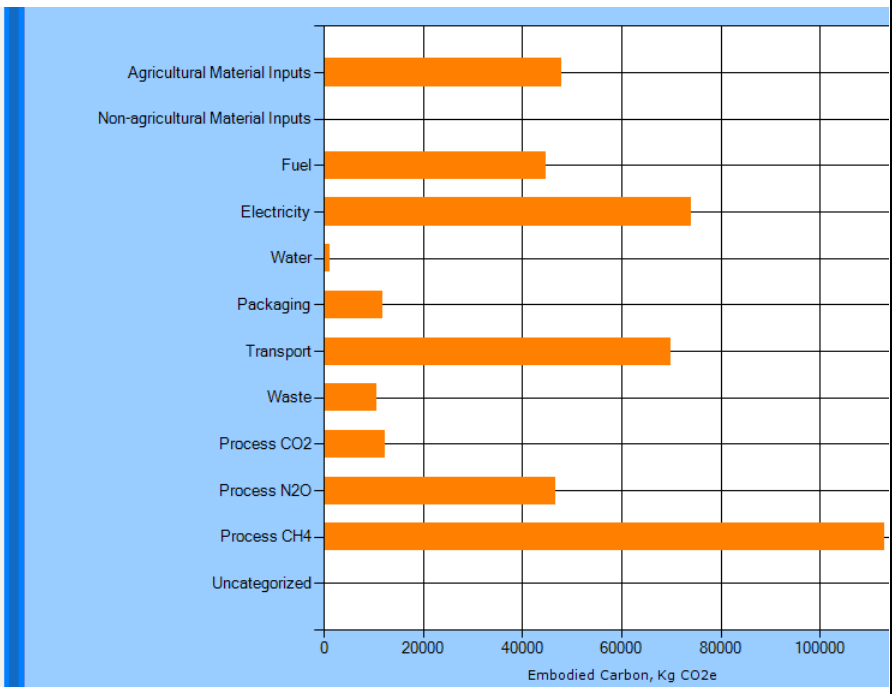
Stage Name	Type	Input Weight	Output Weight	Embodied Energy	Embodied Water	Embodied Carbon	Transport Carbon	Package Carbon	Waste Carbon
Procurement	Procurement	5.499	5.499	23.407	0.000	1.856	0.000	0.616	0.000
Production	Production	5.499	4.499	112.607	0.000	8.353	0.000	0.000	0.375
Fulfillment	Fulfillment	11.600	11.600	23.583	0.000	1.830	0.873	0.493	0.412
Retail	Retail	11.600	14.200	91.431	0.000	4.274	1.068	3.206	0.000
Use	Use	14.200	13.800	126.826	0.000	9.231	1.253	0.167	0.187
Disposal	Disposal	13.800	0.000	-6.483	0.000	5.168	0.000	0.000	5.168
TOTAL	**TOTAL**	5.499	0.000	371.371	0.000	30.712	3.194	4.482	6.142



Results by GHG emissions inventory drill down to the emissions contributions from all the basic input materials and energy used throughout the value chain, as well as from transport, packaging and waste disposal. Note that the analysis uses a life-cycle approach to trace all of the input materials, energy and processes all the way back to the point of resource extraction from the ground. Also included in these results are the direct and indirect GHG emissions and carbon sequestration in production.

Note: The material input processes below are cradle-to-gate. The packaging, transport and waste emissions are from processes that occur after the production of these inputs.

Emission Source	Embodied Carbon (Kg CO2e)
Agricultural Material Inputs	47879.595
Non-agricultural Material Inputs	72.473
Fuel	44682.265
Electricity	74052.173
Water	1051.055
Packaging	11785.924
Transport	69847.284
Waste	10614.220
Process CO2	12201.660
Process N2O	46605.924
Process CH4	113068.354
Uncategorized	100.000
TOTAL	431960.926



The **material flow and waste results** identify quantities of purchased materials that are wasted in an operation – such as construction, manufacturing, food processing or food service – along with both the cost and life-cycle environmental impacts of the waste. The report itemizes each component material of the waste separately, and provides both the dollar value and the life-cycle environmental burdens of that waste component. The report can be easily re-organized to prioritize on the basis of any of the reported metrics. Charts are available to view the results graphically. The first sample output below is for a simple building construction example with about 5% of the materials wasted on average (prioritized by cost), and the second is for a

commercial food service example with an average of 20% food waste (prioritized by GHG emissions).

Table and chart on this page show the life-cycle impact of wasted materials.

Note: CO2e. EE = embodied energy in MJ. EW = embodied water in L. EC = embodied carbon in Kg CO2e.

Input Material	Wasted Qty	Unit	Weight (Kg)	Cost ($)	EE (MJ)	EW (L)	EC (Kg CO2e)
Bricks & stone	744091.000	kilogram	744091.000	148818.20	590722.514	0.000	40637.139
Concrete (foundation)	279873.000	kilogram	279873.000	139936.50	482244.245	45483.667	66501.767
Concrete (wall, poured-in-place)	279873.000	kilogram	279873.000	139936.50	637575.502	51525.591	83404.404
Asphalt	360910.000	kilogram	360910.000	108273.00	1048041.053	0.000	64102.355
Steel (recycled)	6977.000	kilogram	6977.000	27908.00	80064.836	0.000	4049.817
Composite wood (I-joist)	25964.000	kilogram	25964.000	25964.00	305462.754	89147.105	17440.037
Roofing (shingle)	14000.000	kilogram	14000.000	21000.00	185857.547	0.000	6306.335
Steel (bar & rod - virgin)	5091.000	kilogram	5091.000	20364.00	195369.870	0.000	14409.834
Softwood	11127.000	kilogram	11127.000	16690.50	104321.623	0.000	6681.235
Hardwood	11127.000	kilogram	11127.000	16690.50	108772.423	0.000	6903.775
TOTAL	1.000		1739033.000	665581.20	3738432.368	186156.362	310436.699

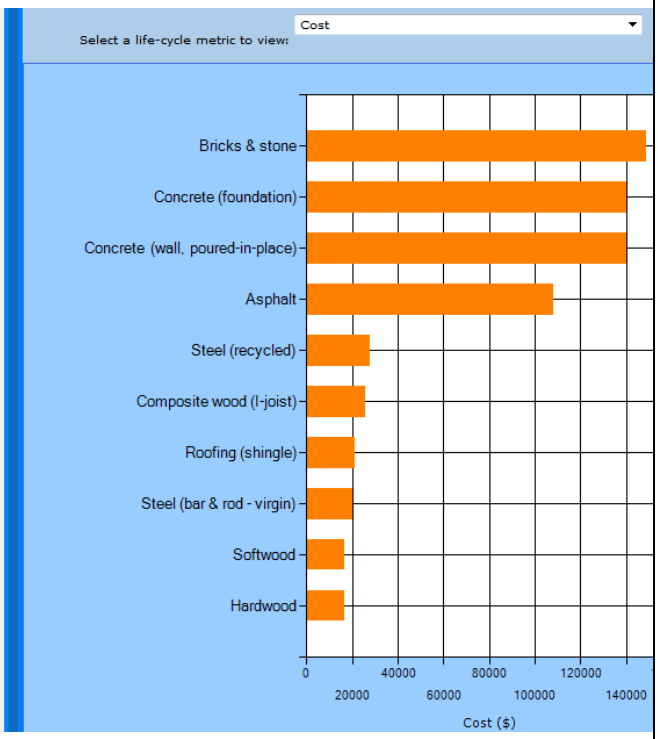
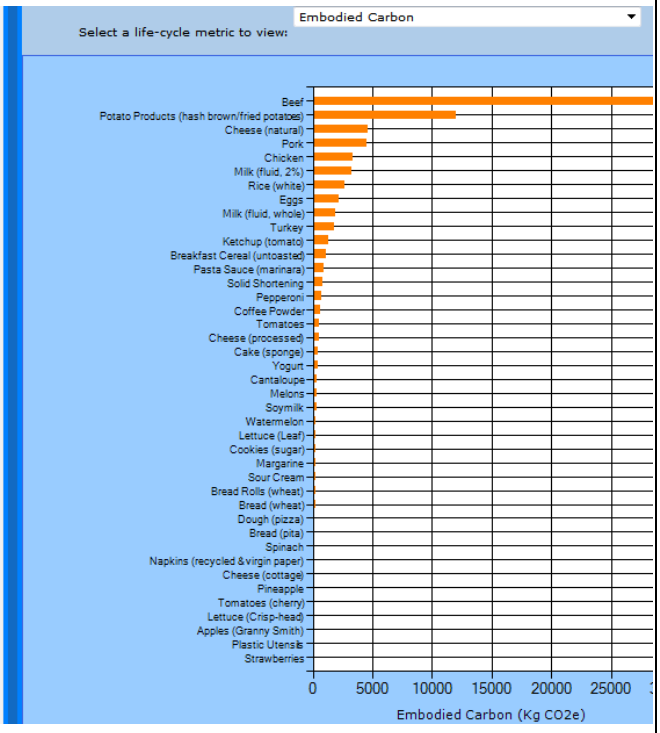


Table and chart on this page show the life-cycle impact of wasted materials.

Note: CO2e. EE = embodied energy in MJ. EW = embodied water in L. EC = embodied carbon in Kg CO2e.

Input Material	Wasted Qty	Unit	Weight (Kg)	Cost ($)	EE (MJ)	EW (L)	EC (Kg CO2e)
Beef	1779.915	kilogram	1779.915	17656.75	120882.521	6997039.492	28601.313
Potato Products (hash brown/fried potatoes)	2826.364	kilogram	2826.364	11305.46	142984.385	471158.137	12001.220
Cheese (natural)	448.154	kilogram	448.154	3159.48	23698.053	1071870.700	4603.496
Pork	839.336	kilogram	839.336	8326.21	30498.539	2731.091	4513.357
Chicken	928.785	kilogram	928.785	7170.22	44219.676	2982.635	3306.856
Milk (fluid, 2%)	2643.807	kilogram	2643.807	11659.19	30689.613	464113.172	3229.203
Rice (white)	907.194	kilogram	907.194	1397.08	13620.228	2267089.744	2655.841
Eggs	898.764	kilogram	898.764	2237.92	23530.898	2956.748	2179.244
Milk (fluid, whole)	1222.026	kilogram	1222.026	5389.14	13791.295	370436.494	1860.427
Turkey	410.505	kilogram	410.505	2894.06	16661.667	20808.606	1813.607
Ketchup (tomato)	467.285	kilogram	467.285	5607.42	19964.736	415687.281	1339.199
Breakfast Cereal (untoasted)	615.078	kilogram	615.078	7380.93	14359.622	468855.699	1136.123
Pasta Sauce (marinara)	826.817	kilogram	826.817	8268.17	13874.121	311793.849	917.912
Solid Shortening	368.321	kilogram	368.321	1462.23	9733.600	1296.489	824.941
Pepperoni	56.700	kilogram	56.700	567.00	5399.023	4.914	757.096
Coffee Powder	226.436	kilogram	226.436	3396.54	8443.783	7824.983	639.863
Tomatoes	1190.692	kilogram	1190.692	2619.52	6856.074	130551.601	561.445
Cheese (processed)	54.251	kilogram	54.251	382.47	2881.710	129754.551	558.081
Cake (sponge)	291.209	kilogram	291.209	3494.51	4828.686	162238.021	384.079
Yogurt	283.045	kilogram	283.045	1248.23	4852.901	50665.914	381.039
Cantaloupe	841.422	kilogram	841.422	2785.11	4076.540	519928.454	318.415
Melons	841.422	kilogram	841.422	2785.11	4088.574	980.762	317.985
Soymilk	280.644	kilogram	280.644	1403.22	4686.462	10613.936	313.788
Watermelon	952.554	kilogram	952.554	3152.95	3600.926	9.045	263.393
Lettuce (Leaf)	630.318	kilogram	630.318	1386.70	3472.020	64772.475	263.144



Additional report views include **results by process/activity** and **results for each model element** (including a detailed breakdown of the three GHG emission scopes), as well as supporting documentation such as detailed life-cycle inventory data sources for each model element. All results can be exported to an Excel file.

Company info

CleanMetrics Corp., based in Portland, Oregon, is dedicated to solving problems in environmental sustainability through innovative software tools, databases and consulting services grounded in robust analytical techniques. CleanMetrics is a leader in applying quantitative methods to produce practical sustainability solutions that you can put to use in your business every day.

The founders of CleanMetrics believe that the best analytical solutions start with a thorough understanding of the target industry or problem domain, which often comes from years of working in the trenches to solve a variety of practical problems for customers. From there, it is a matter of bringing together the right expertise in algorithms, modeling and software/database design to create tools that can standardize, automate and simplify complicated tasks.

CleanMetrics and its predecessor Surya Technologies have successfully provided modeling, analysis, optimization and simulation software and technologies to a broad range of customers in the semiconductor and electronic design automation industries in the US, Japan and India since the mid-1990s. CleanMetrics is now leveraging that expertise to provide rigorous and quantitative sustainability solutions to customers worldwide.

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