

Research for the NSF 426 Task Groups - Environmental Leadership Standard for Servers

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Task:	#4 – GHG reduction criteria
Research Question:	<p><i>Background: Several NSF standards include GHG reduction criteria (see attached). TG 11 is considering such a criterion but is concerned that a reduction-focused criterion would reward companies that haven't worked to reduce their product's impacts to date, and penalize those who have previously dedicated resources to GHG reduction, etc.</i></p> <p>TG-11 wants to explore the possibility of establishing a baseline for GHG emissions and/or other impacts that would allow for the awarding of credits for improvements from an industry baseline. Specific questions include:</p> <ol style="list-style-type: none"> 1) Is data available to establish a baseline for GHGs and/or other environmental impacts on a per production basis? Or a defined functional unit of service (e.g., data productivity/product mass)? 2) Is it feasible to provide a baseline for server products, possibly based on ranges, and award credit for improvements over a stated baseline? 3) Should the functional unit be based on a server product or defined amount of service (e.g., data productivity/product mass)? 4) If establishing a baseline is feasible, what would be reasonable percent reductions?

Research Response:

Definitions

- CDP: Formerly the Carbon Disclosure Project (CDP is now the specified name of the GHG emission disclosure scheme)
- GHG: Greenhouse Gas
- NSF: A Public Health and Safety Organization
- WBCSD: World Business Council for Sustainable Development
- WRI: World Resources Institute

Summary

The task of establishing a baseline for GHG emissions and/or other impacts is challenging considering the lack of data. A more feasible approach would be that of setting a company-wide carbon reduction target for server companies.

1) Is data available to establish a baseline for GHGs and/or other environmental impacts on a per production basis? Or a defined functional unit of service (e.g., data productivity/product mass)?

- Few companies currently manufacture their own products and data is very limited.
- A baseline would struggle to take into account variations in the different server models.
- There is at least a 15% uncertainty in carbon footprinting in the production phase.
- The main server vendors disclose their GHG emissions under the CDP, but only at an operational level – figures are not broken down by product or service.
- No GHG emission data on a per unit basis could be found in this research. The closest match to a baseline is the Fujitsu carbon footprint for a server including its manufacturing and assembly in Augsburg, Germany.

2) Is it feasible to provide a baseline for server products, possibly based on ranges, and award credit for improvements over a stated baseline?

- As servers evolve, it is possible that increased server production impacts (including raw materials) will be offset by the energy efficiency improvements in use, so targets would ideally be balanced against the possible savings in other life cycle stages, although this may add complexity to the process.
- Considering the scarcity of data, a baseline using ranges for server products does not seem feasible.
- A single value for assembly impacts in 2010 is available from the Fujitsu server carbon footprint, but a single source value would not be considered a robust approach.

3) Should the functional unit be based on a server product or defined amount of service (e.g., data productivity/product mass)?

- Mass is not recommended because it is the silicon which has relatively little mass but the largest environmental impact in the server.
- Whilst the WRI / WBCSD guidelines on setting up a baseline¹ suggest the functional unit could be per-user, per unit of storage capacity or per transaction, we would suggest avoiding these units and

¹ <http://www.ghgprotocol.org/files/ghgp/GHGP-ICT-Cloud-v2-6-26JAN2013.pdf>

instead following the ENERGY STAR approach of categorising servers by the number of CPU sockets on the server since this generally dictates the complexity. The number of RAM slots could be used in addition if required. This would allow the baseline to adapt with product complexity.

4) If establishing a baseline is feasible, what would be reasonable percent reductions?

- NSF Criteria reference targets equal to or stricter than the relevant Kyoto Protocol goals, ranging from 25% to 75% reductions per unit produced – however, for servers it is unlikely a unit baseline can be set at this stage due to the lack of baseline data.
- A company-wide carbon reduction criteria could be specified. Some server manufactures have set strong company-wide carbon reduction targets (presumably through more aggressive investment in renewables). For example:
 - Dell Legacy of good plan 2012: Reduction in greenhouse gas emissions from their facilities and logistics operations by 50 percent by 2020
 - Fujitsu: Reduction of total greenhouse gas emissions associated with manufacturing globally to 6% below FY 1990 levels by end of FY 2012 (CO₂: 5% reduction, other greenhouse gases: 20% reduction). Performance 2012: 24.4% reduction.
- If targets are set, WRI guidelines specify that in contrast to an industry wide approach, they should be specific to each company, ambitious compared to business as usual, and ideally take into account unique reduction opportunities /innovations specific to that company, as well as past performance, energy management best practices for the industry.

Details of baseline data for server products

Data are provided in the 2010 Fujitsu carbon footprint for a relatively basic but very common server model in two form factors, a rack mount server (RX300) and a tower server (TX300) (Figure 1)². This was the only data identified that provided a breakdown of the server manufacturer’s actual carbon emissions. It shows the server assembly in 2010 used 11kgCO_{2e}, less than 0.3% of the total life cycle energy. This is in fact the smallest proportion, while raw materials is the second most significant. However, it is not clear if this would be incorporated within the NSF approach to criteria since the components are not manufactured by the server manufacturer.

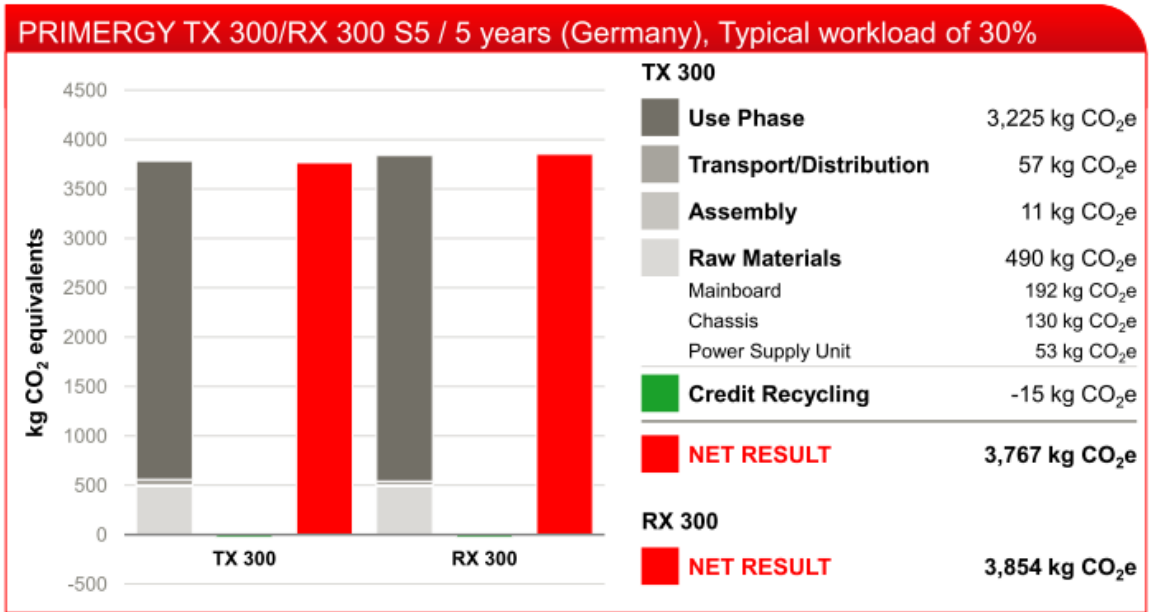
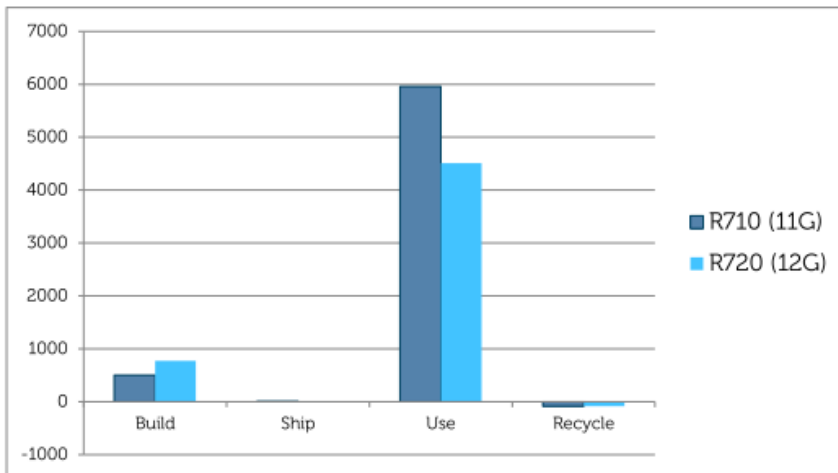


Figure 1 - Fujitsu Carbon Footprint for a server

A comparison of different Dell PowerEdge server generations (2011) shown in

Figure 2, shows that the server production (including raw materials) increased due to additional component complexity, but was more than offset by the energy efficiency improvements in use. This implies that criteria should be balanced against the possible savings in other life cycle stages.



² <http://globalsp.ts.fujitsu.com/dmsp/Publications/public/ps-Carbon-Footprinting-of-IT-Products.pdf>

Figure 2 - Comparison of the carbon footprint (kgCO₂eq) of the Dell PowerEdge R710 and R720 in the different lifecycle phases³

A 2008 IBM study also addressed server carbon footprint, but did not break this down to include an assembly phase. An analysis based on this study suggested that there was a 15% uncertainty around carbon footprinting of the production phase.

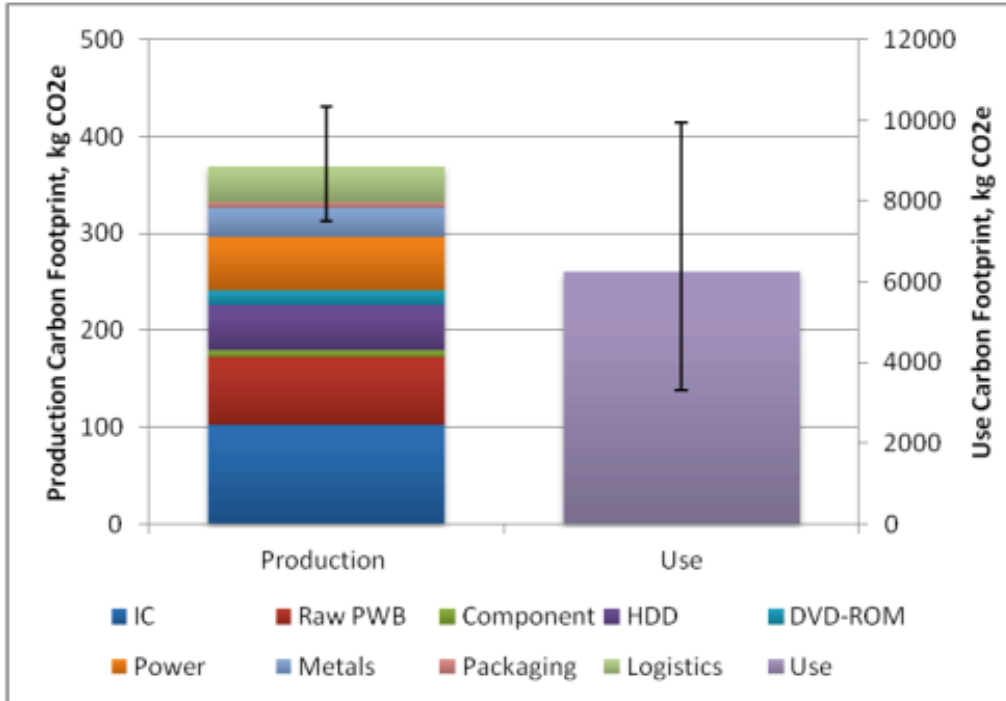


Figure 3 - Production Carbon Footprint of IBM Server by Component and Phase. The production phase is presented on the left axis, use phase on the right axis.⁴

Examples of Greenhouse Gas Reduction goals

NSF Criteria

NSF Criteria reference targets equal to or stricter than the relevant Kyoto Protocol goals. Two options are offered, as shown in the table below:

GHG reductions per unit produced (consistent scope of production, datum post 1989):	GHG reductions against inventory baseline: 1 point for establishing a baseline (for all six GHG) then options of:	
	Absolute ⁵	Normalised

³<http://www.thegreengrid.org/~media/Member%20Added/Comparing%20the%20Carbon%20Footprints%20of%2011G%20and%2012G%20Rack%20Servers%20from%20Dell.pdf?lang=en>

⁴ http://www.ce.cmu.edu/~greendesign/research/CMU_IBM_ExecSum_12032010.pdf "Uncertainty and Variability in Carbon Footprinting for Electronics – Case Study of an IBM Rack mount Server", Christopher Weber, Carnegie Mellon University

2 points for 25%,	1 point for 2%	1 point for 4%
4 points for 50%,	1 point for 4%	1 point for 8%
6 points (max) for 75%	1 point for 6%	1 point for 12%

WRI / WBCSD Criteria

WRI suggest setting a reduction target for the total product lifecycle, including completion date and target level of reduction per unit. Targets are not defined but should be ambitious, reaching significantly beyond BAU, but not specific levels are specified.

⁵ Note: An absolute goal is a decrease in GHG emissions compared to a base year, a normalised goal is a decrease in GHG intensity in production over time (ratio of GHG emissions over a normalising factor, typically physical or economic units).