

# The Environmental Benefits of Deploying MetaSwitch Class 4/5 Softswitches



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## Executive Summary

Modernization of Class 4/5 switching systems using MetaSwitch's Softswitches gives service providers the opportunity to go green while strengthening their business models. Switching systems are significant consumers of electric power and consequently a root-cause of the Greenhouse gas emissions associated with electric power generation. Switching systems have other environmental impacts including those associated with cooling the switching equipment, housing it and supporting the operations staff. This paper shows that deployment of MetaSwitch Softswitches produces substantial energy savings compared to Circuit Switches and competing Softswitches. Specifically, they reduce the cost of power and cooling by:

- 60% to 84% as compared to Circuit Switches
- 14% to 31% as compared to competing Softswitches

MetaSwitch Softswitches also reduce floor space requirements substantially.

The energy reductions also imply a reduction in Carbon Dioxide gas emissions produced as a by-product of generating electricity. The savings are very substantial. For example, replacement of a Circuit Switch driving Remote Switching Centers in 24 Central Offices with a total of 158,000 subscriber lines with a MetaSwitch distributed Softswitch system reduces Carbon Dioxide emissions by 1.2 million pounds per year. This is equivalent to the emissions produced by heating 85 average homes for a year.

Deployment of MetaSwitch Softswitches also delivers additional features and capabilities for strengthening service providers' business models as compared to Circuit Switches and competing Softswitches. These features and capabilities include:

- Full Class 4/5 capabilities suitable for Circuit to Packet migration strategies
- Calling features and routing capabilities that exceed those of Circuit Switches and first generation Softswitches
- IMS solutions for network convergence

These features and capabilities enable wireline service providers to close the widening feature gap between themselves and alternative service providers such as mobile wireless, cable and VoIP providers.

Finally, these additional features and capabilities do not come at the cost of increased energy usage as is common with other electronic products such as mobile phones. As shown above the MetaSwitch Softswitches, with more advanced features, actually consume less energy and make a smaller environmental impact than Circuit Switches and competing Softswitches.

## Introduction

Green business initiatives are now a top priority as the needs to conserve energy and counter the threat of global warming are felt urgently worldwide. Service providers also have an urgent need to improve their competitiveness by lowering operating costs and increasing the attractiveness of their services. Modernization of Class 4/5 switching systems using MetaSwitch's Softswitches gives service providers the opportunity to go green while strengthening their business models.

Carbon Dioxide gas emitted by fossil fuel electric power generation plants significantly contributes to global warming. With 1.3 billion telephone lines in service, switching systems are significant energy consumers and as such contribute to increased Carbon Dioxide emissions. The environmental impact of switching systems, however, extends well beyond the electric power and floor space used by the switches themselves. It also includes activities such as:

- Cooling the switching equipment
- Heating, cooling and lighting the Central Office used by the switch's operations staff
- Transporting operations staff to and from the Central Office
- Maintaining the Central Office and grounds (Cleaning, Grounds Keeping, HVAC service, etc.)

Deployment of compact and energy efficient MetaSwitch Softswitches reduces Central Office power consumption, cooling, and floor space requirements and, therefore, it is a significant green business initiative.

MetaSwitch Softswitches also deliver additional features and capabilities for strengthening service providers' business models as compared to Circuit Switches and first generation Softswitches. These features and capabilities include:

- Full Class 4/5 capabilities suitable for Circuit to Packet migration strategies
- Calling features and routing capabilities that exceed those of Circuit Switches and first generation Softswitches
- IMS solutions for network convergence

Residence and business calling features enable wireline service providers to close the widening feature gap between themselves and alternative services such as mobile wireless, cable, and VoIP providers. Residential features include:

- Call forwarding (unconditional, busy, selective, fixed)
- Call rejection (anonymous or selective)

- Automatic recall (AR) and callback (AC)
- Call waiting (with or without caller ID)
- Caller ID / calling name (delivery and blocking)
- Home intercom and off-premise extension
- Simultaneous ring
- Find-me / follow-me (configurable via MetaSphere CommPortal)
- Hot line / warm line
- Message center (audible and visual message waiting)
- Speed calling (1 or 2 digit)
- Priority call (distinctive ringing on calling number)
- Teen line (distinctive ringing on called number)
- Reminder call (one-time and repeating schedule)
- Toll restriction
- Three-way calling (with ringback)
- Caller ID screen popup via IPTV middleware
- Fully Web-configurable via MetaSphere CommPortal

Business station features include:

- Handsets: IP or analog phones (via GR-303 or ATA)
- Station-to-station intercom dialing
- Flexible dialing plans (including 9+ or assume-9)
- Multiple Appearance Directory Numbers
- Line hunting / ACD
- Do not disturb
- Message waiting lamp (SIP and analog)
- Attendant console (line state monitoring)
- Call park / retrieve
- Directed call pickup
- Short codes (group and personal)
- Account codes (mandatory and optional)
- Internal/external caller ID presentation
- Distinctive ringing for internal/external calls
- Click-to-call, Outlook™ integration and incoming call handling via MetaSphere CommPortal and ICM
- Business group administration via MetaSphere CommPortal

Service providers use these calling features to create value-added service offerings that strengthen the business model through:

- Additional revenue and profit—the features have negligible incremental cost
- Stronger competitive position relative to mobile phones, Cable and VoIP services

- Churn reduction by increasing customer satisfaction

Unlike mobile phones and high feature/function computing devices these additional features do not come at the cost of increased energy usage. The analysis in the next section shows that the MetaSwitch Class 4/5 Softswitch significantly lowers energy consumption and the associated carbon footprint as compared to four alternatives:

- A small legacy Circuit Switch
- A competing Softswitch used for Class 5 replacement
- A legacy Circuit Switch with remotes
- A first generation distributed Softswitch solution

## **Comparison of Power, Cooling and Floor Space Consumption**

Two network scenarios are used to compare MetaSwitch's Class 4/5 Softswitch solutions to four switching alternatives. The scenarios are:

- Class 5 switch replacement for a small to medium sized CO
- Distributed architecture for multiple COs

### **Class 5 Switch Replacement Scenario**

This scenario is used to analyze the energy consumption of the Class 4/5 switching function in a CO with 3,000 to 15,000 subscriber lines. Subscribers are connected to the switch via Digital Loop Carriers using the GR-303 interface. The switch is connected to the PSTN using T-1 trunks.

Energy and cooling cost and floor space requirements are estimated for the Switch including the T-1 interfaces to the PSTN as well as the T-1 interfaces used to connect to the Digital Loop Carriers. The energy consumption of the Digital Loop Carriers is not included in the analysis because it is common to all the alternatives evaluated.

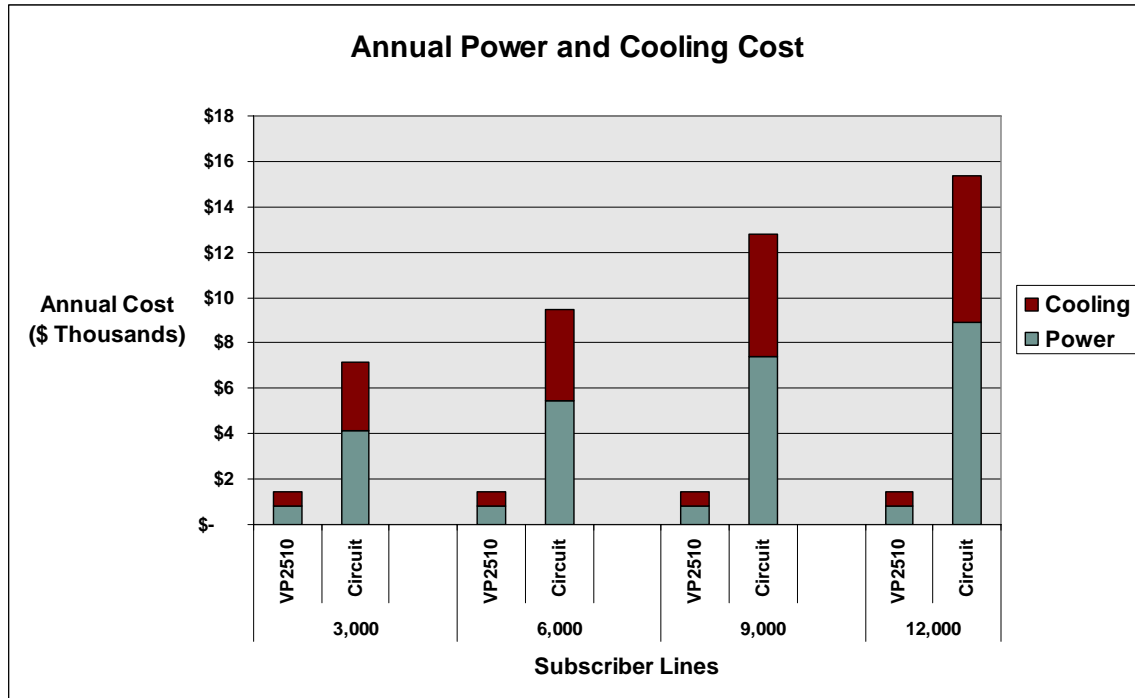
Three solutions are evaluated:

1. MetaSwitch VP2510 Integrated Class 4/5 Softswitch – This solution incorporates all the functions (call agent, media gateway, signaling gateway, and media server) required to deliver Class 4/5 Services. A single system supports up to 250,000 busy hour call attempts and 15,000 subscriber lines.
2. Small to medium sized Circuit Switch – This solution supports up to 12,000 subscriber lines. It uses T-1 interfaces to connect to the PSTN and GR-303 compliant interfaces to the Digital Loop Carriers.

3. Competing Softswitch – This solution is widely deployed and has functions similar to the MetaSwitch VP2510. A single system supports up to 250,000 busy hour call attempts.

### Comparison of MetaSwitch VP2510 to Circuit Switch

Figure 1 compares the energy costs of the VP2510 with the Circuit Switch.



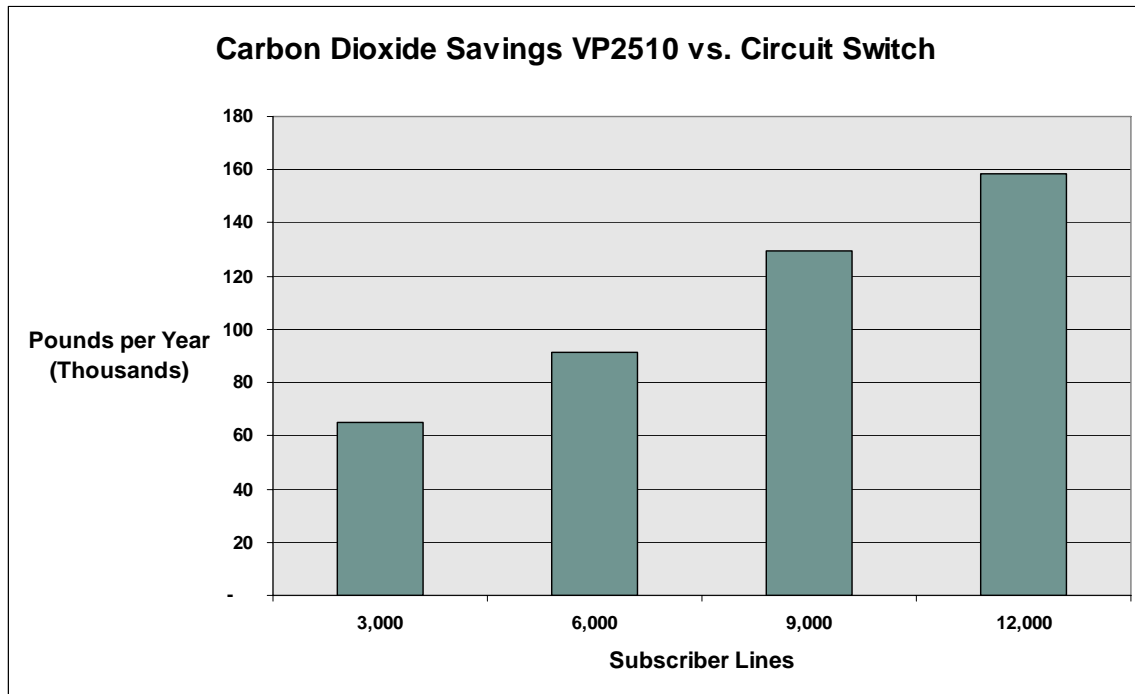
**Figure 1**  
**Power and Cooling Cost – VP2510 vs. Circuit Switch**

The figure shows a very substantial energy cost savings advantage for the MetaSwitch VP2510 as compared to the Circuit Switch—80% savings at 3,000 subscriber lines growing to 91% savings at 12,000 subscriber lines. The VP2510 offers much better scaling and port density than does the Circuit Switch. The single chassis VP2510 system occupies 15% of a standard seven foot rack and accommodates 80 protected T-1 ports. The control and switching matrix of the Circuit Switch requires 1 ¼ equipment racks (Bays) alone while many additional equipment shelves are required for the trunk and subscriber line-side ports. Each additional equipment shelf carries with it additional power and cooling requirements, which is the root cause of the Circuit Switch’s high energy consumption.

Cooling costs include the cost of electric power used to operate the HVAC system plus the amortized cost of the HVAC equipment.

Another way to analyze the environmental impact of energy use is to calculate the number of pounds of Carbon Dioxide gases that are emitted by fossil-fueled electric

power plants. Figure 2 shows the Carbon Dioxide emissions savings of the MetaSwitch VP2510 as compared to the Circuit Switch.



**Figure 2**  
**VP2510 Emissions Reductions**

Hundreds of thousands of pounds of CO<sub>2</sub> per year are saved by using the VP2510 instead of the Circuit Switch. Each Class 5 replacement project, therefore, makes an important contribution to the fight against global warming. Since pounds of CO<sub>2</sub> is a rather abstract concept the savings can be made more concrete by noting that the 65 thousand pounds per year of CO<sub>2</sub> saved in a 3,000 subscriber line Central Office is the same as the amount of CO<sub>2</sub> produced by driving 83 thousand miles. Also, the 159 thousand pounds of CO<sub>2</sub> saved per year in a 12,000 subscriber line Central Office is equivalent to the emissions produced by heating 11 average homes for a year.

The floor space needed to house the Class 5 switches also creates environmental harms beyond those directly related to energy use. These environmental effects include reduction in wilderness areas and farm land and the need for more public infrastructure—roads, water, sewer, and public safety facilities. These environmental effects in turn affect the survival of plants and animals, the availability of food, environmental pollution, and our quality of life in general.

The Circuit Switch requires twenty to forty-five times as much floor space as does the MetaSwitch VP2510.

### Comparison of MetaSwitch VP2510 to a Competing Softswitch

Both the MetaSwitch VP2510 and the Competing Softswitch solution can accommodate up to 15,000 subscriber lines and support up to 250,000 busy hour call attempts. They provide T-1 ports that supply connections to the PSTN and line-side connections to the Digital Loop Carriers used in the Class 5 Replacement scenario. Each system accommodates the Class 5 Replacement scenario using a single chassis. Table 1 summarizes annual power and cooling savings.

Item	VP2510	Competing Softswitch	VP2510 Savings
Power	\$841	\$1,211	\$370
Cooling	\$629	\$910	\$281
<b>Total</b>	<b>\$1,470</b>	<b>\$2,121</b>	<b>\$651</b>

**Table 1**

#### **Annual Energy Savings MetaSwitch VP2510 Compared to a Competing Softswitch**

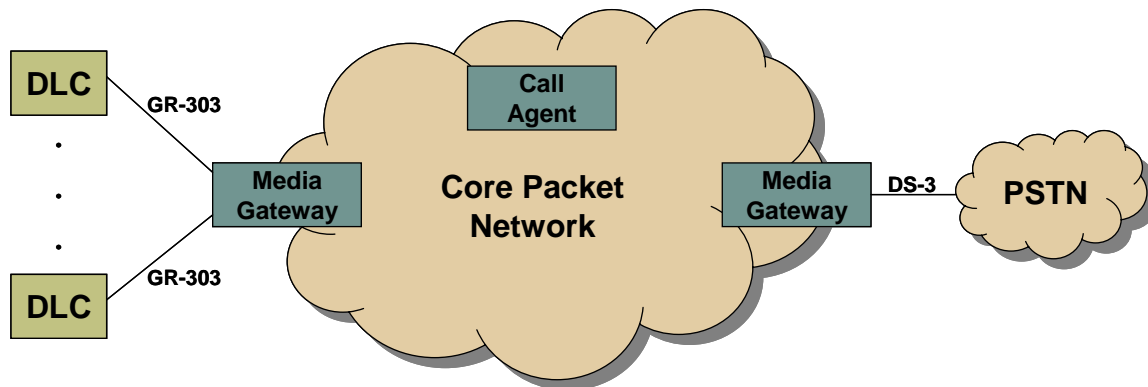
The annual energy savings produced by the MetaSwitch VP2510 compared to a Competing Softswitch are 31%. This amounts to a 7,434 pounds per year reduction in CO<sub>2</sub> emissions, which is equivalent to 7 months of household electricity use.

The MetaSwitch VP2510 also is a much more compact system than the Competing Softswitch. It uses 43% less floor space.

### Distributed Architecture for Multiple Central Offices Scenario

This scenario is used to compare the MetaSwitch multiple Central Office (IMS) solution to a Circuit Switch with Remote Switching Centers and to a first generation Softswitch solution. Figure 3 is a network schematic applicable to both Softswitch solutions.

### Distributed Architecture for Multiple COs

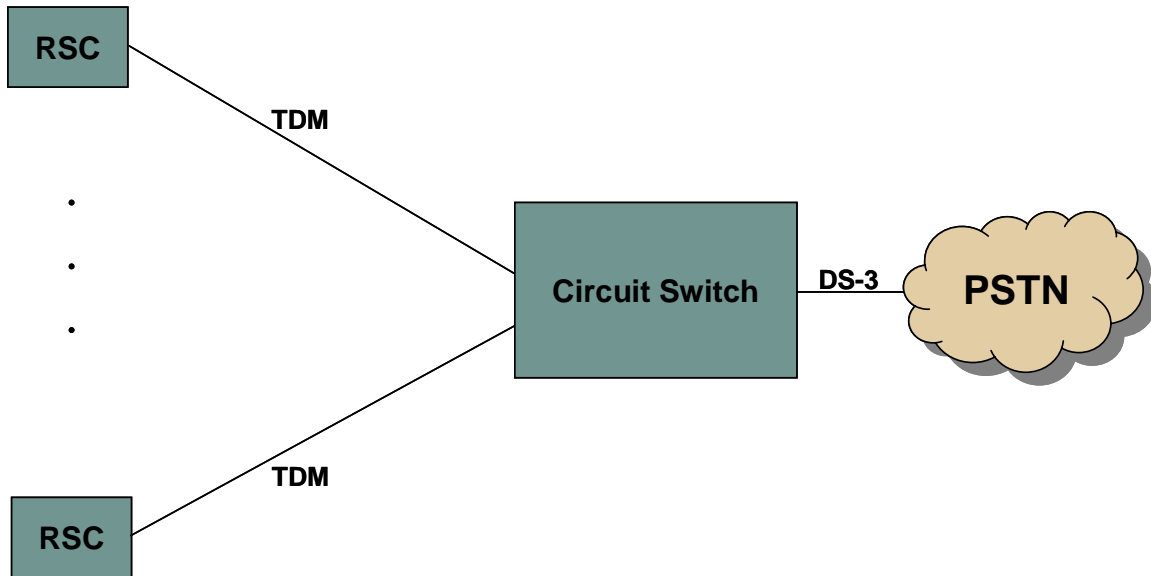


**Figure 3**  
**Distributed Softswitch Architecture**

A Call Agent performs the IMS roles of Serving Call Session Control Function (S-CSCF), PSTN Services Application Server (IMS-AS), and Media/Signaling Gateway Control Function (MGCF). Media Gateways are located at each Central Office. They provide the linkage between the Core Packet Network and Digital Loop Carrier system using the GR-303 protocol on the subscriber line-side of the Gateway and the IP protocol on the Core Packet Network side of the Gateway. A Media Gateway also is used to connect the Core Packet Network to the PSTN.

Figure 4 shows the architecture of a large Circuit Switch that uses Remote Switching Centers in a distributed architecture.

## Remote Circuit Switch for Multiple COs



**Figure 4**  
**Distributed Architecture for Circuit Switch**

The Circuit Switch distributed architecture uses TDM for both switching and transport throughout the network. The Remote Switching Centers provide GR-303 interfaces to the DLCs while the Circuit Switch provides DS-3 interfaces to the PSTN. The DLCs are common to all solutions and are excluded from the analysis.

Table 2 summarizes the entire distributed network.

Item	Number of Subscriber Lines				Total
	3,000	6,000	12,000	20,000	
Number of COs	10	8	5	1	24
Total Subscriber Lines	30,000	48,000	60,000	20,000	158,000

**Table 2**  
**Network Description**

The network consists of 24 Central Offices serving a total of 158,000 subscriber lines.

### Comparison of MetaSwitch Solution to a Circuit Switch with Remotes

The MetaSwitch employs two network elements, the CA9000 Call Agent with Class 4/5 calling features and the MG3510 Media Gateway. A Media Gateway is located in each Central Office and at a central location on the Core Packet Network for interconnection to the PSTN. Two Call Agent Servers (for system redundancy) also are located at separate locations within the Core Packet Network. The Circuit Switch is located centrally and provides DS-3 connections to the PSTN and TDM connections using a proprietary protocol to each Remote Switching Center.

Table 3 shows the annual power and cooling costs for each solution.

Item	MetaSwitch	Circuit Switch with Remotes	MetaSwitch Savings
Power	\$40,787	\$96,017	\$55,230
Cooling	\$30,443	\$83,571	\$53,128
<b>Total</b>	<b>\$71,230</b>	<b>\$179,588</b>	<b>\$108,358</b>

**Table 3**  
**MetaSwitch vs. Circuit Switch with Remotes Annual Energy Cost**

The MetaSwitch solution provides very large (60%) power and cooling cost savings as compared to the Circuit Switch with Remotes. These energy savings are due to the generational gap in electronic circuit packaging that exists between legacy Circuit Switches and MetaSwitch's Softswitch. Furthermore, additional energy savings are achieved by MetaSwitch's use of a Core Packet Network versus the TDM network employed by the Circuit Switch. Ethernet/IP routers are much more energy efficient than the TDM multiplexers and cross-connect systems used in the Circuit Switch network. This saving is in addition to that shown in Table 3.

The MetaSwitch solution reduces CO<sub>2</sub> emissions by 1.2 million pounds per year as compared to the Circuit Switch with Remotes. This is equivalent to the emissions produced by driving 1.6 million miles or heating 85 average homes for a year.

The much more dense physical design of the MetaSwitch Softswitch versus the Circuit Switch produces a 95% floor space savings. For example, the control function of the Circuit Switch requires three seven foot equipment racks while the entire MetaSwitch Call Agent occupies 6% of one rack. This floor space savings produces benefits to the environment in addition to those directly attributable to energy savings—see the floor space discussion in the Comparison of MetaSwitch VP2510 to Circuit Switch section.

## Comparison of MetaSwitch Solution to a First Generation Class 4 Softswitch

The MetaSwitch Class 4/5 distributed architecture solution is compared to a first generation Class 4 distributed Softswitch solution with a high-level architecture identical to that illustrated by Figure 3. The MetaSwitch solution, however, includes all of the residential service and business station features discussed in the Introduction while the Class 4 only Softswitch lacks most of these features. Table 4 compares the power and cooling costs for the two solutions.

Item	MetaSwitch	First Generation Class 4 Softswitch	MetaSwitch Savings
Power	\$40,787	\$46,884	\$6,097
Cooling	\$30,443	\$35,537	\$5,093
<b>Total</b>	<b>\$71,230</b>	<b>\$82,421</b>	<b>\$11,190</b>

**Table 4**  
**Annual Power and Cooling Savings for MetaSwitch vs. First Generation Class 4 Softswitch – Distributed Architecture**

The \$11,190 annual savings in power and cooling cost of the MetaSwitch solution compared to the First Generation Class 4 Softswitch is a 14% cost reduction. This is notable in that MetaSwitch's delivery of a rich set of Class 5 features is achieved without a corresponding increase in energy consumption. This differs from many electronic devices where additional features require more power. For example, mobile phones with video and Internet features have much shorter battery life than do mobile phones with voice only capabilities.

The energy saving implies a reduction of 127,755 pounds of CO<sub>2</sub> per year. This is equivalent to the emissions produced by heating 9 average homes for a year.

The MetaSwitch solution requires 89 square feet of floor space as compared to 177 square feet for the First Generation Class 4 Softswitch solution—a 50% saving.

## Conclusion

The analysis shows that the MetaSwitch VP2510 Softswitch used for Class 5 switch replacement and the MetaSwitch distributed (IMS) solution are more energy efficient and reduce Carbon Dioxide emissions as compared to Circuit Switches and competing Softswitches. They achieve these savings in energy and emissions while delivering more Class 5 calling functions.

Table 5 summarizes the environmental contributions of the MetaSwitch solutions as compared to the alternatives analyzed in this whitepaper as well as equivalent measures of other activities that produce CO<sub>2</sub> emissions—they are provided to give a human-scale to the environmental contributions.

Alternative	Percent Power and Cooling	Percent Floor Space	Pounds CO <sub>2</sub> (Thousands)	Miles (Thousands)	Heating Years
<b>Small Circuit Switch</b>	84%	96%	91	117	6
<b>Competing Softswitch</b>	31%	43%	7	10	1
<b>Circuit Switch with Remotes</b>	60%	95%	1,237	1,594	85
<b>First Generation Class 4 Softswitch</b>	14%	50%	128	165	9

**Table 5**  
**Annual Savings of MetaSwitch Solutions Compared to Alternatives**

The MetaSwitch solutions produce very substantial environmental savings when compared to the Circuit Switch alternatives. This alone could justify upgrade projects. The MetaSwitch Class 4/5 solutions also produce savings compared to other Softswitch solutions that offer fewer calling features where increased functionality often comes at the price of increased power consumption.