

VMware Aria™ Operations

Drive Capacity Planning, Sustainability & Cost Management

Kate Rychlik
Senior Solution Architect – Multi-Cloud Management
May 2023

Agenda

Capacity Management

Cost Management

Sustainability

Efficient Capacity Management

The screenshot shows the VMware Aria Operations interface. At the top, there's a dark header bar with the VMware logo, the title "VMware Aria Operations", the location "US West (Oregon)", and user information "Thomas Kopton CMBU TMM". Below the header is a search bar with the placeholder "Search for object or metric and more...". The main content area has a blue banner at the top that says "Welcome to VMware Aria Operations". To the left, there's a sidebar with navigation icons and a list of "Pillars of Operations": Observability, Sustainability, Capacity, and Compliance. The "Capacity" pillar is highlighted with a green border. It contains the text: "Assess, monitor and optimize capacity across VMware clouds, on-premises and in public cloud". To the right of the Capacity pillar are two other sections: "Sustainability" and "Compliance". The bottom right corner of the interface has a "SUPPORT" link.

Assess Capacity Insights

The screenshot shows the VMware Capacity Launchpad interface. At the top, there's a navigation bar with a house icon, 'Launchpad', and 'Capacity'. Below it, a blue header bar contains a 'Learn more' button. The main content area is divided into three sections: 'Assess', 'Optimize', and 'Plan'. The 'Assess' section is highlighted with a green border. It contains a 'Capacity' card with the sub-section 'Determine if there is sufficient capacity in your VMware Cloud environment for current and...'. Below the card are 'VIEW' and 'LEARN MORE' buttons. The 'Optimize' section contains three cards: 'Rightsize' (with a gear icon), 'Reclaim' (with a trash bin icon), and 'Workload Optimization' (with a gear and arrow icon). Each has 'VIEW' and 'LEARN MORE' buttons. The 'Plan' section contains four cards: 'Infrastructure Planning' (with a building icon), 'Workload Planning' (with a document icon), 'Migration' (with a cloud icon), and 'Committed Plan' (with a checkmark icon). Each also has 'VIEW' and 'LEARN MORE' buttons.

Capacity

/ Launchpad / Capacity

> Learn more

Assess

Capacity

Determine if there is sufficient capacity in your VMware Cloud environment for current and...

VIEW LEARN MORE

Optimize

Rightsize

Reclaim

Workload Optimization

VIEW LEARN MORE

VIEW LEARN MORE

VIEW LEARN MORE

Plan

Infrastructure Planning

Workload Planning

Migration

Committed Plan

VIEW LEARN MORE

VIEW LEARN MORE

VIEW LEARN MORE

VIEW LEARN MORE

Assess Capacity, Predict Demand, and get Recommendations

Sort DC by most capacity risk
(Time Remaining), by most cost savings or optimization status

Overview

Production	sc2dc02	Host Based Licensing	wdc01	SC
18 Days Remaining US\$621 Cost Savings Optimized	18 Days Remaining US\$5,544 Cost Savings Optimized	24 Days Remaining US\$0 Cost Savings Not Optimized	94 Days Remaining US\$380 Cost Savings Optimized	22 US\$86 Cost Savings Optimized

ALL DATACENTERS

Production

Time Remaining

- 2 clusters at the Critical level
- 1 cluster at the Warning level
- 2 clusters at the Normal level

5 Total Clusters

Optimization Recommendations

You can reduce waste by reclaiming unused resources.

US\$521/mo. Cost Savings

18 VMs With Reclaimable Resources

VIEW RECLAMABLE VMs

Predict upcoming capacity shortfalls: Do this at the Datacenter and cluster levels. Sort by highest time risk to running out of resources

Single view: Across private cloud or VMware Cloud on AWS (Remember a VMware Cloud on AWS vCenter can be registered with Aria Operations and will look like any other vCenter environment)

Tune risk thresholds for capacity remaining with policies

Define your Business Intent.

Cluster Time Remaining Settings

Affected Policy: tk-HomeLab

Criticality Threshold

Applying these changes affects all clusters in the policy.

Set the time remaining thresholds.

Critical Threshold: 90 Days (90 days to 1 year)

Warning Threshold: 120 Days (90 days to 120 days)

Risk Level

Allocation Model

Applying these changes affects all clusters in the policy.

Set time remaining thresholds to enable Allocation Model

Conservative: Set overcommit ratio, to enable Allocation Model

Time remaining threshold: CPU: 1:1, Memory: 1:1, Disk Space: 1:1

Agressive: Time remaining before threshold: CPU: 1:1, Memory: 1:1, Disk Space: 1:1

Peak for: Select this projector

Capacity Buffer

Applying these changes affects all clusters in the policy.

CPU

Demand Allocation

Memory

Demand Allocation

Disk Space

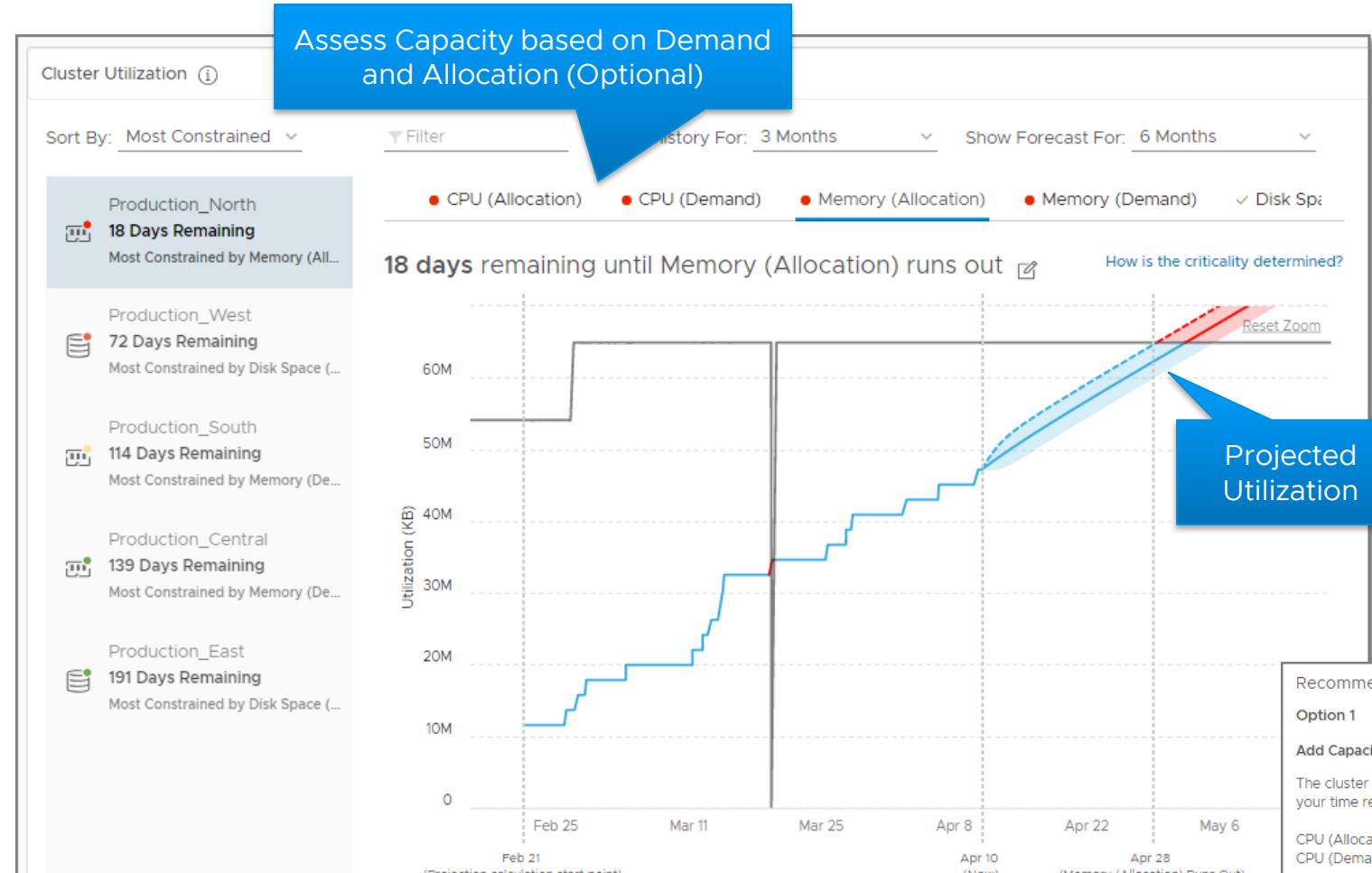
Demand Allocation

Business Hours

Time zone: Host

Day	Start Time	End Time
Monday	8:00 AM	10:30 PM
Tuesday	8:00 AM	10:30 PM
Wednesday	8:00 AM	10:30 PM
Thursday	8:00 AM	10:30 PM
Friday	8:00 AM	10:30 PM
Saturday	12:00 AM	12:00 AM
Sunday	12:00 AM	12:00 AM

Assess Capacity, Predict Demand, and get Recommendations



Assess Overall Capacity: Single view of the world

Capacity Projection: View current utilization and projection per resource (CPU, Memory, and Disk Space)

Get recommendations

- Reclaim unused capacity
- Add capacity in private cloud
- Run what-if scenario to migrate to public cloud

Capacity Planning

Models of capacity planning



Demand



Allocation

Capacity Monitoring

Helps monitor the day to day capacity usage on the basis of actual resource demand of workloads.

Drives Utilization

Provides maximum utilization as one can continue to overcommit to drive utilization.

Performance Based

Performance is the key consideration and capacity is full as soon as performance is at risk.

Procurement Planning

Helps in procuring new resources with an estimated overcommitment ratio.

No Overcommitment

Helps avoid overcommitment for running business critical workloads.

Showback and Reporting

Used by IT providers in shared services to not overcommit beyond contractual obligation.

Capacity Buffer

The screenshot shows the 'Cluster Time Remaining Settings' configuration window. It includes sections for 'Affected Policy' (Default Policy), 'Criticality Threshold' (with a note about applying changes to all clusters in the policy), 'Time Remaining' (90 days critical, 120 days warning), 'Risk Level' (Conservative or Aggressive), 'Allocation Model' (overcommit ratios for CPU, Memory, and Disk Space), and 'Capacity Buffer' (percentage of total capacity reserved for HA). A blue callout box labeled 'Capacity Buffer Settings' points to the bottom section.

The screenshot shows the 'Production_West' dashboard under the 'Capacity' tab. It displays 'Time Remaining' (101 Days), 'Capacity Remaining' (10% / 5.9 GB), 'Virtual Machine Remaining' (2), and detailed resource usage for CPU, Memory, and Disk Space. Two blue callout boxes labeled 'HA and Buffer' point to the 'Virtual Machine Remaining' section and the 'Memory' usage bar chart.

Capacity Buffer provides an option to reserve a percentage of Total Capacity – HA for **Cluster Compute Resource** and **Datastore Cluster** objects

Use to **reserve capacity** beyond what is reserved for HA

Disabled by default on new installs

Settings retained during upgrade from vRealize Operations 6.6.1

Define Custom Profiles

Virtual Machines Remaining

Define Custom Profiles to see Capacity Remaining based on your standard virtual machine sizes

Custom Profiles

Configure CPU, Memory, or Disk Space for Demand or Allocation

Custom Profiles can be disabled per cluster using policies to allow different profiles per cluster

Example: Small, Medium, and Large profiles

Demand or Allocation Settings

Name	Description	Adapter Type	Object Type
Large VM	IT standard large VM profile.	vCenter Adapter	Virtual Machine
Medium VM	IT standard medium VM profile.	vCenter Adapter	Virtual Machine
Small VM	IT Standard Small VM Profile	vCenter Adapter	Virtual Machine
Web Server	Profile based on field demo web server VM	vCenter Adapter	Virtual Machine

Add New Profile

Profile Name:

Profile Description:

Object Type: Virtual Machine

Metric	Value *	Unit
CPU	11.03	MHz
CPU Allocation	2	vCPUs
Memory Usage on Host	519.71	MB
Memory Allocation	2	GB
Disk Space Allocation	55.77	GB
Disk Space Usage on Datastore	30	GB

vCenter Adapter - Cluster Compute Resource

Workload [What is workload?](#)

Time Remaining [What is time remaining?](#)

Capacity Remaining [What is capacity remaining?](#)

Compliance [What is compliance?](#)

Maintenance Schedule

Allocation Model [What is Allocation Model?](#)

Disk Space 3 : 1

Custom Profile

Small VM x Medium VM x Large VM x

Disable Profiles per Policy

Reclaim

Reduce waste

The screenshot shows the VMware Capacity Launchpad interface. At the top, there's a navigation bar with icons for Home, Launchpad, and Capacity, followed by a 'Learn more' link. Below this is a section titled 'Assess' which includes a 'Capacity' card. The main focus is the 'Optimize' section, which contains three cards: 'Rightsize', 'Reclaim' (which is highlighted with a green box), and 'Workload Optimization'. Each card has a brief description and 'VIEW' and 'LEARN MORE' buttons. Below the optimize section is a 'Plan' section with four cards: 'Infrastructure Planning', 'Workload Planning', 'Migration', and 'Committed Plan'. Each plan card also has 'VIEW' and 'LEARN MORE' buttons.

Capacity

Home / Launchpad / Capacity

> Learn more

Assess

Capacity

Determine if there is sufficient capacity in your VMware Cloud environment for current and...

VIEW LEARN MORE

Optimize

Rightsize

Rightsize workloads to ensure performance and optimize utilization

VIEW LEARN MORE

Reclaim

Reduce waste by reclaiming unused resources

VIEW LEARN MORE

Workload Optimization

Optimize your data center for optimal workload performance by ensuring your workloads...

VIEW LEARN MORE

Plan

Infrastructure Planning

Determine the impact of adding or removing capacity in your environment

VIEW LEARN MORE

Workload Planning

Plan for deployment of new workloads or removal of existing workloads

VIEW LEARN MORE

Migration

Evaluate the possibility of moving workloads across supported clouds

VIEW LEARN MORE

Committed Plan

Publicize upcoming changes to add or remove infrastructure resources or VMs

VIEW LEARN MORE

Reclaim Capacity and Automate Cost Savings

The screenshot shows the VMware Capacity Reclamation dashboard under the 'Production' tab. It displays the following key information:

- How much you can potentially save:** US\$621/mo.
- Resources:** 18 VMs (With Reclaimable Resources) and 5 Orphaned Disks (To Reclaim).
- Total Reclaimable Capacity:**

Resource	Reclaimable Capacity	% Reclaimable
CPU	7 vCPUs	Low
Memory	6.43 GB	Medium
Disk Space	186.59 GB	High
- Powered Off VMs:** US\$249/mo. (selected)
- Idle VMs:** US\$251/mo.
- Snapshots:** US\$21/mo.
- Orphaned Disks:** US\$10/mo.
- Reclamation Settings (Modal):** Shows 'Show Cost Savings' ON and 'Show the following types of VMs for reclamation':
 - Powered Off VMs: 7 Days
 - Idle VMs: 7 Days
 - Snapshots: 7 Days
 - Orphaned Disks: 30 Days
- Reclaim and Save:** A callout pointing to the reclaimable resources section.
- How long before VMs get flagged as Reclaimable:** A callout pointing to the reclamation settings.

Define Business Intent for Reclamation:

- Turn on or off cost savings on this dashboard.
- Specify your desired time requirements for reclamation

Powered Off VMs

- VMs that have been continuously powered off during the defined period of time

Idle VMs

- VMs that have used no more than 100MHz CPU during the defined period of time

Snapshots

- VM snapshots that have existed for the entire defined period of time

Orphaned Disks

- VMDKs on datastores that aren't connected to any registered VMs and have not been modified during the defined period of time

Reclaim: Orphaned Disks

Orphaned Disks are VMDKs that exists on a datastore that are not attached to any registered VMs

Orphaned Disks visible on Reclaim page

Show **Reclaimable Disk Space** and **Cost Savings** per month

Export Orphaned Disks to CSV

Last Modification Age is file modification timestamp

CSV Export

The screenshot shows the VMware Reclaim interface. At the top, there's a navigation bar with tabs for 'DC-vSAN', 'Production', 'sc2dc02' (which is highlighted), 'sc2dc01', and 'wdcc01'. A blue callout box labeled 'Reclaimable Orphaned Disks' points to the 'sc2dc02' tab. Below the tabs, there's a summary section with icons for CPU, Memory, and Disk Space, and a note about cost savings: 'US\$1,010/mo.' for reclaimable resources and '6 Orphaned Disks To Reclaim'. A large blue button labeled 'Export to CSV' is prominently displayed. To the right, there's a detailed table titled 'Orphaned Disks' with columns for 'Resource', 'Reclaimable Capacity', and '% Reclaimable'. The table lists CPU (10 vCPUs), Memory (12.26 GB), and Disk Space (249.06 GB). Further down, another table titled 'File Modification Date' lists items from 'datastore_sdd1' and 'datastore_sdh1' with columns for 'Disk Name', 'Cost Savings / mo(US\$)', 'Reclaimable Disk Space(GB)', and 'Last Modification Date/Time'. A blue callout box labeled 'Orphaned Disks' points to the 'Orphaned Disks' table, and another blue callout box labeled 'File Modification Date' points to the 'File Modification Date' table.

A	B	C	D	E	F	G
vCenter Name	Datacenter Name	Datastore Name	Disk Name (Note: The VMDKs listed here are potentially orphaned. It's your responsibility to decide which are actually subject to reclamation.)	Cost Savings / mo(US\$)	Reclaimable Disk Space(GB)	Last Modification Date/Time
SC2VC02	Production	datastore_sdd1	ds:///vmfs/volumes/ac4048ba-2e42abcd/phoenix-web-oph-839239/phoenix-web-oph-839239_11.vmdk	37.768	12.589	02/15/2019 12:25
SC2VC02	Production	datastore_sdh1	ds:///vmfs/volumes/bc94b7b4-0c96fc62/phoenix-app-oph-849392/phoenix-app-oph-849392_11.vmdk	25.179	12.589	02/15/2019 12:25
SC2VC02	Production	datastore_sdm1	ds:///vmfs/volumes/d47f68b9-b44590c3/phoenix-web-oph-784923/phoenix-web-oph-784923_11.vmdk	12.594	12.594	02/15/2019 12:12
SC2VC02	Production	datastore_sdm1	ds:///vmfs/volumes/d47f68b9-b44590c3/phoenix-web-oph-389201/phoenix-web-oph-389201_11.vmdk	12.594	12.594	02/15/2019 12:12
SC2VC02	Production	datastore_sdj1	ds:///vmfs/volumes/4067d7d9-1d6fe7bc/phoenix-app-oph-893923/phoenix-app-oph-893923_11.vmdk	12.594	12.594	02/15/2019 12:33

Rightsizing

Ensure performance and optimize utilization

The screenshot shows the VMware Capacity Launchpad interface. At the top, there's a navigation bar with 'Capacity' and 'Launchpad / Capacity'. Below it, a 'Learn more' button is visible. The main area is divided into three sections: 'Assess', 'Optimize', and 'Plan'. The 'Optimize' section is the focus, featuring a card for 'Rightsize' which is highlighted with a green box. This card includes the description: 'Rightsize workloads to ensure performance and optimize utilization', and 'VIEW LEARN MORE' buttons. To the right of the Rightsizing card are other cards for 'Reclaim' and 'Workload Optimization', each with their own descriptions and 'VIEW LEARN MORE' buttons. In the 'Plan' section, there are four cards: 'Infrastructure Planning', 'Workload Planning', 'Migration', and 'Committed Plan', each with their respective descriptions and 'VIEW LEARN MORE' buttons.

Workload Optimization – Simplified Rightsizing

Because moving VMs can't solve all your performance problems!

New Rightsizing UI

- Oversized and Undersized
- Launched from Optimize Performance left panel
- Uses the CDC header for context

The screenshot shows the 'Rightsizing' interface for datacenter **sc2dc01**. The left sidebar includes 'Quick Start', 'Operations Overview', 'Optimize Performance' (with 'Workload Optimization' selected), 'Recommended Actions', 'Rightsizing' (selected), 'Optimize Capacity', 'Troubleshoot', and 'Application Monitoring (Wavefront)'. The main area displays 'Oversized VMs' (80 VMs) and 'Undersized VMs' (11 VMs). A table at the bottom lists VM details like name, allocated resources, and recommended reductions.

VM Name	Allocated CPU	Recommended CPU Reduction	Allocated Memory	Recommended Memory Reduction
sc2-vesxi-34	4 vCPUs	1 vCPUs	16 GB	0 KB
sc2-vesxi-29	4 vCPUs	2 vCPUs	16 GB	0 KB
sc2-vesxi-16	4 vCPUs	2 vCPUs	16 GB	0 KB
rdc-proxied	4 vCPUs	2 vCPUs	8 GB	3 GB
sc2-vesxi-30	4 vCPUs	2 vCPUs	16 GB	0 KB

What-If Analysis

Intelligent planning

The screenshot shows the VMware Capacity Launchpad interface. At the top, there's a navigation bar with a home icon, 'Launchpad', and 'Capacity'. Below it, a 'Learn more' button is visible. The main area is divided into three sections: 'Assess', 'Optimize', and 'Plan'. The 'Assess' section contains a 'Capacity' card with a cloud icon, describing it as determining if there is sufficient capacity in the VMware Cloud environment. The 'Optimize' section contains 'Rightsize', 'Reclaim', and 'Workload Optimization' cards, each with a corresponding icon. The 'Plan' section contains 'Infrastructure Planning', 'Workload Planning', 'Migration', and 'Committed Plan' cards, also with icons. A green rectangular box highlights the 'Infrastructure Planning' card in the 'Plan' section.

Capacity

Learn more

Assess

Capacity

Determine if there is sufficient capacity in your VMware Cloud environment for current and...

VIEW LEARN MORE

Optimize

Rightsize

Rightsize workloads to ensure performance and optimize utilization

VIEW LEARN MORE

Reclaim

Reduce waste by reclaiming unused resources

VIEW LEARN MORE

Workload Optimization

Optimize your data center for optimal workload performance by ensuring your workloads...

VIEW LEARN MORE

Plan

Infrastructure Planning

Determine the impact of adding or removing capacity in your environment

VIEW LEARN MORE

Workload Planning

Plan for deployment of new workloads or removal of existing workloads

VIEW LEARN MORE

Migration

Evaluate the possibility of moving workloads across supported clouds

VIEW LEARN MORE

Committed Plan

Publicize upcoming changes to add or remove infrastructure resources or VMs

VIEW LEARN MORE

Plan for future needs and datacenter migration scenarios

Plan and stack multiple scenarios to arrive at accurate capacity decisions

Capacity Planning Scenarios

-  Onboarding new workloads
-  Decommission existing workloads
-  Server procurement planning (includes HCI)
-  Decommission existing servers
-  Server hardware refresh
-  Hybrid cloud migration
-  Public cloud cost comparison

CHOOSE SCENARIOS 

DEFINE SCENARIOS 

STACK SCENARIOS 

VISUALIZE OUTCOMES 

Workload Planning Physical Infra Planning HCI Planning Cloud Planning

Add Workload Add Capacity

SCENARIO NAME: Production-App-01 SCENARIO NAME: Increase-Prod-Capacity

LOCATION: PRODUCTION CDC LOCATION: PRODUCTION CDC

APPLICATION PROFILE: Configure SERVER DETAILS: Server type Dell Inc. PowerEdge R640

Overview Saved Scenarios

RUN SCENARIO EDIT DELETE DESELECT ALL

Scenario Name	Scenario Type	Datacenter	Scenario Start & End Date
Production-App-01	Add Workload	PRODUCTION CDC	Jun 20, 2019 - May 02, 2020
Zynop-Dev-App-Decom	Remove Workload	PRODUCTION CDC	Sep 30, 2019 - Not Specified
Increase-Prod-Capacity	Add Capacity	PRODUCTION CDC	Aug 15, 2019 - Jun 02, 2020

Scenario Timeline

Production-App-01 Increase-Prod-Capacity Zynop-Dev-App-Decom

Jul '19 Nov '19 Jan '20 Mar '20 May '20 Jul '20 Sep '20

Add Workload Add Capacity Remove Workload

Migrate-Finance-App-01

Private Cloud Amazon Web Services IBM Cloud Microsoft Azure

Select region: US West (Oregon) (us-west-2) Select region: Dallas (DALEDB) Select region: East US 2 (m-east-2)

US\$6,140 US\$21,100 US\$21,674 US\$29,826

The workload will fit. It will cost US\$3,529/month. Your time remaining is > 1 Year.

The recommended cluster is: CMBU_ESO_Haas_Cl... Peak CPU 106.24 GHz Peak Memory 878.55 GB Peak Disk Space 5.45 TB

1 vCPU 4 vCPU 12 vCPU 16 vCPU

8GB 16GB 32GB 64GB

1TB 2TB 4TB 8TB

Any Operating System Instance Cost: US\$0 Total Cost: US\$0 Instance Cost: US\$0 Total Cost: US\$0

What-If: Stacked Scenarios

Plan complex situations the easy way

Stack multiple What-If Scenarios
together by selecting more than
one at a time

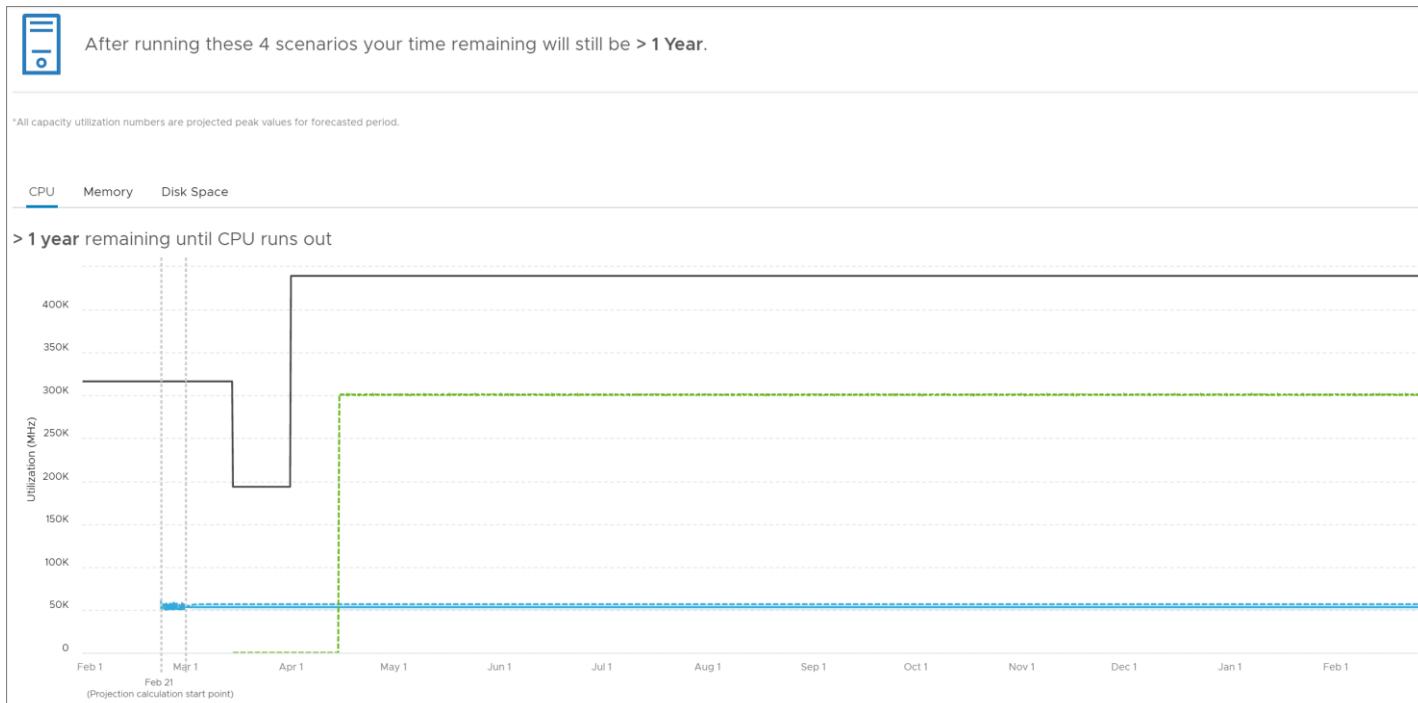
Enables capacity planning for real-
life business scenarios

- Application Deployment
- Application Retirement
- Hardware Refresh
- Decommission Hosts

Supported Stacked Scenarios

- Add/Remove Workload +
Add/Remove Hardware
- Add/Remove Workload +
Add HCI Node

What-If Analysis					
Overview		Saved Scenarios			
RUN SCENARIO		EDIT		DELETE	
Scenario Name	Scenario Type	Datcenter	Cluster	Date Created	Scenario Start & End Date
Remove all hosts from sc2c01	Remove Capacity	sc2dc01	sc2c01	Feb 28, 2019	Mar 15, 2019 - Not Specified
Add new hosts to sc2c01	Add Capacity	sc2dc01	sc2c01	Feb 28, 2019	Apr 01, 2019 - Feb 28, 2020
Inventory Application	Add Workload	sc2dc01	sc2c01	Feb 28, 2019	Apr 15, 2019 - Feb 28, 2020
Retire Billing Application	Remove Workload	sc2dc01	sc2c01	Feb 28, 2019	Mar 15, 2019 - Not Specified



Demo

Efficient Cost Management

The screenshot shows the VMware Aria Operations interface. At the top, there's a dark header bar with the VMware logo, the title "VMware Aria Operations", the location "US West (Oregon)", and a user profile for "Thomas Kopton CMU TMM". Below the header is a search bar and several navigation icons. The main content area has a blue banner at the top that says "Welcome to VMware Aria Operations". To the left, there's a sidebar with a tree icon and several menu items: Home, Launchpad (which is selected and highlighted in blue), Multi-Cloud Overview, Pillars of Operations, Observability, Capacity, Sustainability, and Support. The "Cost" pillar is highlighted with a green box. It features a money bag icon and the text: "Cost Manage, plan and Optimize your infrastructure Cost & Price for showback and chargeback". There are also other pillars visible on the right: Observability, Capacity, Sustainability, and Support.

View Total Costs & Cost Savings Opportunity

Multi-Cloud Environment

Home

Launchpad New Multi-Cloud Overview New

All Clouds Accounts: 26

vCenter Accounts: 13

VMware Cloud Foundation Accounts: 1

VMware Cloud on AWS Accounts: 1

Azure VMware Solution Accounts: 1

Google Cloud VMware Engine Accounts: 1

?

51 Locations

Inventory

Cloud Provider	Count
vCenter	13
AWS	3
Azure	3
GCP	2
VMC on AWS	1
VCF	1
AVS	1
OCVS	1
GCVE	1

3113 Compute 246 Storage 184 Applications

VMware Cloud

Capacity Remaining

9 / 44 Clusters running out of capacity

CPU 90% (19121.42 GHz)

Memory 92% (177.00 TB)

Disk Space 93% (4028.06 TB)

Used Remaining

Time Remaining

44 Total Clusters

Cost

Month to Date

Category	Value
Total Cost of Ownership	US\$ 453761.93
Potential Savings	US\$ 34694.09
Realized Savings	US\$ 529.12

View total cost savings opportunity:

Get an overview of total cost Savings opportunity from the entire managed environment

Assess Overall Costs of Running Your Environment

What's my total Cost?

Total Inventory and Costs					
Datacenters	vSphere Hosts	vSphere Clusters	CPU Sockets	Total Cost of Ownership	Potential Cost Saving Opp...
6	98	25	283	108,243 US\$/Mo...	7,982 US\$/Mo...

Total Cost of Ownership: View the total cost of the private cloud environment

Cluster Costs: What's the cost of each of the clusters. List of clusters by the most expensive and least expensive

Datacenter Resource Cost							
Name	VMs	Hosts	Clusters	Total Cost of Clusters	Datastores	Total Cost of Datastores	Monthly Direct Cost
DC-vSAN	23	24	4	12,226.77 US\$/Month	24	1,137.96 US\$/Month	90.38 US\$/Month
Datacenter	105	2	1	2,213 US\$/Month	3	1,272.9 US\$/Month	360.84 US\$/Month
sc2dc01	133	12	2	8,657.61 US\$/Month	15	3,893.59 US\$/Month	482.88 US\$/Month
sc2dc02	220	49	15	46,815.87 US\$/Month	16	4,101.92 US\$/Month	11,806.59 US\$/Month
wdccdc01	144	8	2	9,934.59 US\$/Month	12	4,808.2 US\$/Month	439.5 US\$/Month
Total	625	95	24	79,847.84 US\$/Mon...	70	15,214.56 US\$/Month	13,180.19 US\$/Month

Datastore Costs: What's the number and cost of the datastores in each of my datastores

Customize Cost Drivers: Adjust cost drivers to match your actual costs

View Costs from Infrastructure to VMs

Showback: Create dashboards or reports to show VM cost

Top Most Expensive Clusters				
Monthly Cluster Total Cost	Objects	Hosts	Datastores	Virtual Machines
6,086.8	vSAN-Stretch Cluster	10	11	9
5,204.9	wdcc01	4	7	85
4,729.7	wdcc02	4	7	59
4,526.8	sc2c01	6	8	55

Showback Dashboard

Showback Cost per Group

- Cost Summary
- Top Expensive VMs
- Top Savings Potential
- Cost per VM

Add More Objects by adding them to the Showback Groups widget

Groups of VMs
E.g. Custom Group, Application, Cloud Zone, Project, etc.

The dashboard displays several key metrics and groupings:

- Total Cost of all VMs in the Selected Group:** A summary table showing projected cost, potential savings, and month-to-date costs.
- Most Expensive VMs:** A list of VMs ordered by MTD Effective Total Cost, showing values like 1,017.2, 1,014.6, 1,014.4, 1,014.3, and 1,013.8.
- VMs with the Most Potential Savings:** A list of VMs ordered by Potential Savings, showing values like 1,022.2, 1,018.7, 1,018.4, 1,018.3, and 1,017.6.
- Cost Trend of Selected VM:** A section showing the cost trend for selected VMs, with a table for each VM including MTD Cost, Potential Savings, and Projected Cost.
- Members of the Group (Select to View Trend):** A list of VMs in the selected group: BCA-Billing-App-01, BCA-Billing-App-02, BCA-Billing-DB-01, BCA-Billing-DB10-02, and BCA-Billing-Web-01.
- Showback Groups (select one):** A list of predefined groups: Inventory, Billing, Accounting, BDG - My VMs, VMs to Migrate to Public Clo..., Most Constrained Disk Spac..., Allocation Model Clusters, Windows VMs, Most Constrained by Disk Sp..., vSAN Datastores, Most Constrained Memory A..., Most Constrained by CPU D..., Linux VMs, Most Constrained CPU Alloc..., Most Constrained by Memor..., Non vSAN Datastores.

Datacenter Cost Drivers Dashboard

Detailed Datacenter Costs
using the new Datacenter
Cost Drivers dashboard

Datacenter
Costs

Cost Driver breakdown per
datacenter

View Cost for child cluster,
datastore, and servers

Cluster, Datastore,
and Server Cost
Details

Cost Driver
Breakdown

The screenshot displays the Datacenter Cost Drivers dashboard interface. At the top, there are navigation links for 'Actions' and 'All Dashboards'. A blue callout box labeled 'Datacenter Costs' points to the main content area. The dashboard features several sections:

- Datacenters:** A table showing datacenter names, expenses, and host counts. Examples include sc2dc02 (62,724.38 US\$/Month, 49 hosts), wdcdc01 (15,182.29 US\$/Month, 8 hosts), DC-vSAN (13,455.11 US\$/Month, 24 hosts), sc2dc01 (13,034.08 US\$/Month, 12 hosts), and Datacenter (3,846.74 US\$/Month, 2 hosts).
- Cost Drivers: Compute:** A detailed breakdown of compute costs. It includes hardware (3,101.02 US\$/Month), license (2,286.8 US\$/Month), maintenance (1,564.02 US\$/Month), facilities (1,878.15 US\$/Month), servers labor (67.43 US\$/Month), and VM additional costs (90.38 US\$/Month). A note indicates 1 - 6 of 6 items.
- Cost Drivers: Non Compute:** Summary of non-compute costs. Storage is listed at 1,137.96 US\$/Month and Network at 3,330 US\$/Month. A note indicates 1 - 2 of 2 items.
- Expense trend:** A line chart showing total expense trends from Oct '18 to Sep '19. The chart includes a 'Historic' data series and a 'Trend/Forecast' line. Categories shown are Total Expense, Compute, Storage, and Other Costs.
- DC-vSAN:** A specific view for the DC-vSAN datacenter, showing cluster expenses for hosts like vsAN-Stretch Cluster, vsAN-Stretch-Prod01, vsAN Encrypted Clu..., and vsAN Branch Office.
- Cluster Expenses (Select to View Hosts):** A table showing monthly expense, CPU usage, and depreciation for selected clusters. Examples include vsan-esxi-10.cmbu... (598.39 US\$), vsan-esxi-09.cmbu... (449.13 US\$), vsan-esxi-08.cmbu... (446.82 US\$), vsan-esxi-04.cmbu... (446.82 US\$), vsan-esxi-07.cmbu... (446.82 US\$), and vsan-esxi-01.cmbu... (446.82 US\$).
- Datastore Expenses:** A table showing monthly expense for datastores. Examples include vsnDatastore (277.24 US\$/Month), Branch Office vSAN (277.24 US\$/Month), Stretch Cluster vSAN (277.24 US\$/Month), and Encrypted vSAN Da... (277.24 US\$/Month).
- Server Expenses (Of Selected Cluster):** A table showing monthly expense, purchase cost, depreciation, and deprecation period for selected servers. Examples include vsan-esxi-10.cmbu... (598.39 US\$), vsan-esxi-09.cmbu... (449.13 US\$), vsan-esxi-08.cmbu... (446.82 US\$), vsan-esxi-04.cmbu... (446.82 US\$), vsan-esxi-07.cmbu... (446.82 US\$), and vsan-esxi-01.cmbu... (446.82 US\$).

Daily Cost for VMs

Daily Cost Metrics

Daily Cost metrics now available

Use transformations in views to show any time period (year to date, month to date, 30 days, etc.)

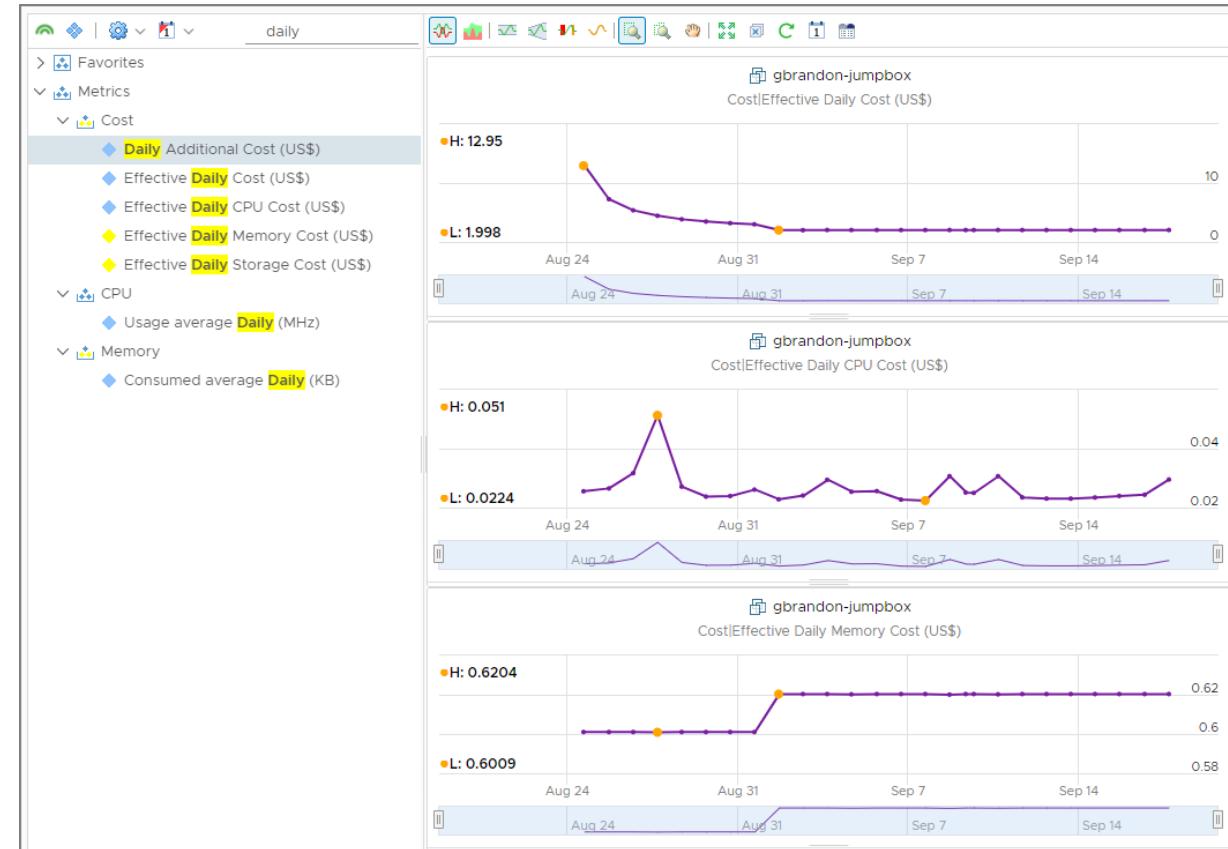
Virtual Machine

- Effective Daily Cost
- Effective Daily CPU Cost
- Effective Daily Memory Cost
- Effective Daily Storage Cost
- Daily Additional Cost

Cluster and Host Metrics

- Aggregated Daily Total Cost
- Aggregated Deleted VM Daily Total Cost

MTD Cost metrics disabled by default (enable in policy, if needed)



Demo

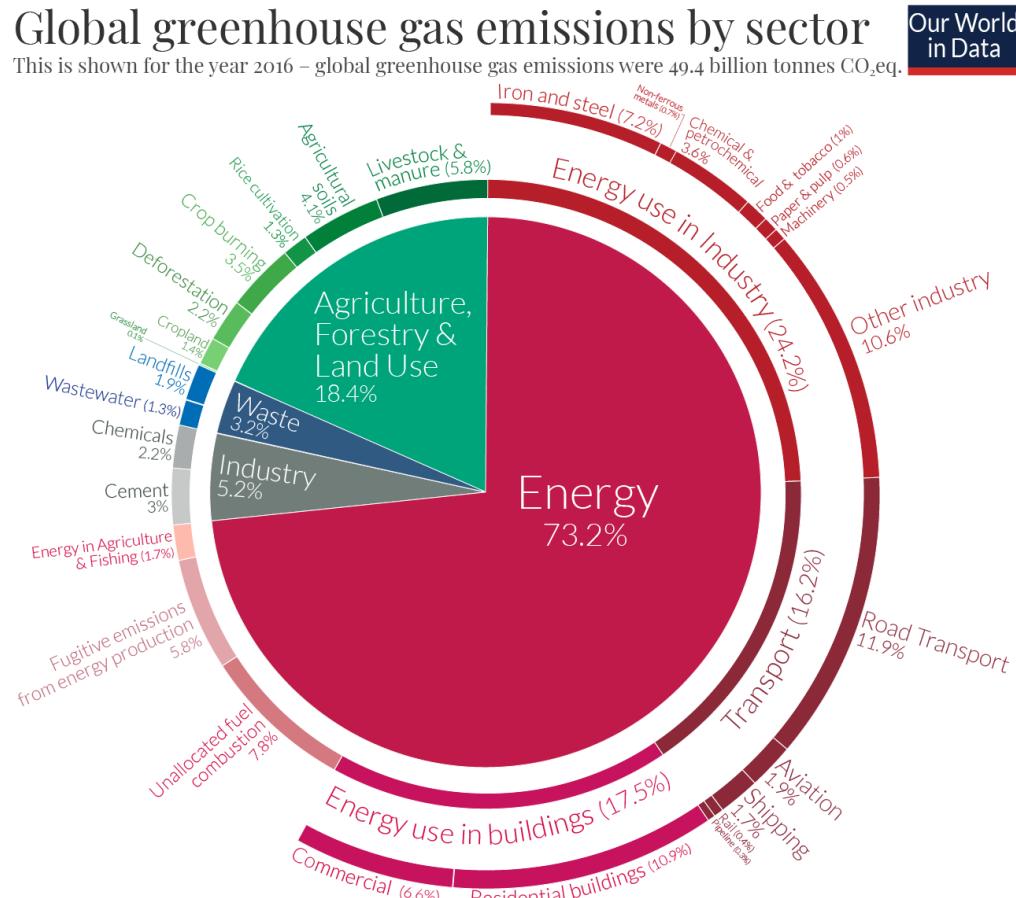
Sustainability

The screenshot shows the VMware Aria Operations interface. At the top, there's a dark header bar with the VMware logo, the title "VMware Aria Operations", the location "US West (Oregon)", and a user profile for "Thomas Kopton CMBU TMM". Below the header is a search bar with the placeholder "Search for object or metric and more...". The main content area has a blue header bar with the text "Welcome to VMware Aria Operations". On the left, there's a sidebar with navigation icons and a "Pillars of Operations" section. The main area features four cards: "Observability" (Monitor, Troubleshoot and full-), "Capacity" (Assess, monitor and optimize across VMware clouds, and in public cloud), "Cost" (Manage, plan and Optimize your infrastructure Cost & Price for showback and chargeback), and "Compliance" (Comply with both industry regulation and internal customized audit requirements). A fifth card, "Sustainability", is highlighted with a green border. It contains the text "Drive towards environmentally responsible IT operations using industry first Green Score" and features a small tree icon.

The Greenhouse Effect and the Digital Impact

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.



OurWorldinData.org – Research and data to make progress against the world's largest problems.

Source: Climate Watch, the World Resources Institute (2020).

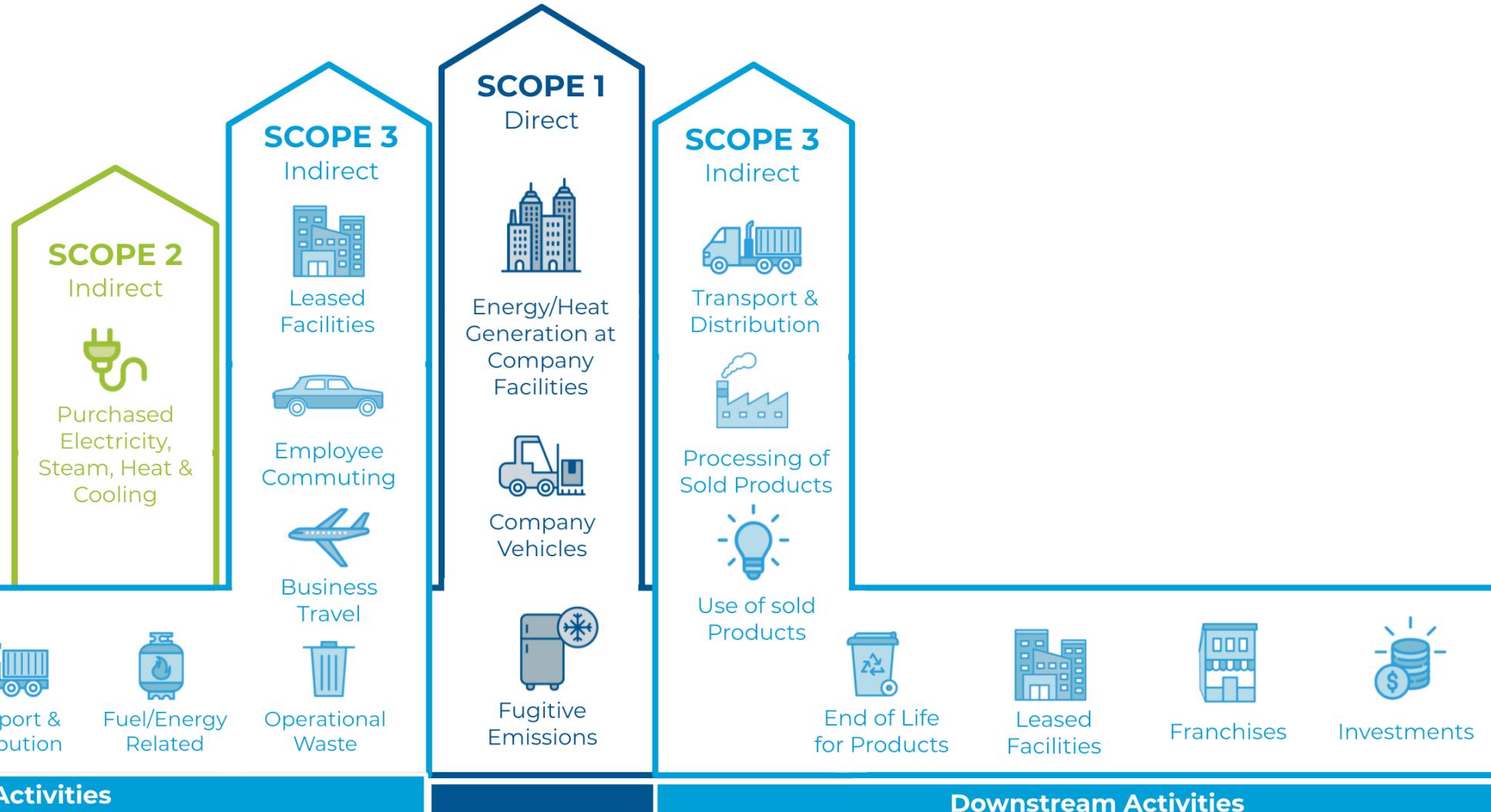
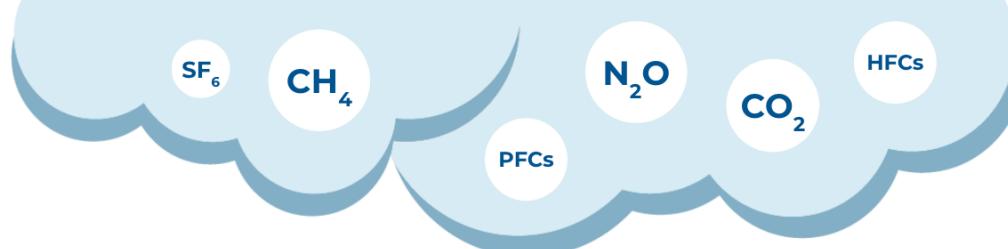
Licensed under CC-BY by the author Hannah Ritchie (2020).

The Digital Industry

- Consumed more than 2% of the world's electricity.
- Emitted as much CO₂ as the airline industry.
- Rapid growth, 6% annually
- Datacenters are responsible for 10 -15%
- Network (Antenna and data transfer) = 25 – 30%
- User devices = More than 50%

Methodology

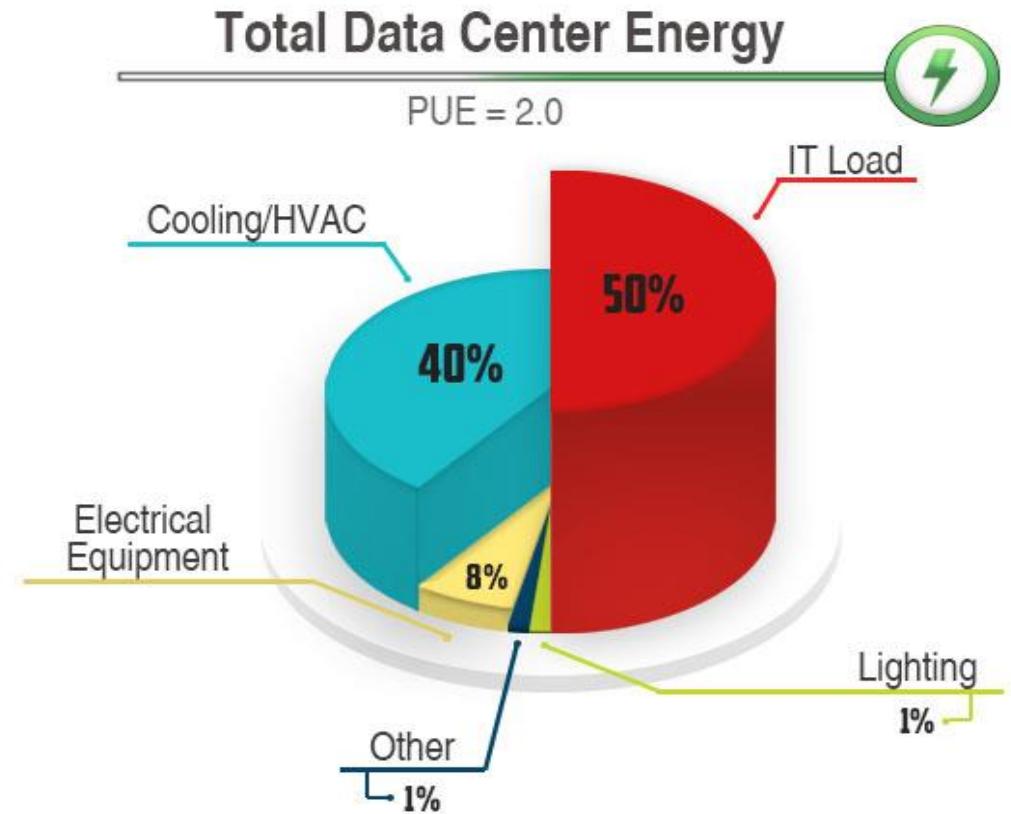
The GHG Protocol



Scope 2: Data Center Power Usage Effectiveness (PUE)

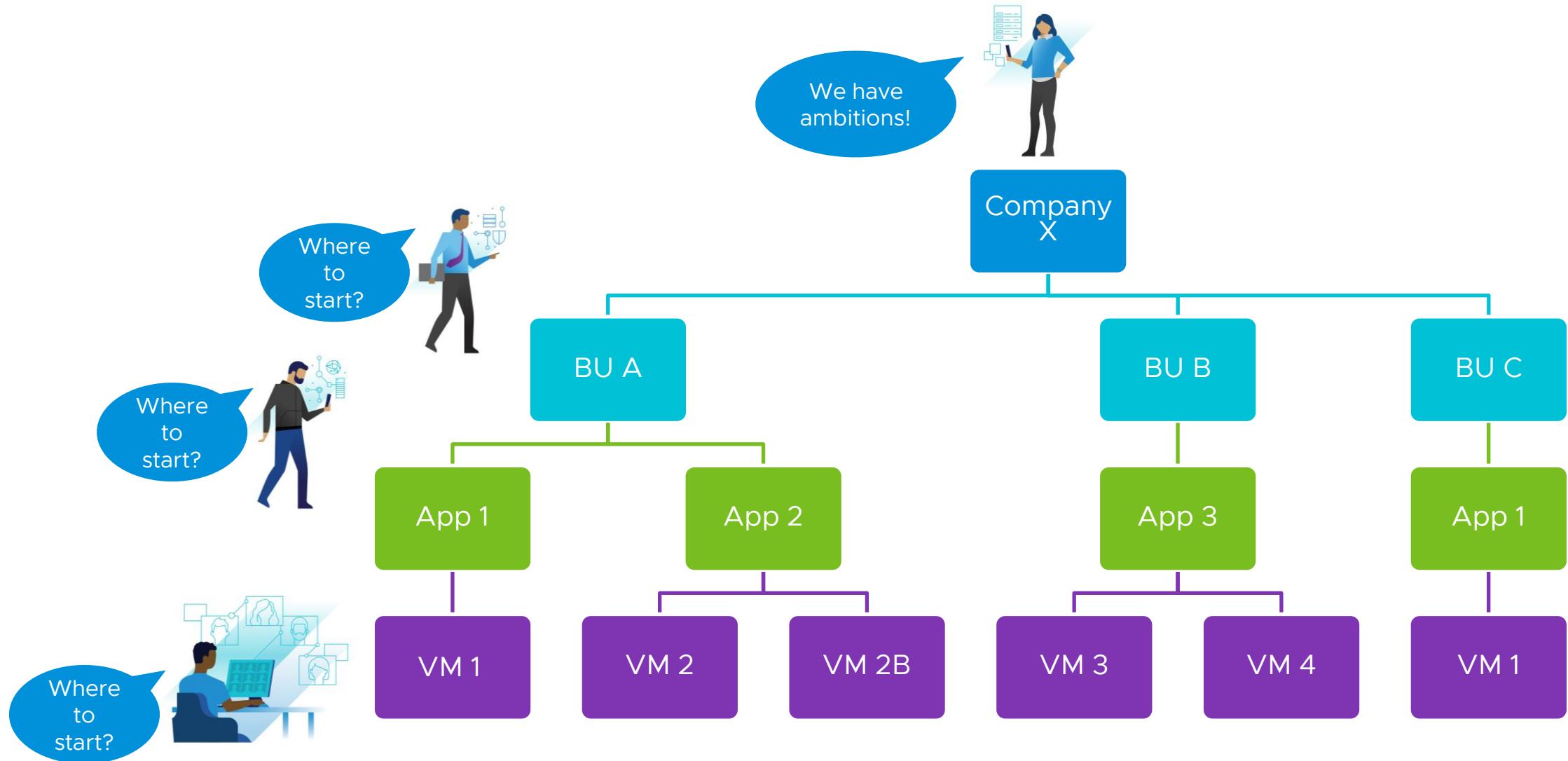
$$\text{PUE} = \frac{\text{Total data centre power demand from grid}}{\text{Total power demand from IT systems}}$$

PUE	Level of Efficiency
3.0	Very Inefficient
2.5	Inefficient
2.0	Average
1.5	Efficient
1.2	Very Efficient



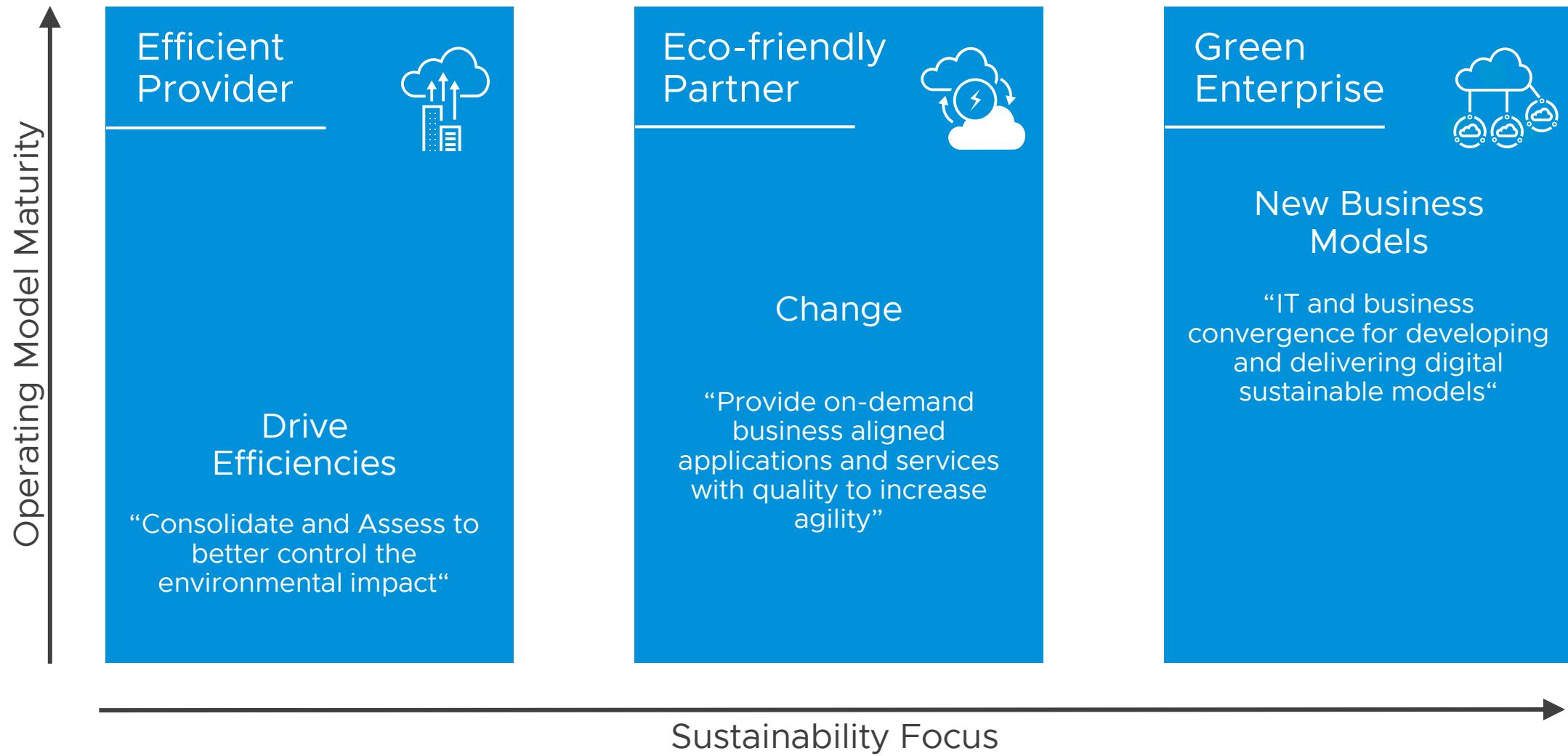
<https://www.iso.org/standard/63451.html>

How are Companies reducing their CO2 emissions?

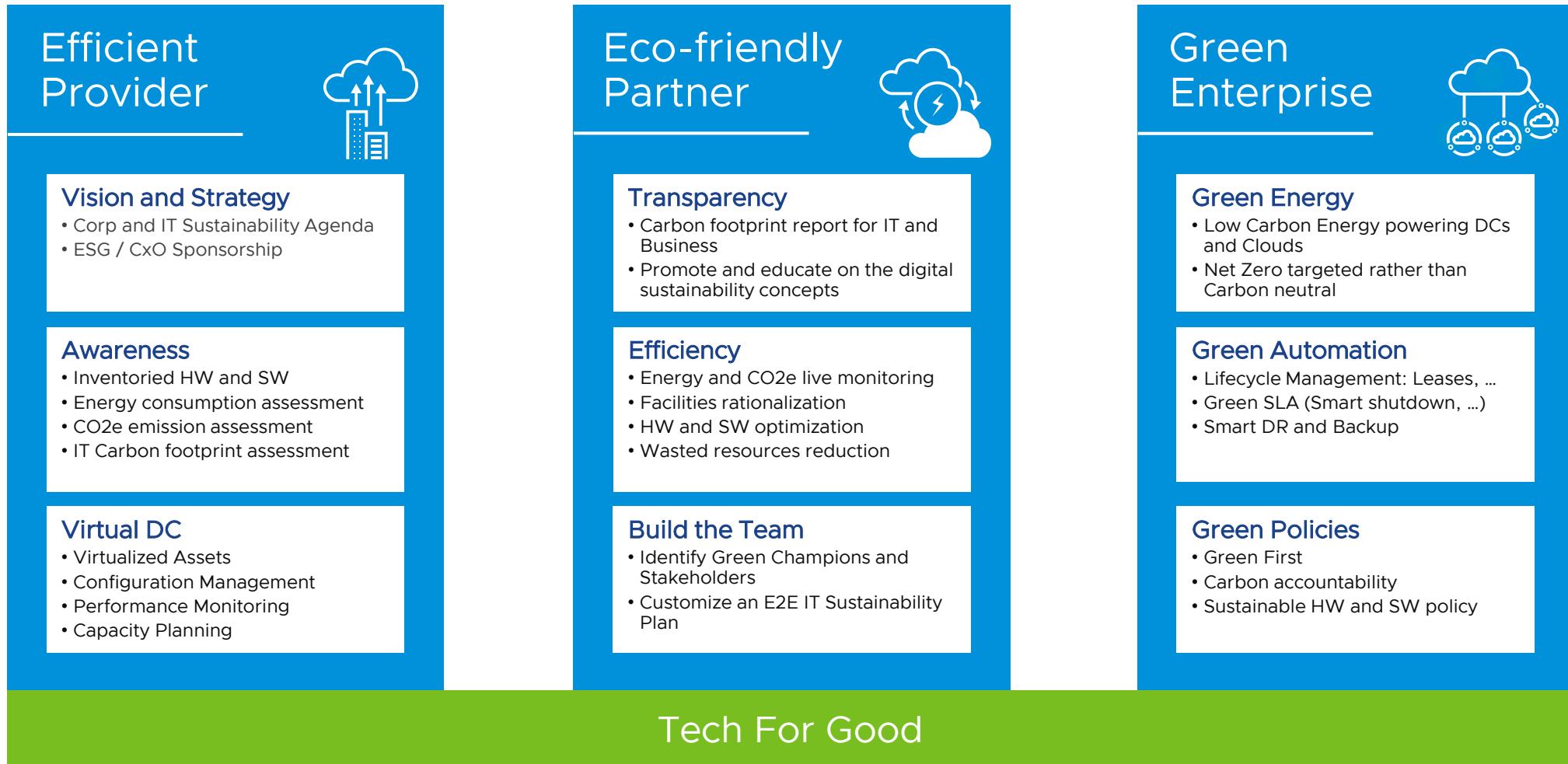


How can VMware help?

Sustainability Maturity Model

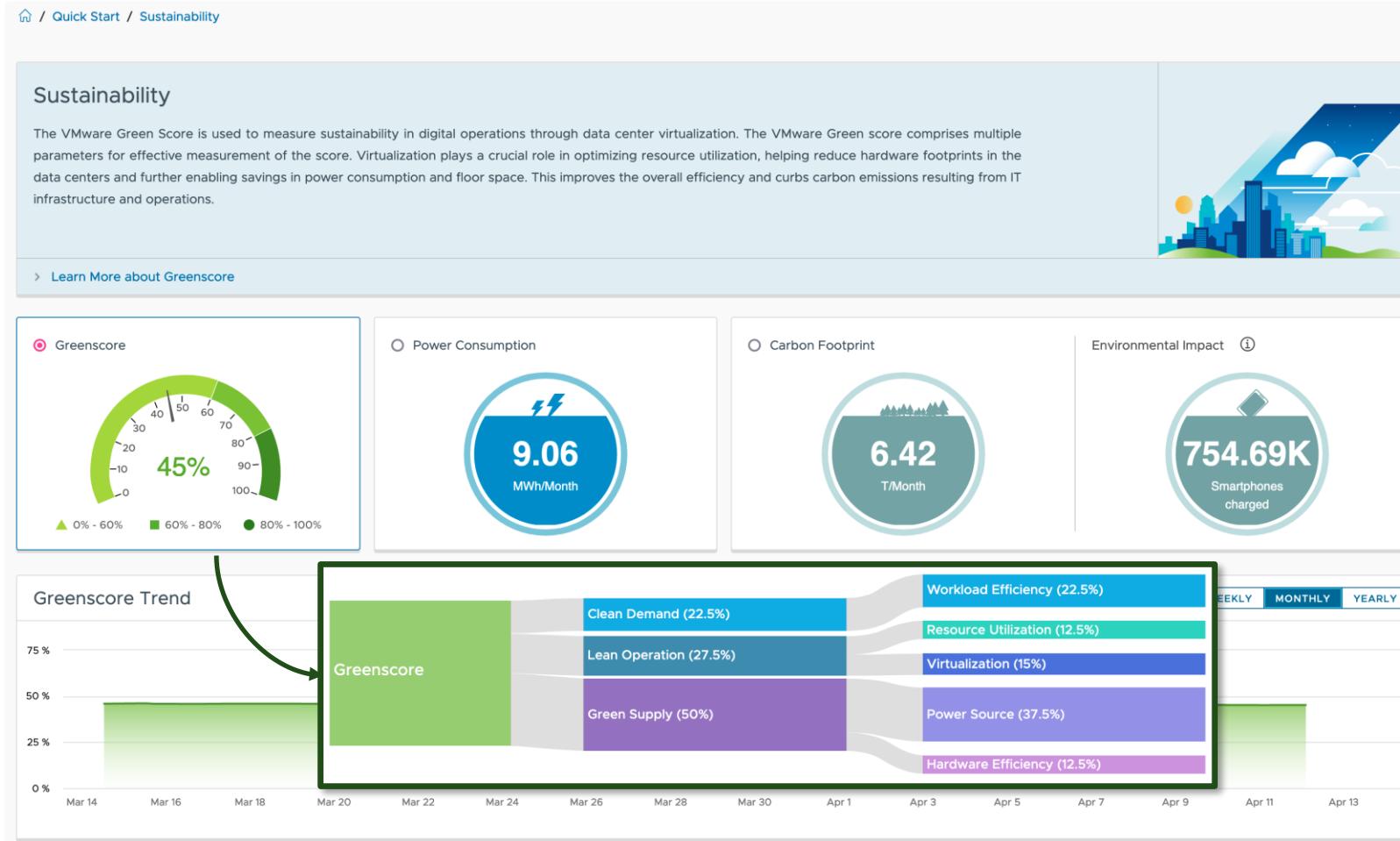


Sustainability Maturity Model



VMware Greenscore

Measure the Effects of Sustainability Actions



Clean Demand

- Workload Efficiency

Lean Operations

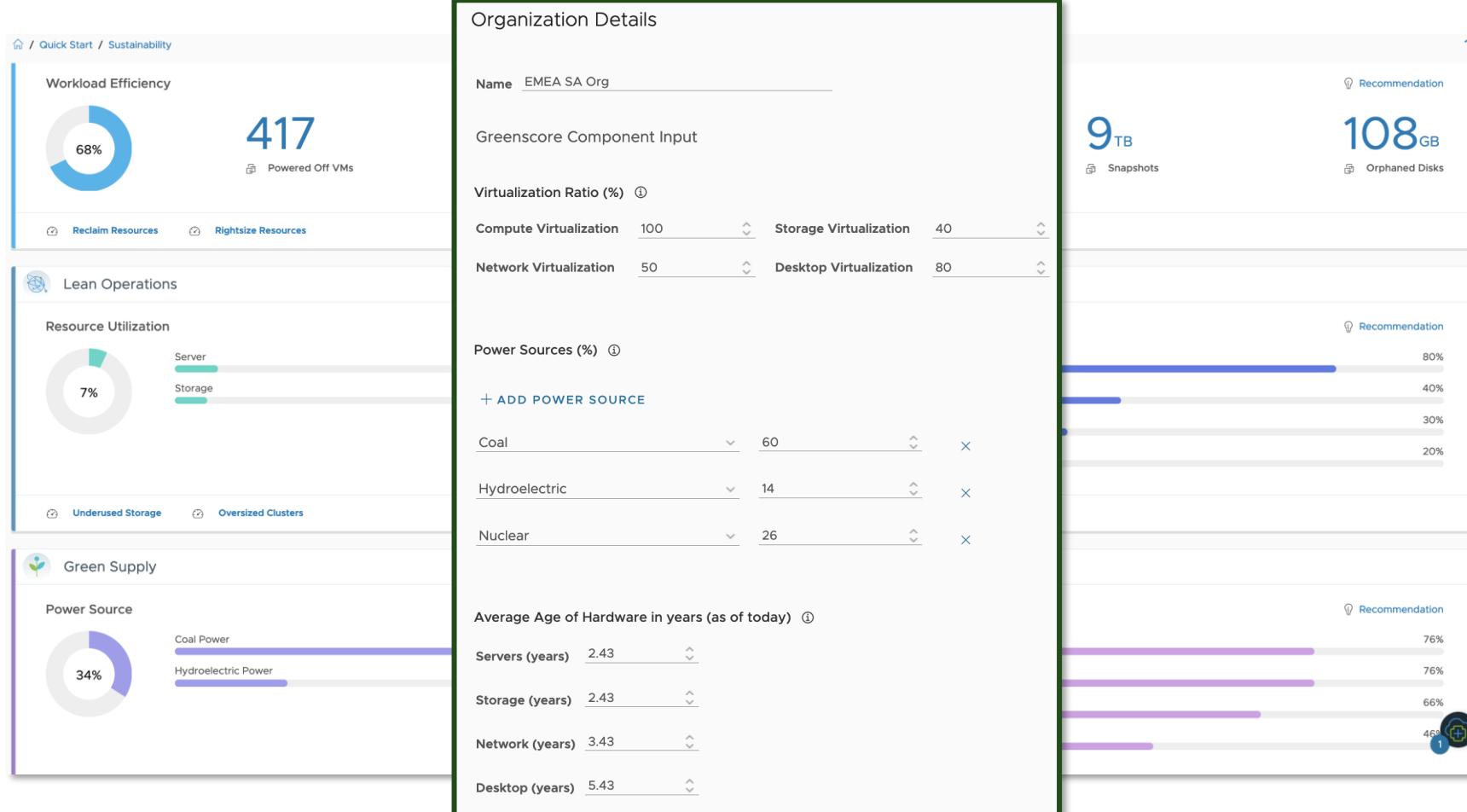
- Resource Utilization
- Virtualization

Green Supply

- Power Source
- Hardware Efficiency

VMware Greenscore

Organization Drivers



Multiple parameters for effective measurement of the VMware Greenscore.

Clean Demand through Workload Efficiency

Find and remove the waste

VM Rightsizing ACTIONS 1H 6H 24H 7D CUSTOM ?

Summary

440 Running VMs	△ 1 TB Oversized Memory	○ 0 TB Undersized Memory	● 565 vCPUs Oversized CPU	○ 8 vCPUs Undersized CPU
---------------------------	-----------------------------------	------------------------------------	-------------------------------------	------------------------------------

Datacenters

Name	Running VMs	Clusters	ESXi Hosts	Datastores	vCenter
vSphere World	440	11	39	52	-
SDDC-Datacenter	153	1	6	2	VMC_PROD-LC
oci-w01dc	96	1	3	13	OCVS-AMD
muc-dc01	50	1	8	11	vCenter-SE-Lab
VCC-Infrastructure-...	44	1	4	7	MUC-Fujitsu-VK
dc01	25	1	4	3	vCenter-SE-Lab
cPod-MCM-UK	25	1	5	2	cpod-uk
Demo-Datacenter	13	1	3	5	MUC-HPE-Lab

Clusters in Selected DC

Name	Time Remaining	Capacity Remaining	VM Remaining	ESXi Hosts	Running VMs
oci01-w01-consolidation	> 1 Year	67.61 %	299	3	96
VCC-Inf-Cluster-Riem	> 1 Year	50.67 %	59	4	44
Demo-Cluster	> 1 Year	42.98 %	12	3	13
Cluster	> 1 Year	34.44 %	23	5	25
muc-cl01	> 1 Year	33.75 %	36	6	50
Cluster-1	> 1 Year	11.11 %	22	6	153
cl01	0 Day(s)	0 %	0	4	25
CL02	-	-	-	-	-

VM counts by CPU to add

VM counts by Memory to add

VM counts by CPU to reclaim

VM counts by Memory to reclaim

> Host Licensing Cluster 02 US\$30/mo.

25.4 GB

Find and remove unused resources

Powered off and idle VMs

Snapshots

Orphaned disks

Align the size of Virtual Machines with their true demand.

Automation Central

Self-Driving Optimization

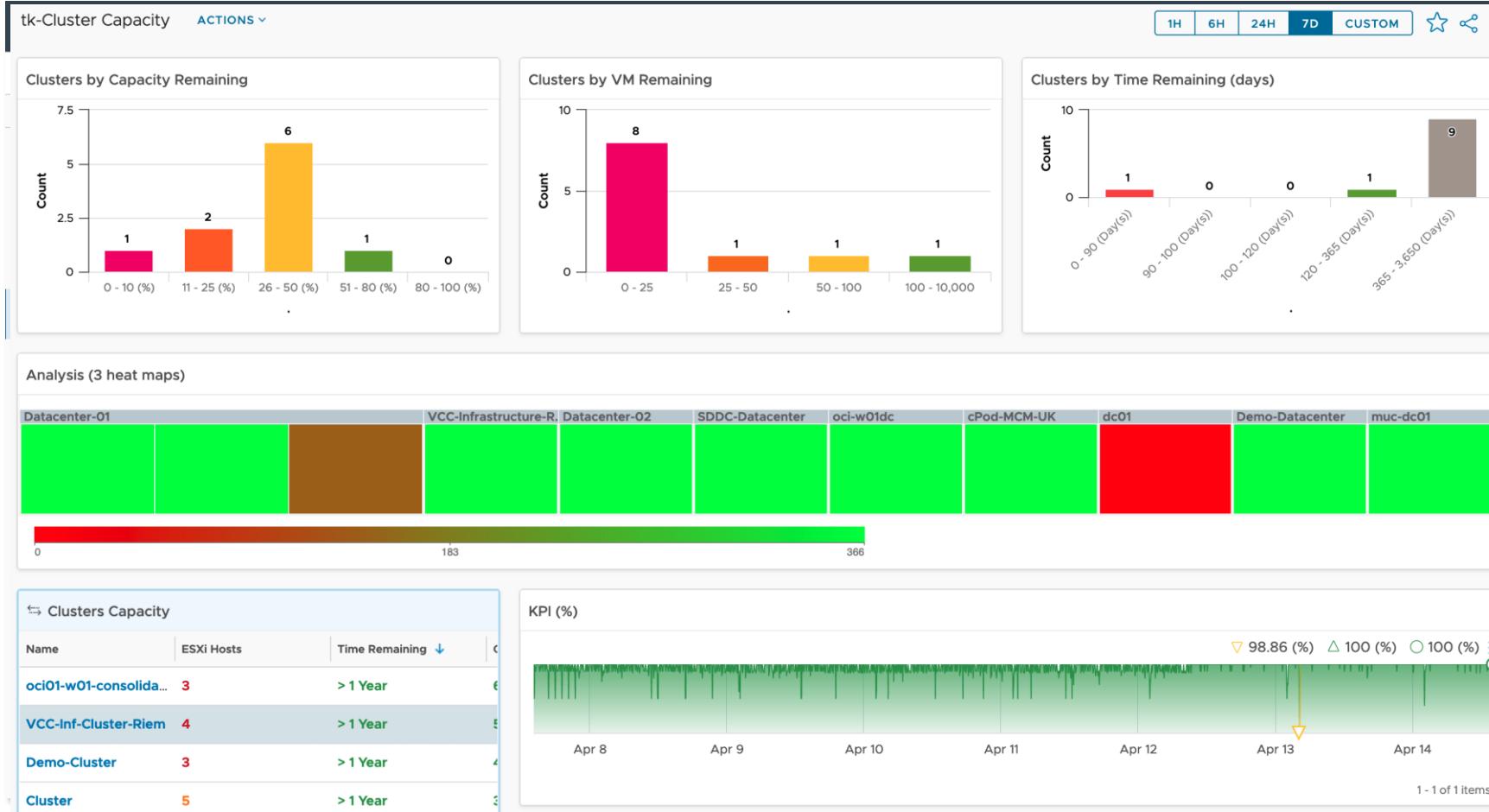
The screenshot shows the VMware vRealize Operations Cloud interface for Automation Central. The top navigation bar includes the VMware logo, the title "VMware vRealize Operations Cloud", the location "US West (Oregon)", and user information "Thomas Kopton CMBU TMM". The main area is titled "Build Automated Jobs" with the sub-instruction "A job is a recurring performance and capacity optimization process. Control the behavior of your environment by building customizable processes that run jobs for you." Below this is a navigation bar with tabs "Schedule" (selected), "Report", "History", and "Jobs". A date range selector shows "← → April 2023" and a "Synchronize time with: Browser GMT+02:00" button. The central feature is a weekly calendar grid from Sunday to Saturday. Several days have scheduled tasks: Sunday, Monday, Tuesday, Wednesday, Friday, and Saturday all have entries at 5:00 AM labeled "Rightsize Oversized VMs". Friday the 15th has a blue circle around it. The bottom right corner of the calendar has a small circular icon with a plus sign and a question mark.

Recurring performance and capacity optimization process.

Control the behavior of your environment.

Lean Operations

Increasing Resource Utilization



Identify oversized and underused vSphere Clusters and Datastores

- Buffer- and Admission Control-aware
- Use your own Virtual Machine profiles

Workload Balancing

Optimize Virtual Machines Placement across Clusters

The screenshot shows the VMware vRealize Operations Cloud interface. The top navigation bar includes the VMware logo, the title "VMware vRealize Operations Cloud", the location "US West (Oregon)", and the user "Thomas Kopton CMBU TMM". The main dashboard is titled "Workload Placement" and displays "OPTIMIZATION SCHEDULES" for various clusters:

- EMEA Datacenter: US\$618 Cost Savings, 0 Days Remaining, Not Optimized
- Hillsboro: US\$188 Cost Savings, 0 Days Remaining, Not Optimized
- Hybrid Cloud OVH / Hill...: US\$188 Cost Savings, 0 Days Remaining, Not Optimized
- PKS-DC-SOUTH: US\$605 Cost Savings, 0 Days Remaining, Not Optimized
- Production: US\$231 Cost Savings, 0 Days Remaining, Not Optimized
- sc2dc01: US\$2,047 Cost Savings, 0 Days Remaining, Not Optimized

A button "ALL DATACENTERS" is located at the bottom right of this section. Below this, the cluster "sc2dc01" is selected. The "Optimization Status" tab is active, showing "Not Optimized". A message indicates: "You can optimize your datacenter by moving workloads to avoid performance issues." Below this are three sections: "Optimization Recommendation", "Operational Intent", and "Business Intent". The "Optimization Recommendation" section has a status of "Not Optimized" and shows a flow diagram from a single server icon to two server icons. The "Operational Intent" section has a utilization objective of "Balance" and lists "Avoid Performance Issues" and "Balance Workloads". The "Business Intent" section is labeled "Intent Not Set" and provides options to "Set up your business intent to place VMs based on criteria such as above." At the bottom, there is a table titled "Are your clusters meeting your utilization objective?" with columns for "Name", "CPU Workload %", "Memory Workload %", "DRS Settings", "Migration Threshold", "Violated Tags", and "VM Name". It shows two rows: sc2c01 (23% CPU, 65% Memory, Fully Automated, Default, -, sc2c01) and sc2c02 (48% CPU, 104% Memory, Fully Automated, Default, -, sc2c02). A "VIEW DRS SUMMARY" and "SET DRS AUTOMATION" link are also present.

Driven by custom Operational and Business Intents

- Increase efficiency
- Reduce resource contention
- Maintain optimum system performance

Green Supply

Hardware Efficiency

Green Supply ACTIONS ▾

Read Me

Smaller clusters have relatively higher overhead. A cluster with 2 nodes has 50% overhead, while a cluster with 10 nodes has only 10% overhead, basing on N+1 design.

Cluster with lesser capacity requires more hosts, hence consuming more electricity.

The table lists clusters that meets one of these criteria:

- 4 or less nodes
- 120 or less CPU cores and less than 1 TB memory.

Empty widget indicates that defined green goals are met.

Customize the settings to fit your green goals.

Small Clusters

Name	ESXi	CPU	Cores ↑	Mem
App Cluster DCA, GU...	2	0.70 GHz	4 Cores	10 GB
UCS 220	1	14.37 GHz	6 Cores	15.8 GB
UCS	2	19.2 GHz	8 Cores	55.8 GB
App Cluster:Second...	2	17.56 GHz	8 Cores	31.9 GB
Consolidation Clust...	2	17.56 GHz	8 Cores	31.9 GB
Consolidation Clust...	3	26.34 GHz	12 Cores	47.9 GB
PSO - Sales	3	26.34 GHz	12 Cores	47.9 GB
PSO - Marketing	3	26.34 GHz	12 Cores	47.9 GB

1 - 38 of 38 items

Read Me

Technology advancement enable ESXi to deliver higher efficiency. It can deliver more CPU and memory capacity, often with less power requirements.

The table lists ESXi hosts that meets one of these criteria

- ESXi version 6.0 or older
- 40 or less CPU cores, and less than 256 GB of memory

Empty widget indicates that defined green goals are met.

Customize the settings to fit your green goals.

Ageing Compute Hardware

Name	Model	Version ↑	CPU Model	Cores ↑
w2-bm-dev-a0203...	Cisco Systems Inc U...	6.5.0-17477841	Intel(R) Xeon(R) CPU...	4 Cores
w2-bm-dev-a0204...	Cisco Systems Inc U...	6.5.0-17477841	Intel(R) Xeon(R) CPU...	4 Cores
w2-bm-dev-a0302...	HPE ProLiant DL360...	6.5.0-4564106	Intel(R) Xeon(R) Silv...	16 Cores
w2-bm-dev-a0206...	Cisco Systems Inc U...	6.5.0-7967591	Intel(R) Xeon(R) CPU...	6 Cores
w1-vrni-tmm-esx012...	Dell Inc. PowerEdge ...	6.7.0-14320388	Intel(R) Xeon(R) Gol...	28 Cores
w1-vrni-tmm-esx013...	Dell Inc. PowerEdge ...	6.7.0-14320388	Intel(R) Xeon(R) Gol...	28 Cores
w1-vrni-tmm-esx014...	Dell Inc. PowerEdge ...	6.7.0-14320388	Intel(R) Xeon(R) Gol...	28 Cores

Context of selected Cluster

false	HA
false	DRS
WDC	Datacenter
vcsa-e	vCenter
-	vSphere Folder
none	vSphere Tag
regular	Type
false	DPM
1	Running VM
2	Total VM

Context of selected ESXi

Cisco Systems Inc	UCS 220
Vendor	Cluster
-	
vsphere Folder	
none	vsphere Tag
7967591	Build Number
4	NIC
1,000	NIC Speed
C220M4.4.0.0.07111P	BIOS Version
1	1 + 1
true	FCH1920V03J

Reduce overhead

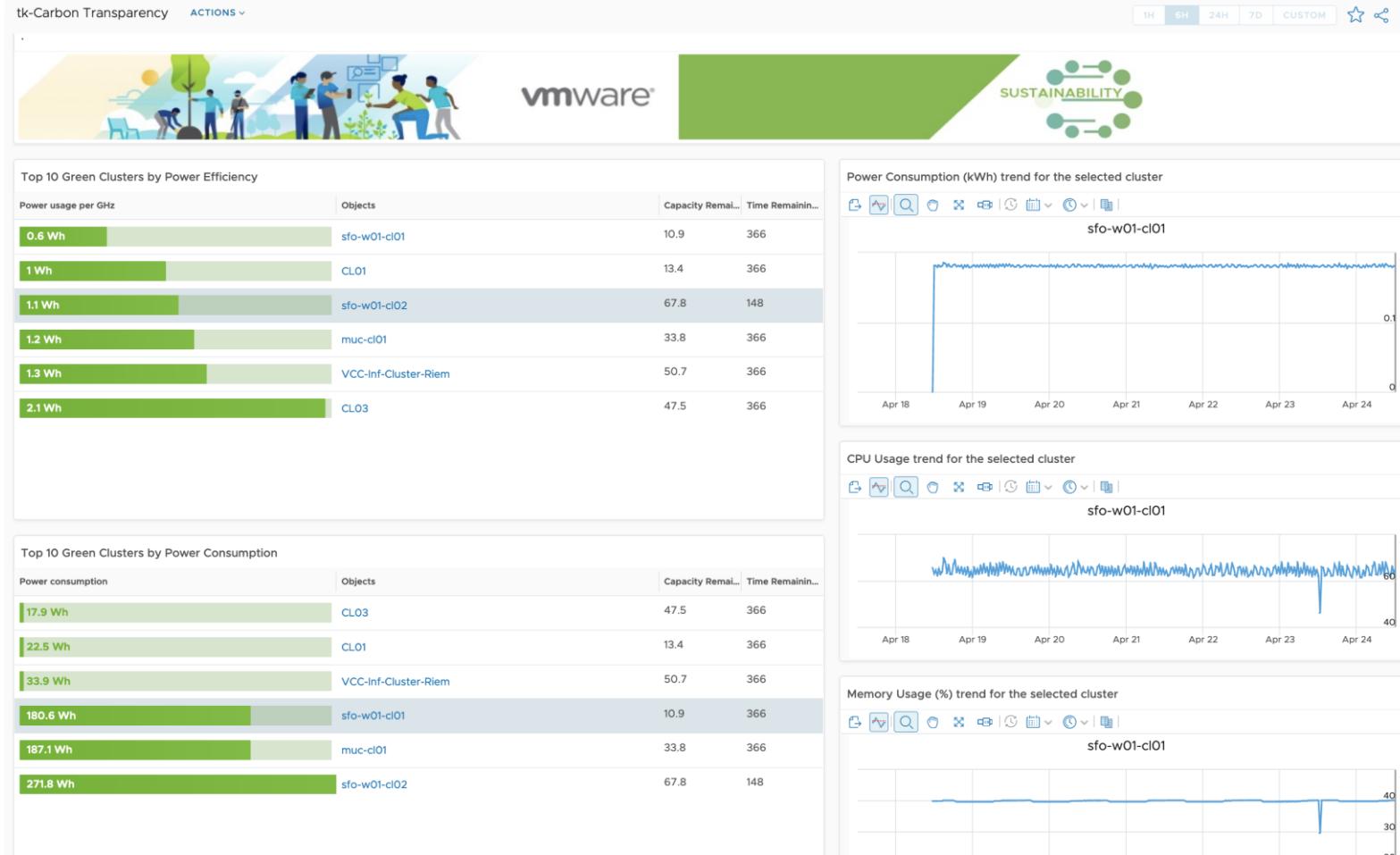
- Find small clusters

Increase efficiency

- Technology advancement (compute and storage)

Green Supply

Carbon Transparency

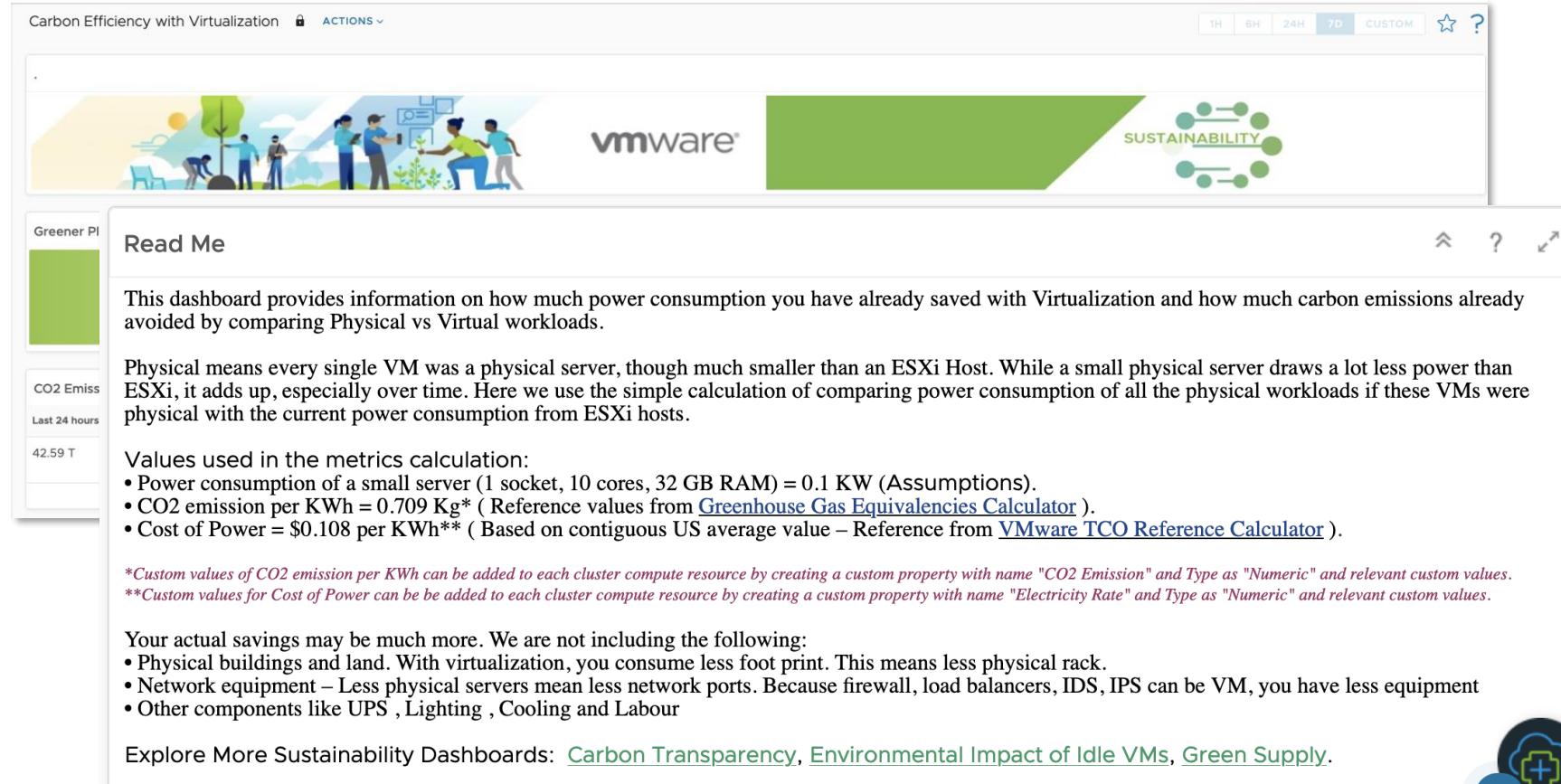


Identify efficient clusters

- Energy consumption per CPU GHz provided
- Total energy consumption

Green Supply

CO2 Emission Savings



The screenshot shows the VMware Carbon Efficiency with Virtualization dashboard. At the top, there's a navigation bar with 'Carbon Efficiency with Virtualization' and 'ACTIONS' dropdown. Below it is a header featuring a nature scene illustration, the 'vmware' logo, and a 'SUSTAINABILITY' icon. On the left, a sidebar displays metrics: 'Greener PI' (green bar), 'CO2 Emiss' (text: Last 24 hours, 42.59 T). The main content area has a title 'Read Me' and text explaining the dashboard's purpose: comparing power consumption and carbon emissions between physical and virtual workloads. It includes a note about physical workloads being equivalent to individual ESXi hosts. Below this, a section titled 'Values used in the metrics calculation:' lists assumptions: power consumption of a small server (0.1 KW), CO2 emission per KWh (0.709 Kg), and cost of power (\$0.108 per KWh). At the bottom, there are footnotes about custom values for CO2 and power cost, and a note that actual savings may include other factors like physical buildings.

This dashboard provides information on how much power consumption you have already saved with Virtualization and how much carbon emissions already avoided by comparing Physical vs Virtual workloads.

Physical means every single VM was a physical server, though much smaller than an ESXi Host. While a small physical server draws a lot less power than ESXi, it adds up, especially over time. Here we use the simple calculation of comparing power consumption of all the physical workloads if these VMs were physical with the current power consumption from ESXi hosts.

Values used in the metrics calculation:

- Power consumption of a small server (1 socket, 10 cores, 32 GB RAM) = 0.1 KW (Assumptions).
- CO2 emission per KWh = 0.709 Kg* (Reference values from [Greenhouse Gas Equivalencies Calculator](#)).
- Cost of Power = \$0.108 per KWh** (Based on contiguous US average value – Reference from [VMware TCO Reference Calculator](#)).

*Custom values of CO2 emission per KWh can be added to each cluster compute resource by creating a custom property with name "CO2 Emission" and Type as "Numeric" and relevant custom values.
**Custom values for Cost of Power can be be added to each cluster compute resource by creating a custom property with name "Electricity Rate" and Type as "Numeric." and relevant custom values.

Your actual savings may be much more. We are not including the following:

- Physical buildings and land. With virtualization, you consume less foot print. This means less physical rack.
- Network equipment – Less physical servers mean less network ports. Because firewall, load balancers, IDS, IPS can be VM, you have less equipment
- Other components like UPS , Lighting , Cooling and Labour

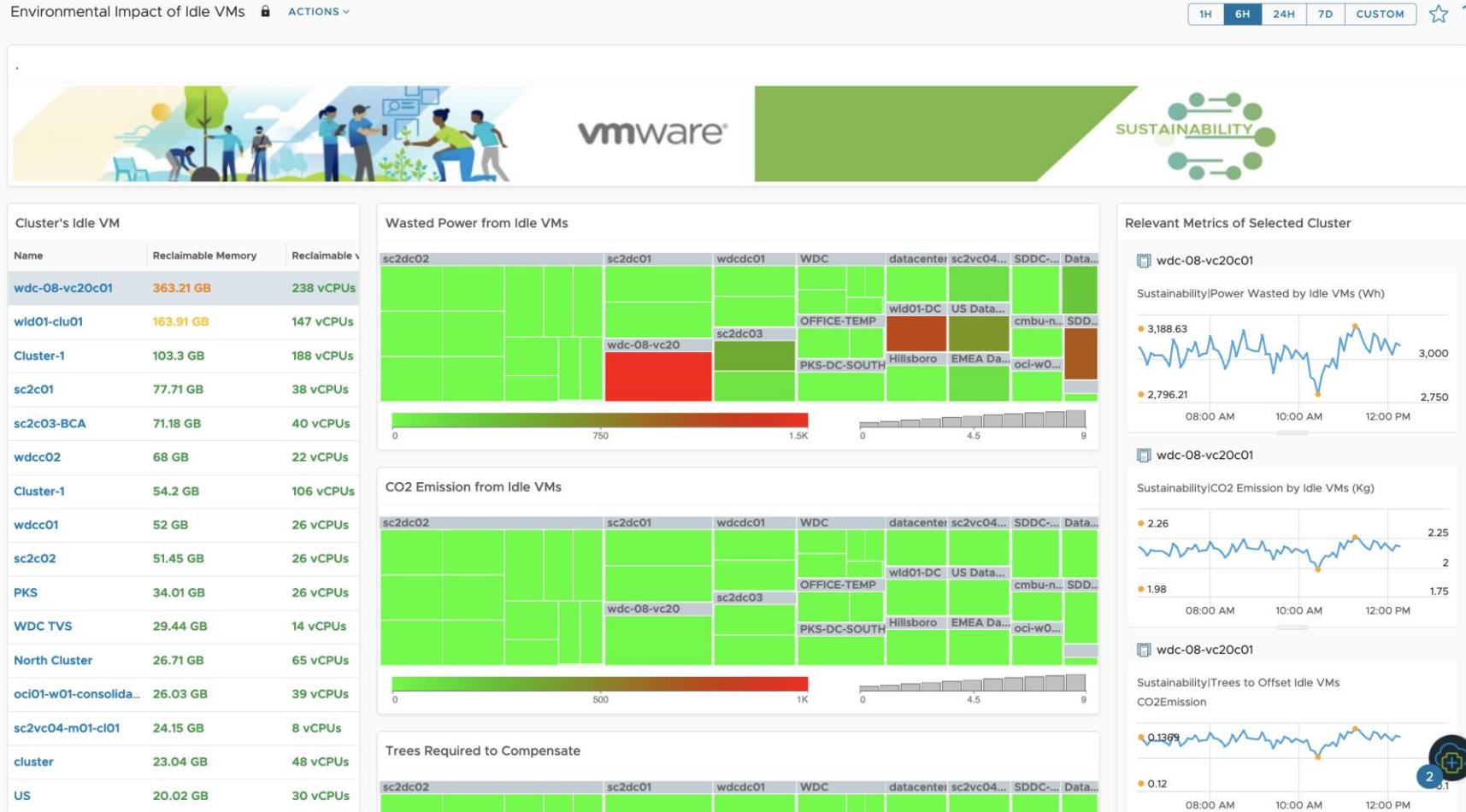
Explore More Sustainability Dashboards: [Carbon Transparency](#), [Environmental Impact of Idle VMs](#), [Green Supply](#).

Saved power and avoided carbon emissions

- Impact of the virtualization
- Customizable parameters

Avoidable CO2 Emissions

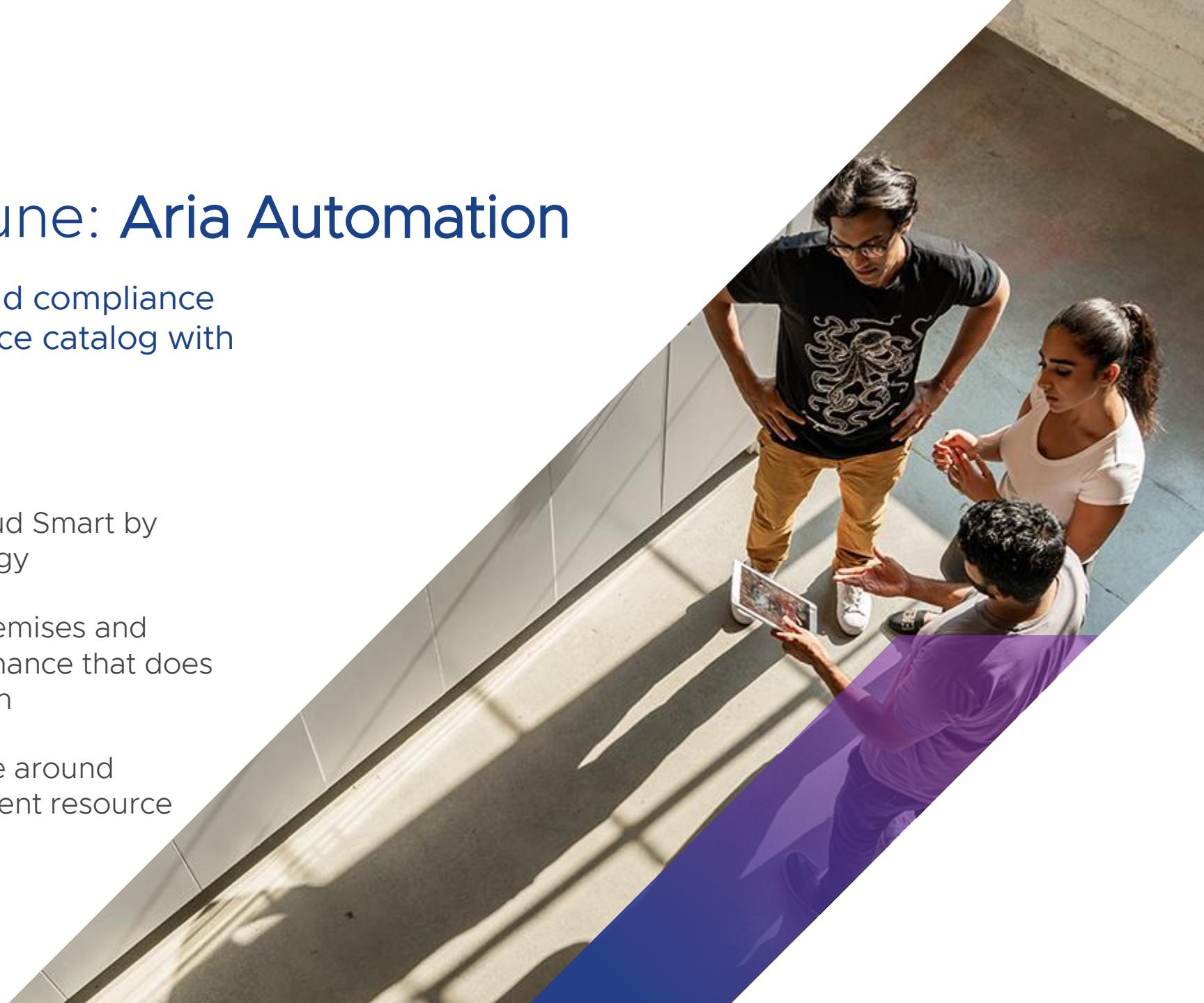
Impact of wasted Work



Live Webinar in June: Aria Automation

How to support sustainability and compliance goals whilst building a self-service catalog with VMware Aria Automation

- Moving from Cloud Chaos to Cloud Smart by adopting a right-cloud first strategy
- Offer multi-cloud services (on-premises and public cloud services) with governance that does not provide a barrier to innovation
- By leveraging correct governance around automation, achieve a more efficient resource utilization





Thank You