### Kubernetes Emissions Insights: Turning Cloud-Native Green

And what can you do

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**Ø** FOSDEM





#### A wake-up call





# The bigger picture





# Do we need all that?

#### **Overprovisioning in Kubernetes clusters**



only 20% memory utilised

Source: study by cast.ai in 2024



#### Using the right tools you can reduce your waste

KEIT

**Green Reviews** 



#### Insights from KEIT - the dashboard



https://github.com/aknostic/keit

#### **FOSDEM**









	datasource    Prometheus v    Namespace    All v    Pod    All v    E    60.22739421681793 v    I    375.7797618047617 v      PUE aws - eu-west-1    :				
	v SCI index components				
	Energy (E)	Energy Carbon Intensity (I)	Embodied (M)	unctional Unit (R)	Software Carbon Intensity equation
		Energy Carbon Intensity (I)	Embodied (M)	unctional Unit (R)	SCI Equation =
Embo	died emiss	be carbon intensity of electricity is a measure of h Control Samissions are produced per control Samissions are produced per sumed.	Embodied carbon (also known as embedded carbon) is the amount of carbon emitted during the creation and disposal of a hardware device.	The unctional unit defines how your application scales. For stance, if your application scales by APIs then choose API as your functional unit.	(E * I) + M per R
gener	ated and a set of the	The only value that matters if you're trying to opt be scheduling of your computing in real-time is used in the second second second second second second itensity of the marginal power plant which will up if you schedule some computing at that mon t.	When software runs on a device, a fraction of the total embodied emissions of the device is allocated to the software. This is the value of M that you need to calculate in the SCI equation.	For in ance, if you are running on the cloud, you can get the to API request/second from the cloud metrics of your A gateway. You can get the data from a produce in instance or carry out lab-based testing (i.e stress ting) to get how much CO2e is emitted per unit	
produ	iction, portation a		More info here.	of the ctional unit. More i here.	
uluis	Energy (E) In kWh - Total. 💿	Emissions (I) in gCO2e/kWh - Ierland (estimated)	Embodied (M) in gCO2e - EKS ③	Functional Unit (R) - EKS	Carbon Intensity (gCO2eq)
disca serve	rding of the rs			The hole EKS cluster	
	00.2	377	107		25003











#### **KEIT components**





#### **Opportunity: CNCF's Green Reviews working group**

Volunteer-run group of open-source contributors 🤎 138 members in Slack channel



Join us at Slack CNCF #tag-env-wg-green-reviews

FOSDEM

What can you do?

You are doing something by being here

Make it part of your system

Start improving by measuring and optimizing

Become an ambassador at your community

#### And contribute!

Image by DC Studio on Freepik

## We can make a positive change





### **Useful links: Community**

- <u>CNCF TAG Environmental</u>
  <u>Sustainability</u>:
  - <u>Zoom calls</u> every 1st and 3rd
    Wednesday of each month at 16:00
    UTC
  - Slack channel <u>#tag-environmental-sustainability</u>
- Green Reviews working group:
  - <u>Zoom calls</u> every 2nd and 4th
    Wednesday of each month at 16.00
    UTC
  - Slack channel

#tag-env-wg-green-reviews

- Meetups in NL
  - Sustainable IT Netherlands
  - Green Software The Netherlands
  - Podcasts
    - <u>Green IO</u>
    - <u>Environmental Variables</u> (Green Software Foundation)
  - Green Software foundation



### Useful links: open source tools

Measuring and estimating:

- Green Reviews repo
- <u>Kepler</u>: tracking energy consumption
- <u>ElectricityMaps</u> for carbon intensity
- <u>Boavizta</u> for embodied carbon
- Green Metrics Tool
- <u>KEIT</u> & About <u>KEIT</u>
- <u>Cloud carbon footprint</u>
- <u>Carbon footprint estimator for AWS</u> <u>instances</u>
- <u>Carbon Costs</u>

Optimising:

- <u>Goldilocks</u> for setting your resource requests and limits
- <u>PerfectScale</u> for optimising your resource requests and limits
- <u>Kube-green</u> to switch off what you don't use
- <u>Carbon aware sdk</u> for running software which is less carbon intensive



### **Thank you! Questions?**

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