Appendixes

A. Interview Guide

If the opportunity is there, always continue to ask ‘Why? Or ‘Oh that sounds interesting, can you tell more about that?’

Start/ get to know

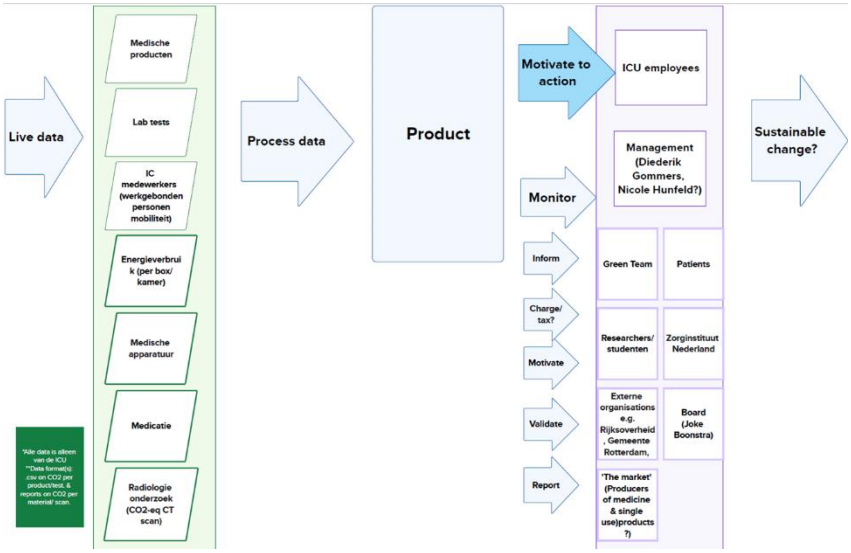
- Why did you choose this subject?
- What do you like best about it now?
- What do you like least about your job?

Context

- What do you do on an IC day?
    - Care tasks
    - Administrative tasks
- How do the shifts differ (morning, evening, night?)
- What work do you like best, and what would you prefer to skip?
- How do you get information from the patient to you?
- How does hix work?
    - How do you submit requests for lab tests or radiology?
    - What kind of dashboards or lists or monitors do you use? (Photo?)

Explain my aim

Show the diagram and ask who they think is the main user/ stakeholder, and what the function of the product should be.



Sustainability in the ICU

- What do you think about sustainability in the ICU?
    - Why?
- What are the things that make the most impact in terms of sustainability?
- Who is responsible for that?
- Who has/have the most impact on that?

Green team/ current practices

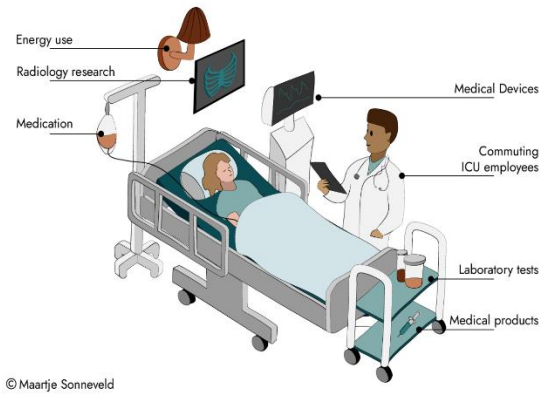
- Have there been any 'interventions' under the name of sustainability during your time at the IC?
- How was this brought about?
- How did you experience this?
- What is the green team and what do they/you do?

Vision for change

- Are there things in the ICU where you think it is possible to make more sustainable change?
- Where do you think the difficulty lies?
- How can an 'intervention' best be approached so that, for you, it is also improvement on the status quo?
- What requirements are important to you to make such an 'intervention' a success?
- Behavioural change, what are the difficulties? Where do you see opportunity?

Groups emissions

- Show figures



- In which group do you think it is easiest to improve emissions?
- Who is responsible for that?
- Who can really make an impact there?

Medical products

- Where do you get them from?
- Where and how do you dispose of them?
- How does the procurement department know to buy?

Energy per box (heating, AC, humidity etc.) + Medical equipment

- Does the ICU itself directly influence this?
- Are devices ever left on unnecessarily?

Laboratory determinations

- How often and for what purpose are lab tests taken?
- How does that work with hix? What kind of information do you have to pass on?
- What kind of packages are there, for instance?
- I happened to see in the data that quite a lot of lab tests are done on some patients, where do you think that comes from?

Staff

- Are home working days a possibility (administrative or something)
- What kind of transport do most people use, what kind of obstacles do you encounter on different shifts?

Medication

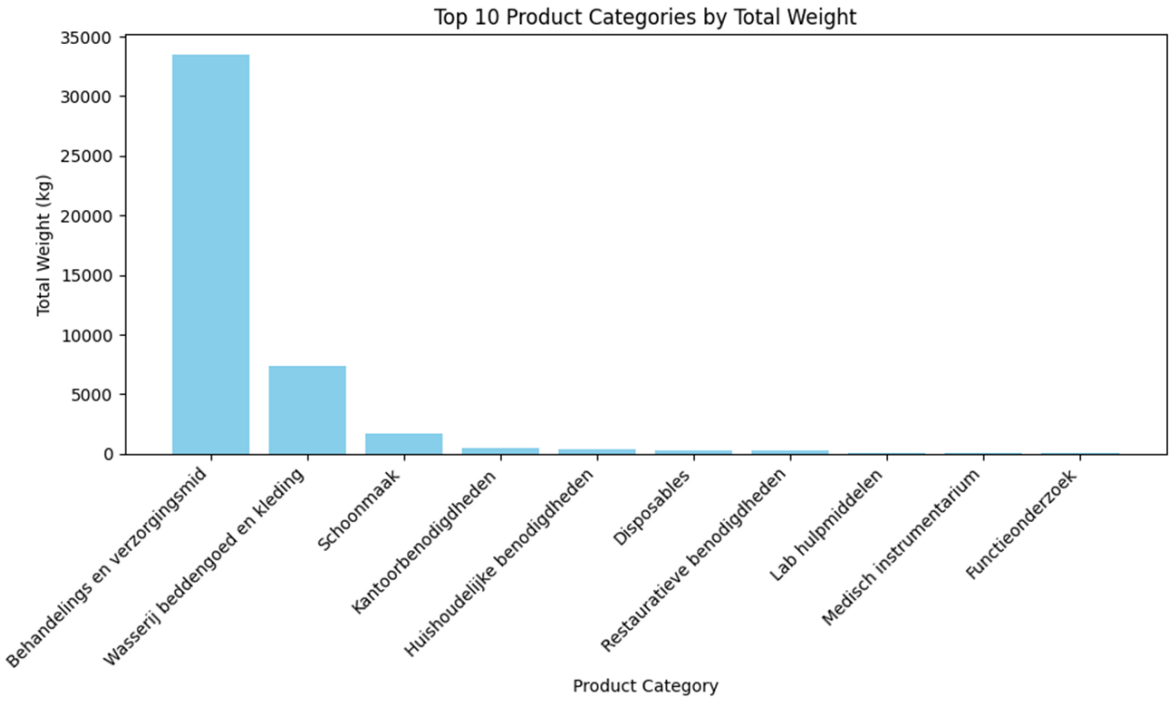
- What kind do you use the most?
- Is there a difference for the patient or for you between infusion (dripline) or oral medicine?
- Do you think there are gains to be made in medication? Either for you, the patient, waste, co2 or otherwise?

Radiology examination

- How are requests made?
- Which devices are in the ICU, which in the radiology department?

Show some graphs and ask what they see in it and learn from it:

- Can they explain what they see? What do these numbers tell us?


Top 10 Product Categories by Total Weight
Total Weight (kg)
35000
30000
25000
20000
15000
10000
5000
0
Behandelings en verzorgingsmid
Wasserij beddengoed en kleding
Schoonmaak
Kantoorbenodigdheden
Huishoudelijke benodigdheden
Disposables
Restauratieve benodigdheden
Lab hulpmiddelen
Medisch instrumentarium
Functieonderzoek
Product Category

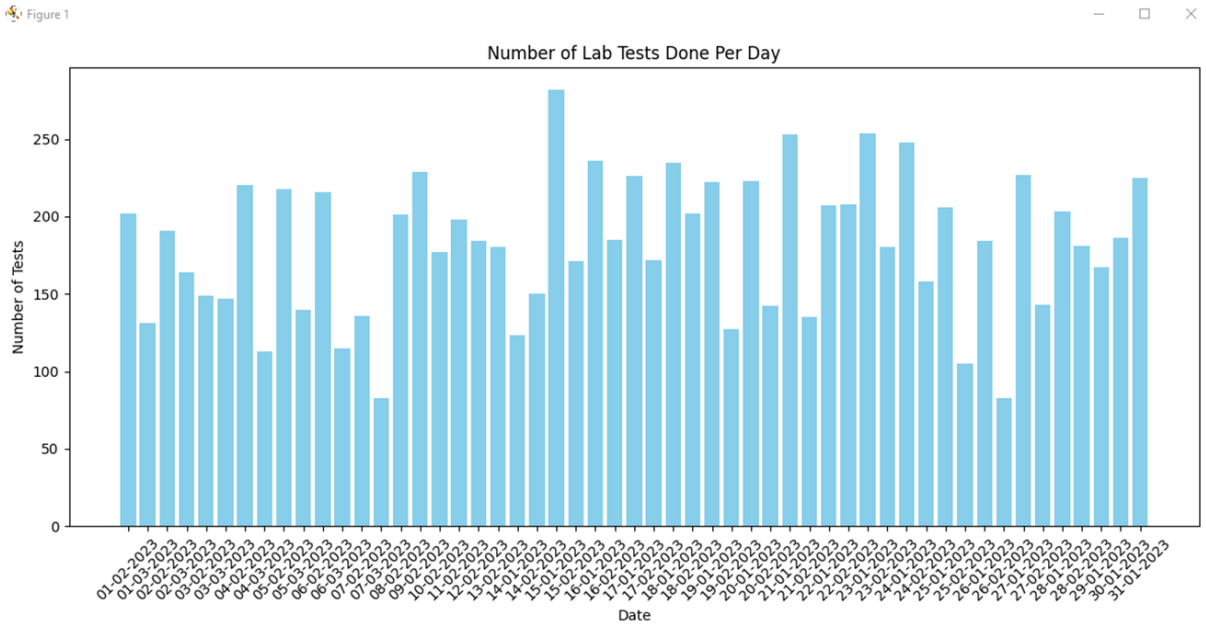
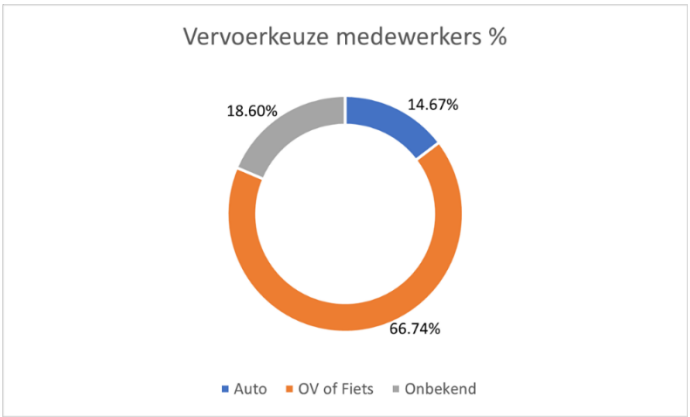


Figure 1
Number of Lab Tests Done Per Day
Number of Tests
250
200
150
100
50
0
Date


Vervoerkeuze medewerkers %
14.67%
18.60%
66.74%
Auto
OV of Fiets
Onbekend

Interview Preparation

• *What do I want to know?*

1. Develop deeper understanding for the context, develop empathy for the end-user of this project
2. Understand what amount of 'ownership' ICU employees feel they have regarding sustainable change and waste management.
3. Learn what changes have been made/pushed by the green team.
4. How are sustainable interventions received by the team?
5. How are sustainable interventions implemented?
6. What moves ICU employees, what does their passion for their work come from?

• *Why do I want to know it?*

Figure out how I can best use this data that we have to activate sustainable change at the IC. What is relevant information for ICU employees, what would they like to see?

What emissions group should I focus on? What is something that they feel is important to change? Or what do they actually have a lot of impact on?

What moves ICU personnel, and similarly, what irritates them? How could I create nudges, activations that actually function.

• *What assumptions am I making about research, and knowledge (what are my theoretical and methodological positions)?*

I am aware of my inexpertise in the medical context and overall, and as such, present myself as a true outsider, just trying to understand a bit of the interviewees world.

• *What type of data would best answer these questions?*

Lots of interviews and own experience in the context

• *What type of data will I use to tell me what I want to know? (The answer to this and to the previous question is not always the same.)*

A little less interviews and a morning walk-along

• *How much data will I need?*

Two things:
1. Until the data is saturated (which might be too big of a challenge)
2. Until I have developed empathy and understanding for the context and understand

more about the status quo, also with the relationship of the Green Team and the overall ICU personnel.

• *How and from whom will I collect my data?, How will I access and recruit those participants?*

1 walk-along day, 2 interviews with green-team people, 1 interview with ICU nurse connected to the datahub & 1 interview with ICU manager. The data will be in 'themes' and then counted how many people mentioned that certain theme. I get into contact with these people myself, or get send through 'snowball effect'

• *How will I analyze my data in order to answer my questions?*

When possible I will record. When that is not possible (walk along) I will take notes.

• *What particular ethical issues do I need to consider?*

Be sensitive about patient data and overall anonymize everything.

• *Are there any pragmatic or practical factors that I need to take into account?*
When trying to schedule time with ICU personal, it is important to realize that their first job is to operate the Intensive care unit. The first job is to keep these people alive and nurse them back to health. Therefore, scheduling interviews can be unpredictable.

B. Interview codes

First 31/ 406 codes

Code	Grounded
○ behavioral change	11
○ Management support	7
○ Need for awareness	7
○ easy improvement	6
○ Infection prevention	6
○ resistance to change	6
○ environmental impact awareness	5
○ focus on patient care	5
○ Impact of product choice	5
○ importance of data	5
○ Difficulty in enforcement of changes	4
○ importance of sustainability	4
○ No workarounds	4
○ patient care vs. sustainability	4
○ protocol development by staff	4
○ Quality of care	4

○ Small initiatives	4
○ stepwise implementation	4
○ Substituting products	4
○ traditional practices	4
○ data-driven approach	3
○ Education for nurses	3
○ focus on waste reduction	3
○ Green team	3
○ Management responsibility	3
○ Medication production impact	3
○ Protocol adherence	3
○ Protocol-driven work	3
○ Staff behaviour	3
○ Together	3
○ willingness to participate	3

C. Interview quotes

COM component	**Barrier/ facilitator**	**Illustrative quote**
CAPABILITY – physical	Patient care & safety is priority (infection risk, quality care, time distribution) B	"..... sometimes I notice that my colleagues are really critical of it too. I also like that. To make sure it's not at the expense of patient care and that the time you put into separating a piece of plastic that that's not at the expense of the time you have for the patient, because there's already not that much sometimes." - Nurse 2 "That is also quite a difficult discussion because actually the real discussion is: what do we accept for infections to be less expensive or more sustainable, to use less plastic. Only we are not there at all yet. Get it? That's a bit of an ethical discussion, maybe." - Man
	Actions guided by protocols & regulation F+B	"We never wrote our protocols with green glasses, so most of the gains are actually... If you were to go through your protocols again with a green comb or green glasses and say (...) Is there evidence for that, is that how it should be?" - Man "And sometimes there are little rules in there that you think, yes, I think there is another way, but yes, You have to listen to the rules."- PhD
	Aware of big amount of waste F	"Have I been shocked over the past few years at what is wasted and thrown away and where there

		are actually easy gains to be made, so I think that is very relevant." - PhD
CAPABILITY – psychological	General awareness about sustainability F	"Yes if we continue like this the whole world will go to ***." - Nurse 1
	Lack of small impact awareness B	"… If you start looking at it completely at the micro level, no. I don't think my average colleague is aware the moment he pulls out an extra sail cloth mat. What kind of environmental impact that has." - Nurse 1
	Need for an actionable and effective process F	"Actually, making it successful is: When you get it into the behavior, but ultimately when your output of waste decreases, right? Because that's my goal. And that you're proud of that." - Man
OPPORTUNITY – physical	Need for transparent & data informed decision-making F	"So data gives you insight and then you have to bring in experts, preferably a couple of professionals to then say: Can you interpret that data? Do you have an explanation for it? and do we find this interesting to do it differently? Can we change the process then? But find that with data." - Man
	Need for user-centric change (avoid extra work, prevent issues) F	"So they actually need to have benefit from the change. So the trick is often to bring it in such a way that the person, the end user, that they see the benefit of the change." - Nurse 1
OPPORTUNITY – social	Soft culture with focus on people B	"Too forgiving and that's kind of the problem, you don't go into healthcare for nothing. A certain moral sense, you go into health care because you want to mean something to society and you try very hard to do that. Yes, and so you do bring up a certain type of human being, yes which is not necessarily tough and to the point and are all often People-people." - Nurse 1
	Importance of management support F	"You do need support for that, don't you? You then have to make sure you have enough support from the leadership team" - ICU nurse 1
MOTIVATION – automatic	Need for activating motivation & interest F	"If you can back it up with figures like: we can recycle 80% and it really does come back into the cycle and we save so much CO2. So then you really do get people on board and then they want to make an effort."- PhD
	No workarounds B + F	"No workarounds. So yes, because people choose the path of least resistance. And if your project or implementation requires resistance. And there is an opportunity to adjust it, they will do so at all costs." - Nurse 1
	Lack of incentive (extra work, busy,	"Now for example those bags from that dialysis machine now need the taps cut off before they are

MOTIVATION – reflective	no financial compensation) B	allowed in the [waste] bag. Well, that costs you 5 minutes. I have an opinion about that too yes, really terrible, inconvenient, really very inconvenient and it costs us more time." - Nurse 2
	Resistance to change B	"There's always a group of 10, 20% that won't do it anyway. Those sorting waste bins that are now in the department, they deliberately throw other products in with the plastic, because they have seen that the cleaner throws all those bags together anyway. Yes, then I think yes, guys, so lame this, you understand? And so you always get backlash." - Man

D. Environmental impact source datasets

Source of Emission	Description	Key Variables	Unit	Source dataset(s)	Frequency of Data Collection
Medical products	Emissions & purchase data from medical products	Product Name, Category, Amount Ordered	[n]	Inventory purchasing dataset 2019	Monthly
		Mass, Emission Factor (per Category)	[kg] [kgCO2-eq / kg]	Material flow analysis (N. Hunfeld et al., 2022)	-
		Mass	[kg]	Manual Weighing	-
		Emission factor	[kgCO2-eq / kg]	LCA Sources	-
Medication	Emissions & waste data from medication production and use	Medication Type, time, patient, Amount prescribed	[mL], [mL/h]. [mg], [nr]	Electronic Health Record (HiX)	Live

		Medication Mass, packaging Mass	[kg]	Research done by PhD Jasper (not published)	-
Radiology research	Emissions data from radiology research activities	Radiology appointment type, amount, date, time	[n]	Electronic Health Record (HiX)	Live
		Emission factor	[kgCO2-eq/scan], [kgCO2-eq/kWh]	LCA Sources	-
		Elecricity use - average	[kWh/scan], [kWh/time standby]	LCA Sources + radiology department	-
Laboratory tests	Emissions data from laboratory testing	Amount of lab-tests done, type of test	[n]	Electronic Health Record (HiX)	Live
		Emission factor	[kgCO2-eq/testbatch]	? De groene bevalling	-
Commuting ICU employees	Emissions data from general employee commuting (not department specific)	Transport Mode, Distance Traveled	[Km], [transport mode]	HR dataset	Yearly?
		Emission factor	[kgCO2-eq in gram/km]	Milieu Centraal	-
Energy use ICU	Energy consumption data for ICU units	Energy Type, Consumption Levels	[kWh per m2]	Utility bills	Yearly
		Square footage ICU, nr of rooms	[m2], [n]	ICU dataset	-
Energy use	Energy consumption data for medical devices	Device Type, amount, time in use, time standby	[n], [min]	Device information	Monthly

medical devices	Energy consumption	[kWh/time active] [kWh/time standby]

E. Iteration dashboard visualizations

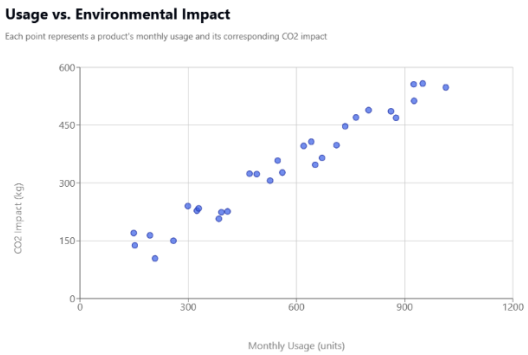
Step	Plot	F	T	O	Total	Key Strength
1. Identify Hotspots						
	A. Environmental Impact by Category	5	4	5	14/15	Clear comparison of multiple impact types per category
	B. Usage & Impact Trends	3	4	3	10/15	Shows seasonal patterns but less direct for hotspots
	C. Usage, CO2 & Cost Trends	4	4	3	11/15	Links multiple metrics but complex for quick hotspot ID
2. Understand Factors						
	A. Environmental Impact by Category	3	4	4	11/15	Shows impact distribution but not underlying causes
	B. Usage & Impact Trends	4	4	4	12/15	Good for identifying seasonal patterns and relationships
	C. Usage, CO2 & Cost Trends	5	4	3	12/15	Excellent for understanding multiple driving factors
3. Establish Goal						

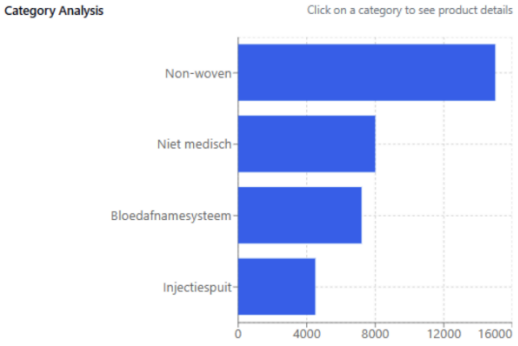
	Progress Towards Target	5	4	5	14/15	Clear visualization of progress vs target with projected path
4. Motivate & Communicate						
	A. Recent Impact Stories	4	3	5	12/15	Narrative approach with concrete examples
	B. Monthly CO2 Saved	3	5	5	13/15	Simple, impactful single metric with icon
	C. Biggest Impact Reduction	4	3	5	12/15	Clear highlight of major achievement
5. Act						
	A. Active Interventions	5	3	5	13/15	Clear actionable steps with practical tips
	B. Today's Priority Actions	4	3	5	12/15	Immediate attention items with context

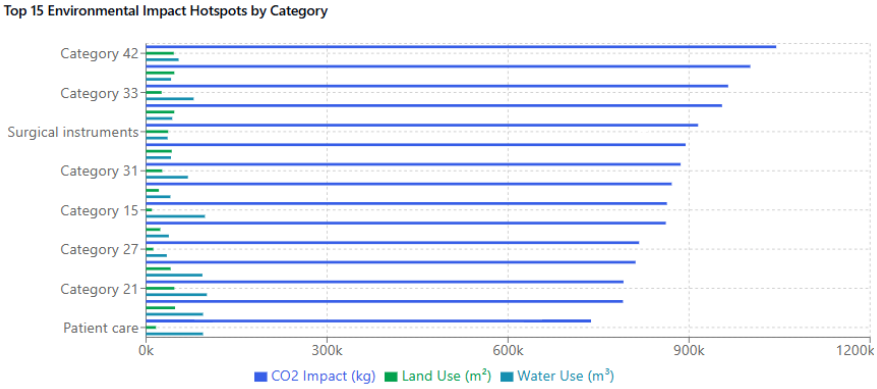
Scoring Key:

- F (Functional): How well it serves the step's purpose
- T (Technical): Data clarity and integration capability
- O (Operational): Ease of use and interpretation
- Total: Sum of scores out of maximum 15 points

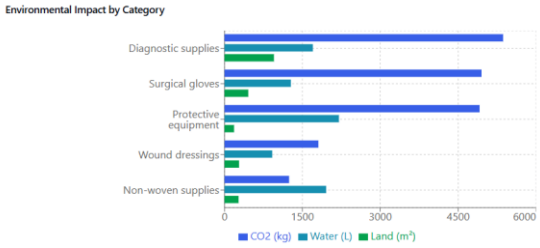
1 Identify Hotspots

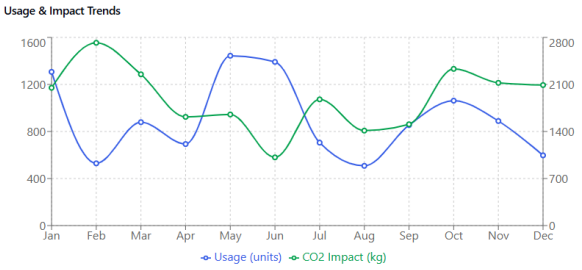


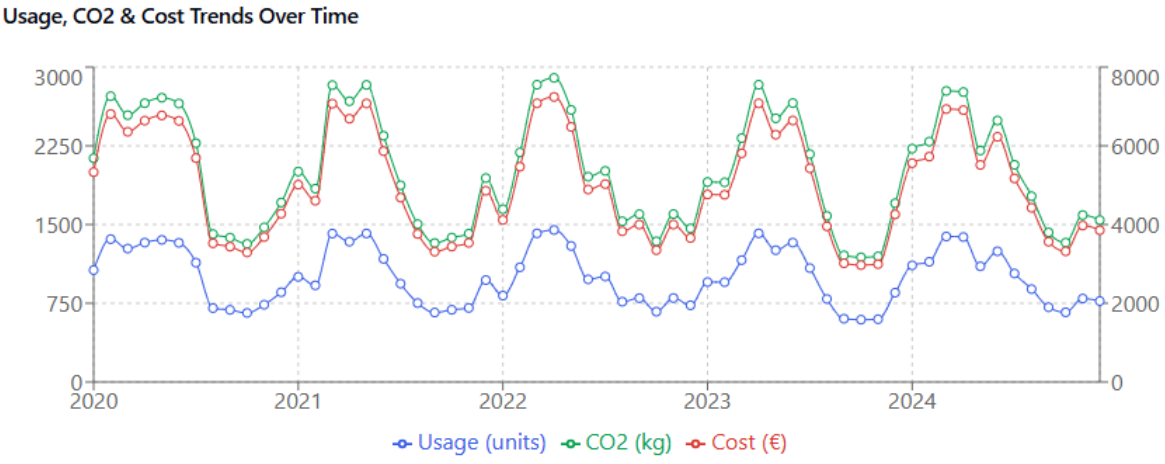




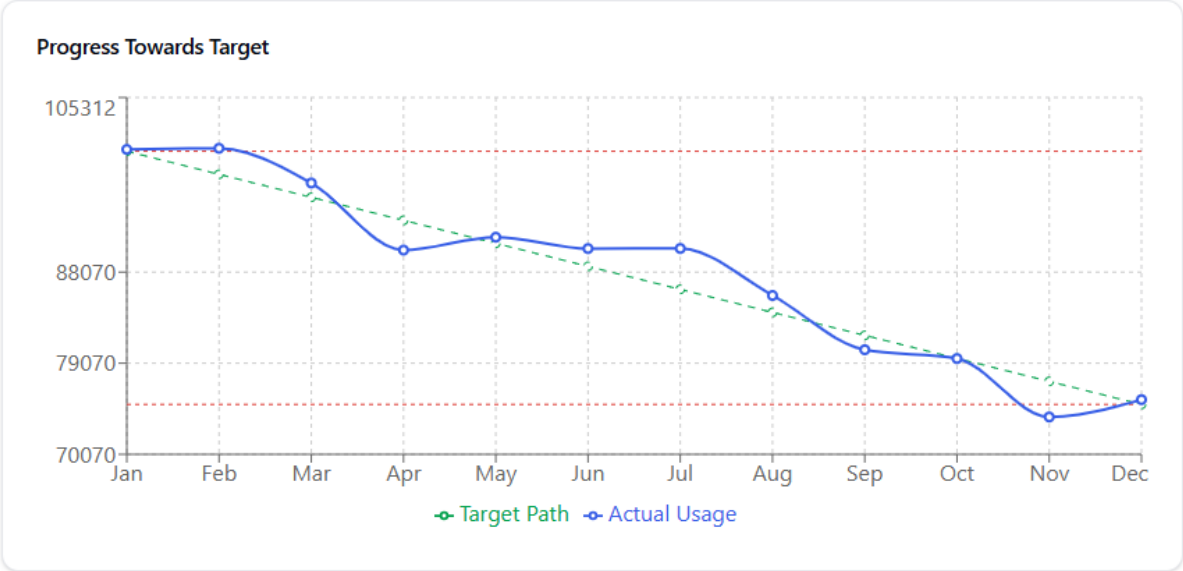
2 Understand Factors







3 Establish Goal



4 Motivate & communicate

Recent Impact Stories

Alternative Suppliers Initiative

Switched to local suppliers for non-woven materials, reducing transport emissions by 45%

This month

Packaging Optimization

Reduced packaging waste in surgical supplies by 28% through optimized sizing

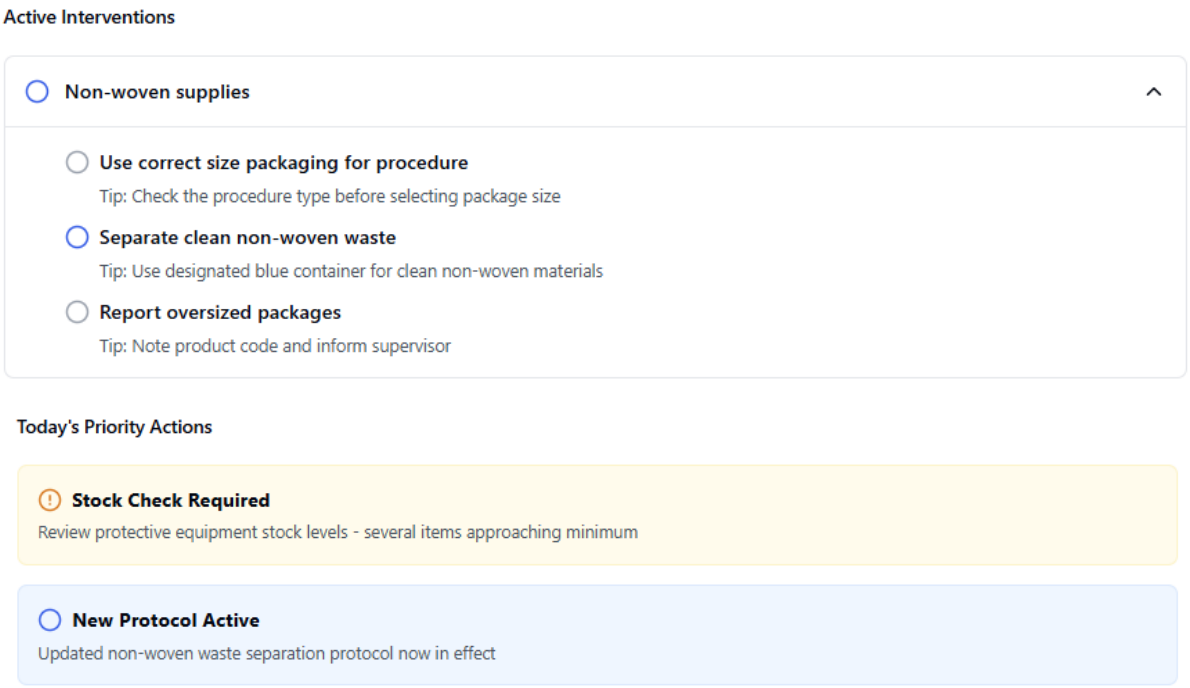
Last month

Biggest Impact Reduction

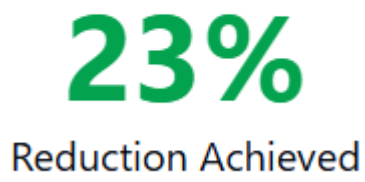
Non-woven supplies

Reduced environmental impact by 34% this year

5 Act



6 Measure Progress



F. Test plan Dashboard

Task based usability test:

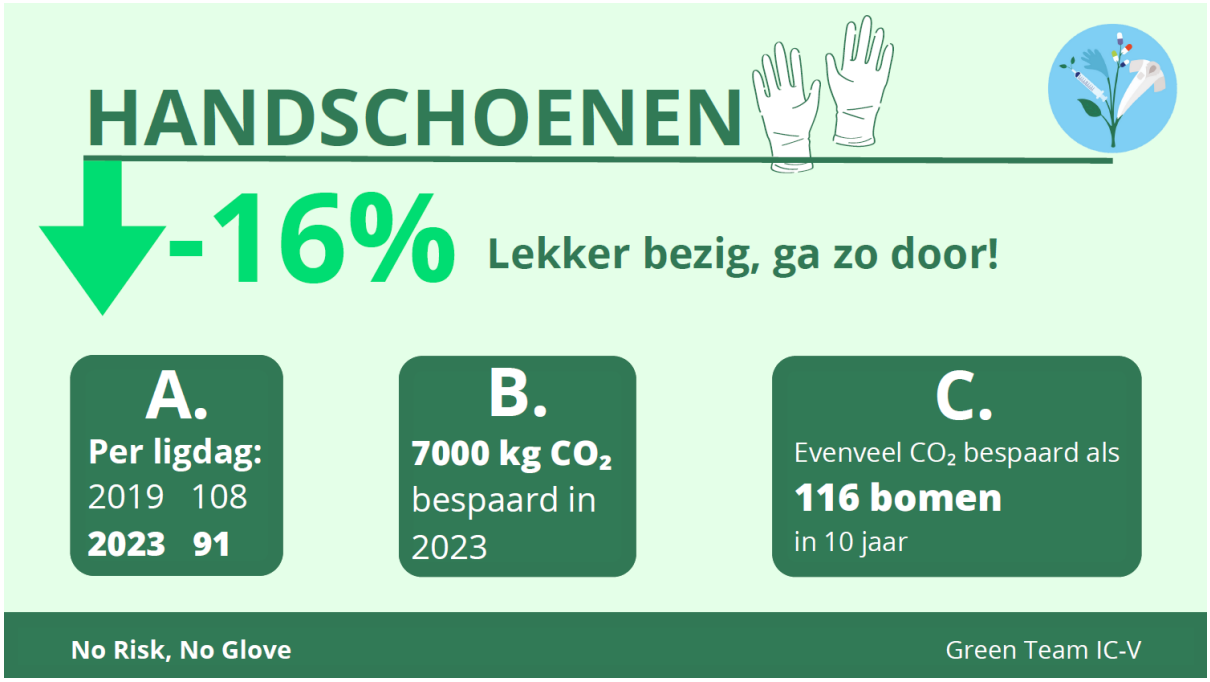
Tasks:

1. Find out how many injection needles were used in 2023 and which type was most used
2. Find out how many kg CO2-equivalent was emitted from using (research) gloves in the IC? Per hospital day?
3. Try to explain the underlying factors for the data you can find about Operating Room clothing
4. Which category of medical products is used the most in total?

Feedback prompts:

2. How would you use this dashboard in your regular Green Team activities?
3. Can you give an example of how this data might change how you choose or plan sustainability projects?"
4. What's missing from this dashboard that would make it more useful for you?
5. How would you use this information to explain sustainability initiatives to other ICU staff?
6. What would you most want to compare using this dashboard - different products, time periods, or something else?
7. What additional features would make this dashboard more valuable in the future?

G. Test Campaign metrics



Wat vond je van de boodschap in **A.** ?

Plak een sticker op de juiste plek:

Demotiverend	Neutraal	Motiverend

In hoeverre maakt **A.** je bewuster van je handschoengebruik?

Plak een sticker op de juiste plek:

Niet bewuster	Beetje bewuster	Veel bewuster

Wat vond je van de boodschap in **B.** ?

Plak een sticker op de juiste plek:

Demotiverend	Neutraal	Motiverend

In hoeverre maakt **B.** je bewuster van je handschoengebruik?

Plak een sticker op de juiste plek:

Niet bewuster	Beetje bewuster	Veel bewuster

Wat vond je van de boodschap in **C.** ?

Plak een sticker op de juiste plek:

Demotiverend	Neutraal	Motiverend

In hoeverre maakt **C.** je bewuster van je handschoengebruik?

Plak een sticker op de juiste plek:

Niet bewuster	Beetje bewuster	Veel bewuster