Junction X Hackathon

Team GreenPurge

Written by:

Istvan Bosznai

Zsofia Peter

Tamas Polgar

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Chosen challenge

"Increase sustainability and environmental awareness within big cities"

Executive summary

The team decided to focus on optimizing energy consumption due to the fact that the trends suggest that the energy consumption of citizens will increase in the future by shifting toward using electric cars, electric micromobility solutions and other devices that use electricity. However the investment in renewable energy is increasing, still storing the produced energy and optimizing energy usage is an issue. Renewable energy is generated when the sun is shining or the wind is blowing, but the demand of the energy is not aligned with it. Our solution is focusing on bridge the gap between renewable energy production and energy consumption. It would serve as a platform that connects end consumers with energy providers. With the help of our service, energy providers would have partial control over the energy consumption of end users and scheduling the operation of given domestic machines would be possible via the platform, in order to balance renewable energy generation and usage.

How exactly?

When renewable energy production is high, energy trade companies would have the option to increase the demand among households, by automatically controlling their smart devices directly via our platform. For example, Anna gets ready in the morning, loads the washing machine, the dishwasher, and at the same time she has her robot vacuum cleaner on the station area. She leaves for work at 7 am with an electric car, and comes back at 5:30 pm. She parks her electric car at her workplace and connects it to the charger. Before she leaves the washing machines and dishwasher are already loaded, battery operated devices are connected to the charger however they're not under power yet. During the day, around 1-2 pm when the sun is shining, solar energy is being generated. With the help of our system, her smart household devices and electric car communicate with the energy trade company via our platform and get a green light by the trade company and start the washing cycle, charging the vacuum and the electric car battery, just when the renewable energy is generated.

The energy trade companies would have bigger control over the energy mix, and if excess renewable energy occurs they can sell it for citizens instead of wasting it. Based on our research 6% of solar energy, and even more wind energy (in some cases 60%) is lost due to mismatch in production and demand. We would motivate end-users to use our platform by applying dynamic pricing. Energy would be cheaper using our system, since renewable energy costs less than energy generated by gas, coal or other fossil fuels. Our customers are the energy provider companies, our key partners are household electric device manufacturers, and electric car manufacturers. Our solution requires no hardware components in most cases, since new devices are already equipped with digital communication interfaces, however we need to agree with the manufacturers that they sell their devices compatible with our service. During our research we could not find any competitor with such a solution.

Refining the problem area

The first task was to identify which of the major issues present in a big city should the team work on. The issues we identified were the following:

- Recycling
- Air pollution
- Power consumption
- Water consumption

*1

According to our research, the biggest contributor to CO2 emission is the Energy industry and in that electricity generation with 21%, and Road transportation is only half of that. This is why the team decided not to focus on road transportation. Also with electrification (Electric cars, electric scooters, etc.), the trend in big cities is that air pollution is steadily declining. With this, the use of electricity is steeply increasing!

- Recycling
- ~~Air pollution~~
- Power consumption
- Water consumption

The water consumption in the world comes mainly from agriculture. According to a study done by Statista, the 71% of water used is consumed by Agriculture and 15% is used by industry. This made the team conclude that the water consumption in Big Cities are out of the scope.

- Recycling
- ~~Air pollution~~
- Power consumption
- ~~Water consumption~~

This left only recycling and electric consumption in our search fields. Plastic waste is mainly coming from packaging including: food, beverage, product packaging. Since food packaging is a category where recycling is not always possible, and plastic bottle recycling in big cities are mostly solved, or controlled by government laws we decided that this topic is also not in the scope for the team.

- ~~Recycling~~
- ~~Air pollution~~
- Power consumption  Chosen focus area
- ~~Water consumption~~

*All statistics and data can be found at the end of the document, see appendix.

Problem and Solution

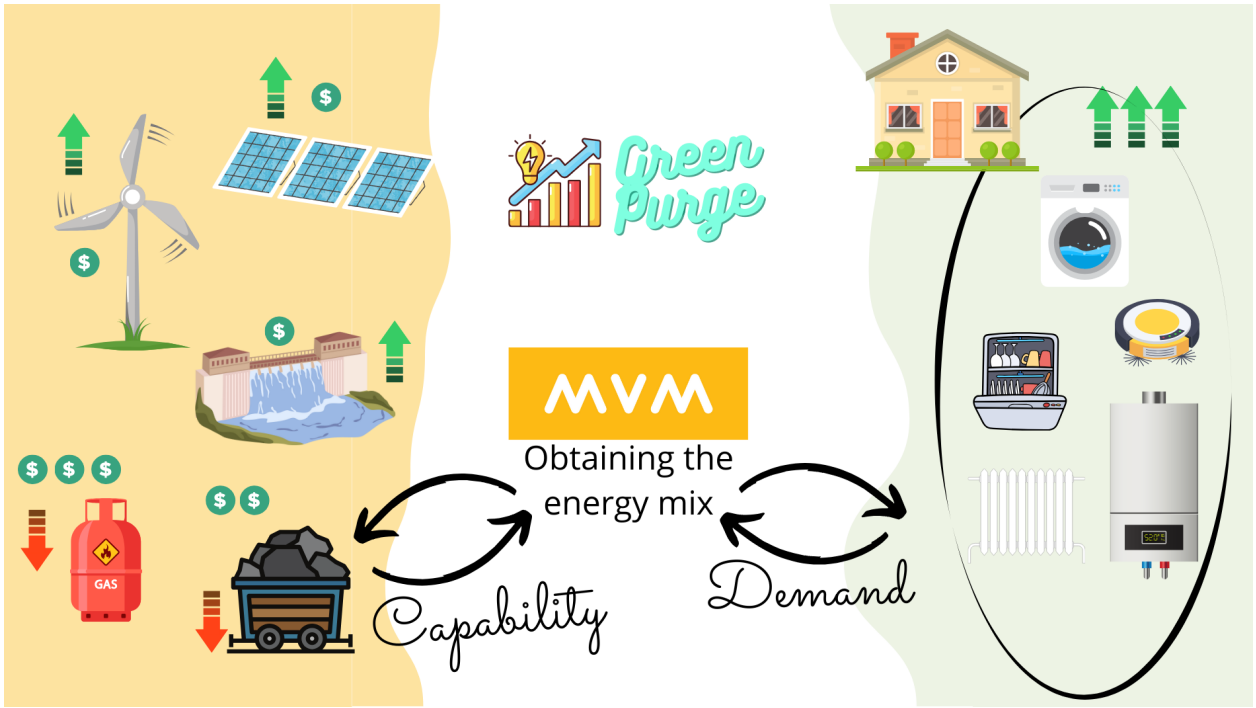
Problem Description

"Meanwhile, in Germany 150 GW hours of wind generated electricity was lost in 2010 during the course of a year."

Renewable energy is only available when the circumstances are met (sun is shining, wind blowing, etc.) It cannot be controlled, and storing excess energy is often very expensive and highly polluting (batteries). So the available renewable energy is unpredictable and fluctuates. This creates often wasted energy, since the end-customer's consumption is not tied directly to renewable energy production. This wasted energy costs the grid operator extra money (they need to utilize more expensive solutions, like gas), the energy farm (they cannot sell the wasted energy), and the consumer who needs to pay a higher price for the electricity.

Problem Solution

We are building a demand-based renewable electricity trading system that balances energy production and consumption.



Our proposed solution would serve as a platform that connects end consumers with energy providers. Energy providers would have partial control over the energy consumption of end users (household machines, electric cars) and charging/ operation scheduling would be possible via the platform, in order to balance renewable energy generation and usage. Our platform and a communication protocol in which the energy trade company can turn on-and-off each individual household appliance, usually the ones that consume a lot of energy. This platform is operated by our company, and we generate revenue by licensing it to energy trade companies, meanwhile end users only have a smaller one-time upfront costs when buying smart household items, otherwise they use the app for free, therefore we can reach a high amount of users. Using this solution the grid operator can increase the power demand when there is abundance of renewable energy available. This way the solar / wind farms can sell their energy to the grid operator, the grid operator will use the cheaper and greener energy, and sell it to the customer (with profit) and the end customer can get the energy cheaper than usual by a dynamic pricing model. In this solution all 3 participants have their own benefits, and they all can profit from this ecosystem. The grid operator uses AI to learn the patterns optimal for generation - and - consumption optimization. Our end-user target customer segment are those who live in an urban environment, do not have the possibility to buy their own solar panels. Our solution can be easily integrated into all new, smart devices that already have the possibility to turn them on and off remotely, therefore no additional hardware components would be necessary.

Business model (Lean Canvas)

PROBLEM
Renewable energy availability depending on external circumstances

Electricity storage is extremely polluting (batteries)

Available renewable energy is unpredictable and fluctuates

End customer electricity consumption is not tied directly to renewable energy production

EXISTING ALTERNATIVES
Smart home devices (end consumer can switch on and off based on energy price probably)

SOLUTION
Our proposed solution would serve as a platform that connects end consumers with energy providers. Energy providers would have partial control over the energy consumption of end users (household machines) and scheduling would be possible via the platform, in order to balance renewable energy generation and usage.

KEY METRICS
Nr. of energy providers

Nr. of users

Nr. of manufacturers, key partners

UNIQUE VALUE PROPOSITION
End users: Cheaper, greener energy without huge upfront investment

End users: Possibility to make a conscious decision to use renewable energy

For electricity providers: they will have bigger control over electricity usage, and they do not need to sell (a lot of times for free) extra energy when renewables overgenerate

For electricity providers: they can increase the energy consumption of citizens in the time when they can buy the most amount of cheap renewable energy, therefore they save money.

HIGH-LEVEL CONCEPT
We are building a demand-based renewable electricity trading system, that balances energy production and consumption.

UNFAIR ADVANTAGE
Based on our research, no other solution connects the end user's smart devices directly with the electricity provider to optimize renewable electricity usage.

CHANNELS
B2B: Direct sales to energy trader companies

B2C, end users: via energy trader companies and key partners, such as household electric device manufacturers

B2C, end users: social media

CUSTOMER SEGMENTS
Citizens in an urban environment who do not have a possibility to use their own renewable energy

Those who live in a house, but do not have the possibility to invest in own renewable energy

Electricity trader companies

Key partner: Household electric device manufacturers (Washing machines, refrigerators etc..)

EARLY ADOPTERS
People who are well educated, tech-savvy, 30+ years old who have money to buy higher end electronic devices, lives in the city, who care about environment protection

COST STRUCTURE
Platform development

Platform maintenance, cyber security

HR costs (sales, management, development, operation etc.)

REVENUE STREAMS
Primary revenue source: license fee for the technology and platform for energy trader companies, like MVM

Secondary revenue source: licensing software technology to household electric item manufacturing companies, like Bosch

Calculations for addressable market

Solar energy wasted annually:

Definition: *When, the solar farms make more energy than the grid can use, and some panels are simply turned off.* *6

According to a source in the US 6% of the produced Solar energy was wasted in 2022. If we calculate that percentage of the total produced energy worldwide than we get:

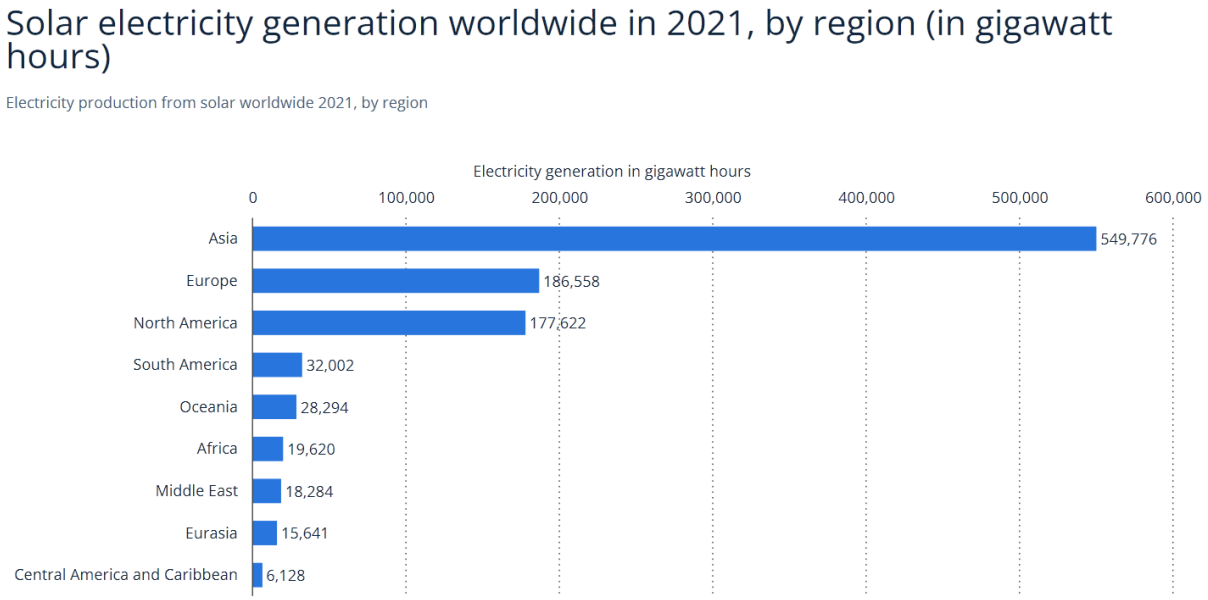
$$1,030,000GWh * 6\% = 61.8TWh$$

This 61.8 TWh wasted is equivalent to a total:

$$61.8TWh = 61.8 * 10^9 kWh$$

$$1kWh = 0.04USD$$

$$61.8 * 10^9 * 0.04USD = 2.47BillionUSD$$



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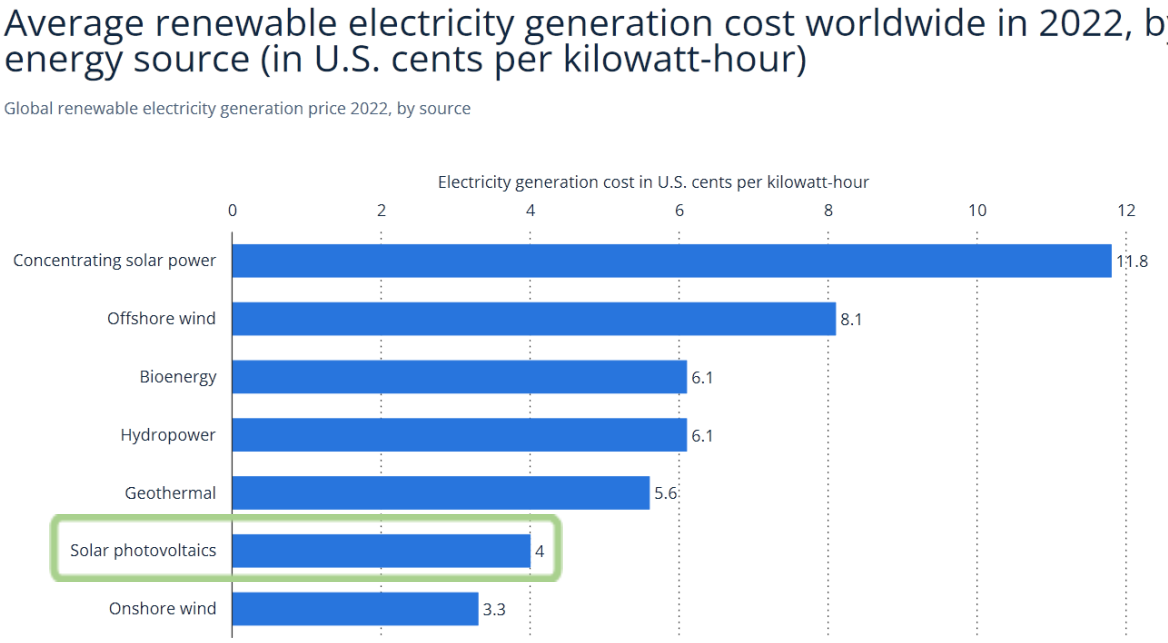

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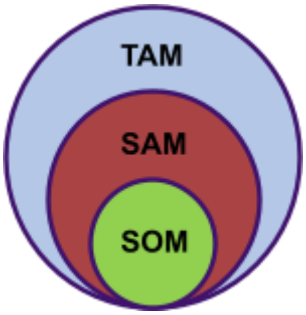
Addressable market



TAM: Revenue generated from Solar power + Wind power

SAM: Revenue wasted from power not sold due to lack of demand

SOM: The same as above but in cities

We decided that our total addressable market is the revenue generated by solar and wind energy globally, annually. Our serviceable available market is the energy that has not been used, due to the lack of demand in the time of energy generation. Our serviceable obtainable market is the unused energy in cities, since we are focusing on end-users who do not have the opportunity to own solar panels, mostly living in apartments.

Due to time limitations and the lack of available data we could not calculate exact numbers, but we could calculate that 2.47 billion USD lost yearly only by the fact that the panels generated more energy than the current consumption. When we look at the wind energy, the numbers are even higher, in some cases over 60% of the generated energy was lost, however we could not find data regarding average energy loss.

Competitor analysis

Schneider Electric

Pulse: The heart of the electrified home. A smart electrical panel powered by embedded technology, functionality, and intelligence to **interconnect various energy sources within the home**. This solution has already been recognized for its innovation with awards from Time, Fast Company, and Green Builder, among others.

Boost: The home **battery for energy storage**. Store solar energy during the day and use it during peak rates for utility bill savings and to keep home power flowing during an outage.

Inverter: The **high-power hybrid inverter** for solar and storage. Converts solar energy output into usable AC electricity.

Charge: The **electric vehicle charger**. Leverages onsite solar and storage to boost charge speed and reduce charging costs.

Home: The single app to control it all. **Monitor, control and automate** whole home energy management through one easy-to-use application.

Robert Bosch

"Our goal is to enable private households to use more of the solar power they generate themselves. That's why we developed the software."

Energy Manager was shoehorned into the palm-sized Bosch Smart Home Controller. It **connects with the photovoltaic system to intelligently and automatically distribute solar power throughout the smart home.** Household appliances take precedence. Once they have all the power they need, the energy flows to the heat pump, with any remaining surplus going to the battery for storage.

IContrAll

Control shades, lighting, sockets, cooling and heating systems and reduce energy consumption! With iContrAll's smart features, saving energy is easy and automatic.

Energy Star

Through SHEMS, energy consumption is simplified by:

1. Facilitating a schedule for your smart devices to operate
2. Suggesting energy saving actions based on usage patterns
3. Automatically controlling smart home devices based on room or home occupancy

ENERGY STAR product categories: Smart Thermostats, Room Air Conditioners, Refrigerators, Freezers, Clothes Washers, Clothes Dryers, Light Bulbs ,Light Fixtures, Dishwashers, Pool Pumps, Electric Vehicle, Chargers (AC-Output), Ceiling Fans, Commercial Ice Machines

Legal environment

Transaction Structure *8

There are three basic options when structuring a consumer-scale solar arrangement. One is a PPA or power purchase agreement, one is solar system ownership, and another is solar energy system leasing. Each of these offers pros and cons, but you will have to determine what best suits your needs.

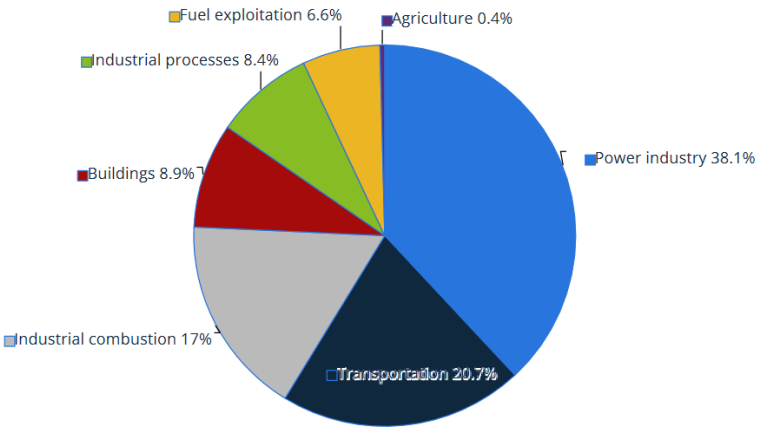
Energy Regulation

If you begin to generate solar electricity, you may become a regulated utility. This is determined based on where the power is generated or where it is sold. This is something that is considered jurisdiction-specific, which means that you need to find out from your local area what the rules are.

Appendix

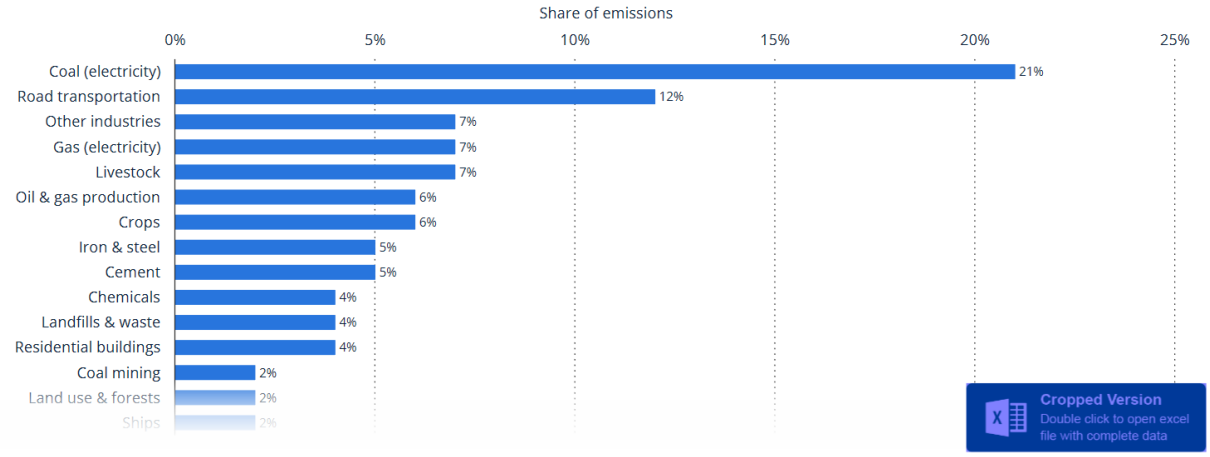
Distribution of carbon dioxide emissions worldwide in 2022, by sector

Global distribution of CO_2 emissions 2022, by sector



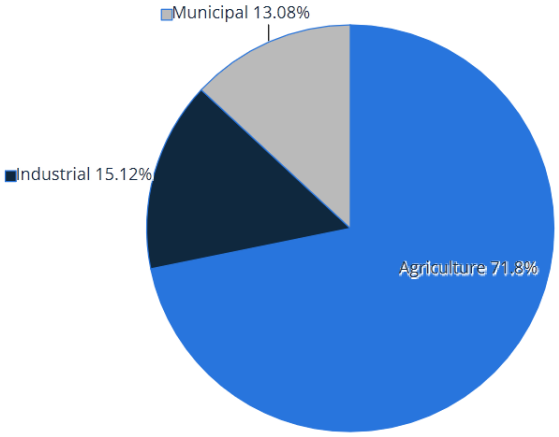
Distribution of greenhouse gas emissions worldwide in 2021, by subsector

Share of global greenhouse gas emissions 2021, by subsector



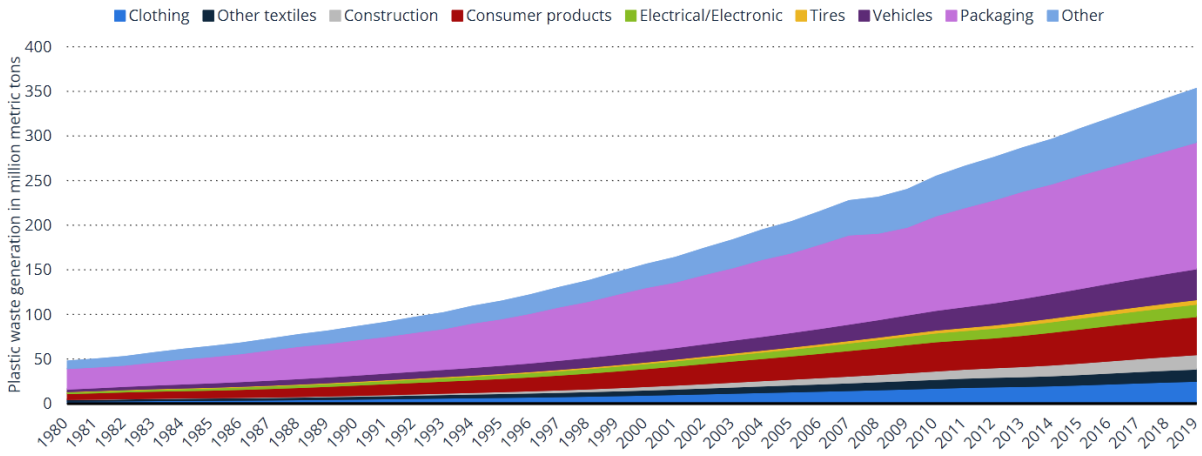
Distribution of water withdrawals worldwide as of 2020, by sector*

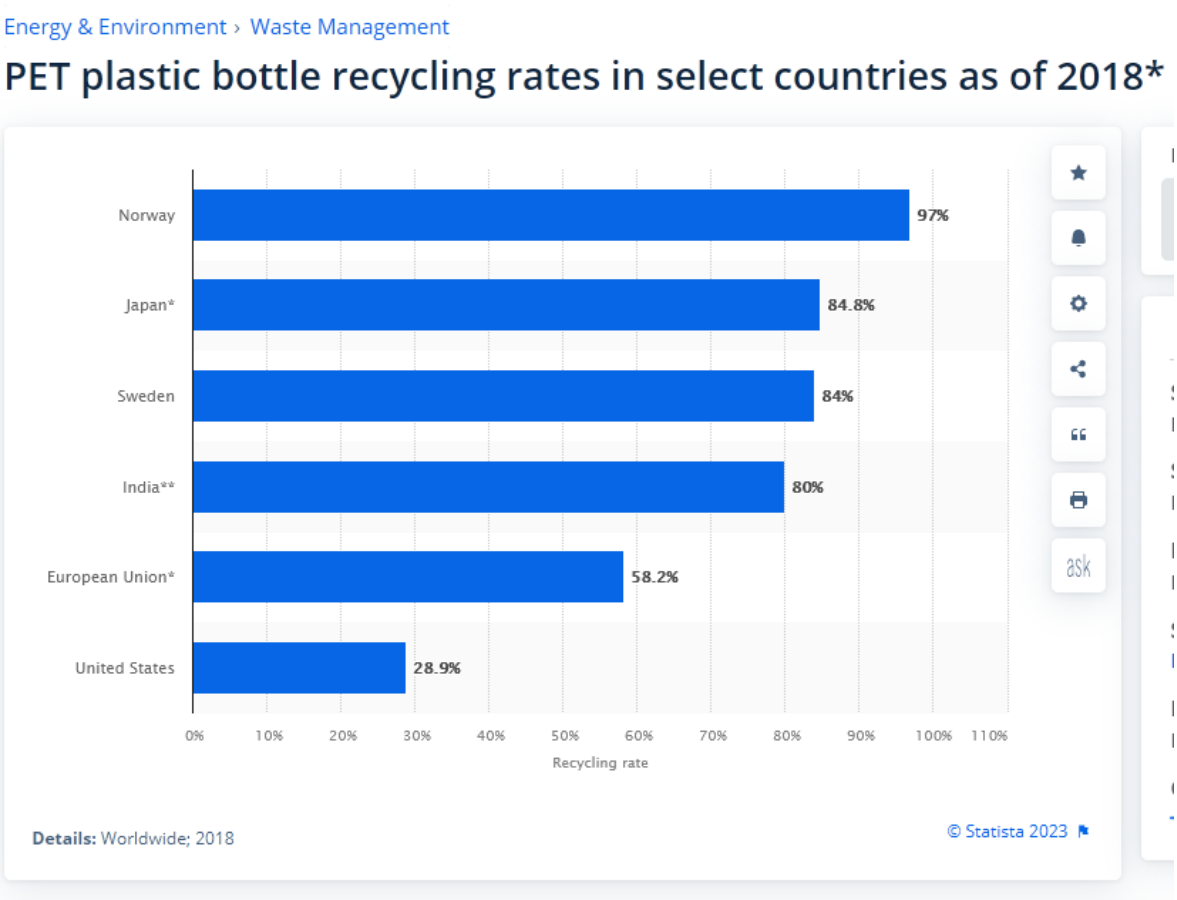
Breakdown of water withdrawals worldwide 2020, by sector



Plastic waste generation worldwide from 1980 to 2019, by application (in million metric tons)

Plastic waste generation worldwide 1980-2019, by application





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