



INTERNATIONAL  
HELLENIC  
UNIVERSITY

## **Sustainable Production and Consumption**

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Project Team

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### **Coursework Project**

"Developing a sustainable new service for books reuse and recycling"

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## Step 1: Describe the use context

### Introduction

#### 1. Envisioned service description

A lot of people find it difficult to find a place to dispose of the books they no longer need and can be used again, so they should not be recycled or books that are in poor condition and of low value that need to be reprocessed and turn into raw material or waste.

The service we have envisioned is provided by a company, designed to collect used and second-hand books, classify them and reuse or send them to recycle, according to their condition and value. The project aims to collect books through predefined spots in schools, public services and specially selected private stores, operating in book retailing. After gathering in the company's warehouse, the books will be sorted out and, according to their utility, value and state, they will be processed and promoted for reuse, resell and offer or they will be sent to be recycled, turning them into waste paper and books into useful material.

The service is destined to be used literally from everyone. Individuals who are looking for a place to dispose of their old books, public services to recycle paper, libraries to get rid of old, bad in shape, books. Furthermore it can be used by people who might look for a certain copy of a book no longer available, or of a specific scientific background, who will now be able to search through the company's database. Recycled material can also be used by factories that process waste to produce energy, as electricity.

The company's operation will depend on the input flow of books, the amount of books that are collected per year and the company's capability to process them. The book collection will be performed in the metropolitan area of Athens, but the company's database will be available online for users throughout Greece, making possible resell in the whole country.

From all the above, it is obvious that the actual value this service will provide to the user, is absolutely justified to the environmental profile it is built upon, assessing the impacts caused to the environment along its life cycle.

#### 2. Service design methodology

Service design is ruled by general principles that focus on the designer's attention on generic requirements of the service. These are complemented by principles that relate to process design, organizational design, information design and technology design. A successful method of service design is important to be employed, as the service will be user-friendly and relevant to the customers, while being sustainable and competitive for the service provider.

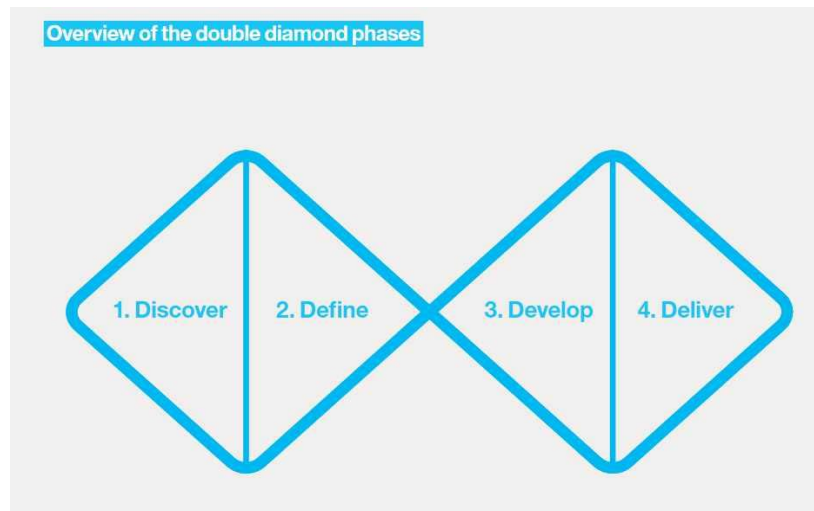
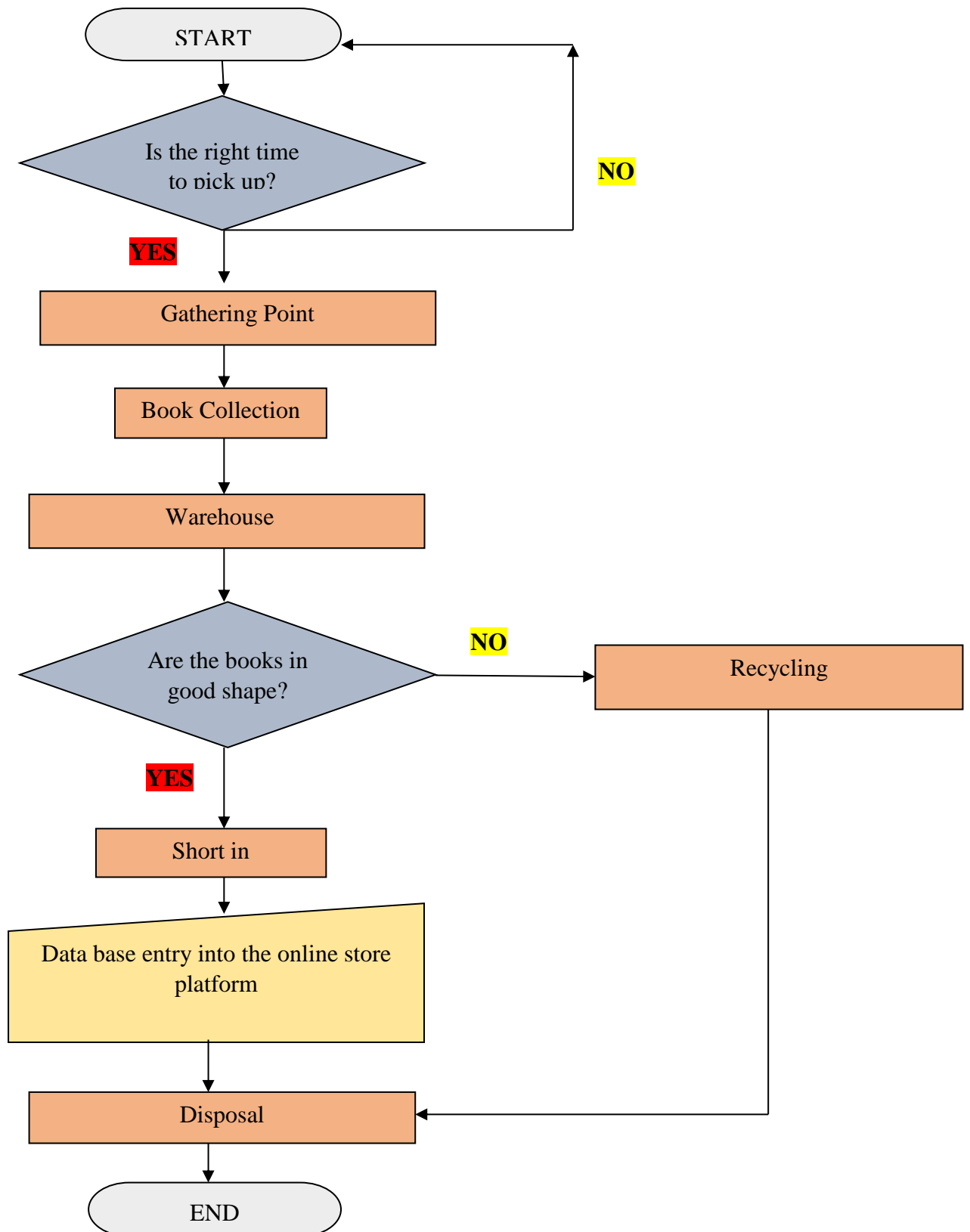


Image 1 the double diamond design process, Design Council

The design process is divided into the following steps: discover, define, develop and deliver. During the discovery phase, we identify the opportunities, needs and problems and try to define a solution through the service we have envisioned. Qualitative and quantitative research tools are used in order to create a knowledge bank, with further analysis of the social and financial trends. At the next step, we analyse our findings and synthesize our service, defining in parallel a net of all the stakeholders. Next, we implement our vision into a service, possibly testing our concept with end users.

The initial design is tested and the outcome is expected to be included in the final service, leading to a robust implementation. Finally, at the deliver phase, the final concept is finalised, available to the market and already able to gather feedback, which will again be used to modify and improve certain aspects of design and work. Designing methods include stakeholder mapping, idea generation, brainstorming, service blueprints, customer lifecycle maps, business models and a huge variety of other tools and methods, according to the company and the special character of the product or service we wish to create.

Step 1: Describe the use context



## Step 2: Create an overview of the environmental impacts.

### Aim

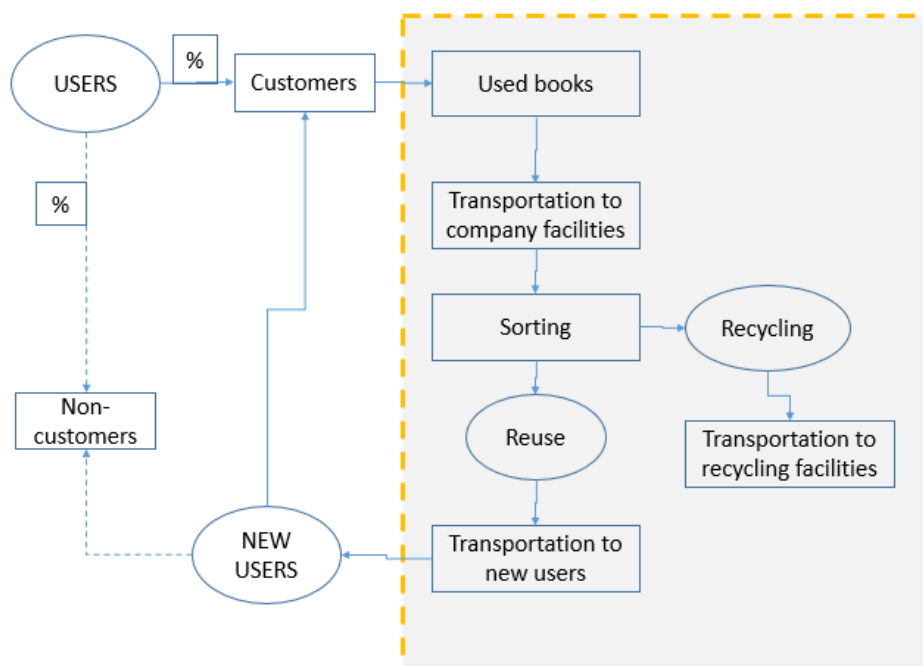
The findings of the project at stake are intended to be communicated and marketed to the great possible extent within Greece in order to raise the environmental awareness of readers and, if feasible, of consumers in general regarding the paper deriving from books. Specifically, it aims at convincing them, based on specific quantifiable figures, to overcome any reservations cultivated by some sources of information regarding the dubious, according to their submissions, utility and benefits of the cyclical economy's logic. So, from that perspective, in essence, it pursues to make fully intelligible the extensive environmental impacts of fully adopting an attitude directed to books recycling and re-usage in comparison with a stance supporting the books single usage, which at last culminates in useless material, namely in unexploited wastes.

This comparative study is expected to totally demolish the argument that books' recycling and re-usage constitute exact the same pollutants as the respective procedure to produce books from scratch. From that point of view, it is strongly believed that its release will not only advertise the commercial venture of our company, but its eco-profile, as well, which is our greatest investment for its future further development, based primarily on its social responsibility.

### Scope

The scope of the system is mainly defined by the system boundaries and the functional unit as described in the following lines:

### System boundaries



## Functional Unit

According to the LCA ISO Standard, the functional Unit should be a clearly quantifiable figure related with the function operated by a company. On the basis of the aforementioned definition and taking into account that the principal function of our company is mainly to sort books for further re-usage, as functional unit is determined:

**One (1) ton of books sorted for re-usage.**

An overview of the service's life cycle and possible significant environmental impacts:

Environmental impacts 1ton of book
<ol style="list-style-type: none"> <li>1. Pollution, if books/paper are not collected.</li> <li>2. CO2 emissions from machinery, trucks, fuel, disposal</li> <li>3. Energy consumption, i.e. electricity.</li> <li>4. Positive impacts: better waste management, saves forests and other natural habitats, "Green" warehouse, renewable resources for energy needs.</li> <li>5. Recycle of paper</li> </ol>

Raw materials	Books, reused, second-hand. Paper
Manufacture	At the company's production facilities. Warehouse for book storage, workers to assess the condition of the books.
Transport	To start with, from the spots of collection, to the company's facilities. Then, after process, to the end user or to the recycling companies.
Use	Resell to clients, offer to students if the value is low/condition is poor, or sent to recycling companies.
Disposal	Re-use Recycling Factories that process waste

### Step 3: Environmental profile of the company

#### Meco - Matrix

	Material	Manufacture	Transport	Use	Disposal
Materials	2,2 t of wood needed for 1 t paper		Trucks Packaging		Reuse books/ Recycle
Energy	Processing of recycled paper, not new raw material	Energy consumption, i.e. electricity	Fuel, according to frequency of collection. Also the embodied energy of the trucks	“Green” warehouse, renewable resources for energy needs	Energy consumption in the factories that process our waste
Chemicals		CO2 emissions	Biodegradable truck lubricants		CO2 emissions, chemicals used to recycle.
Others		Corporate Social Responsibility		Reuse of the books	Improved waste management



## Step 4: Stakeholder Network.

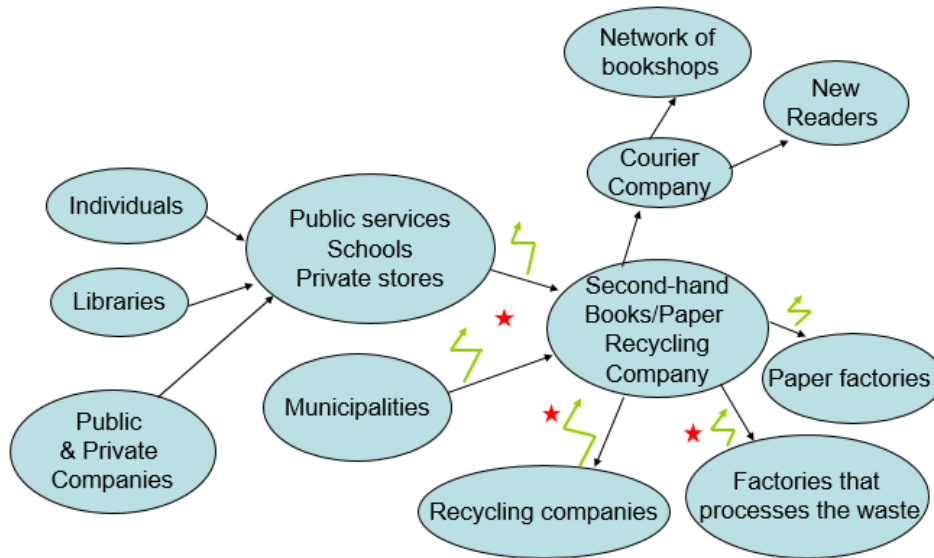


Figure 1. Stakeholder network map of the Second-hand books & Paper recycling Company

The stakeholder network is a very important task for this project. A reduced environmental impact lies on a suitable choice of the several partners and the good cooperation between them. With ambition to constantly improve and evolve corporate goals, company plans, include collaborations with specific goals.

### Future Potential Synergies

Working with a network of Bookshops	➡	Promotional Plan <b>Hand to Hand</b>
Cooperation with recycling companies	➡	Extending activities to other areas of Greece
Participation of municipalities	➡	Involve the municipalities at the stage of collection

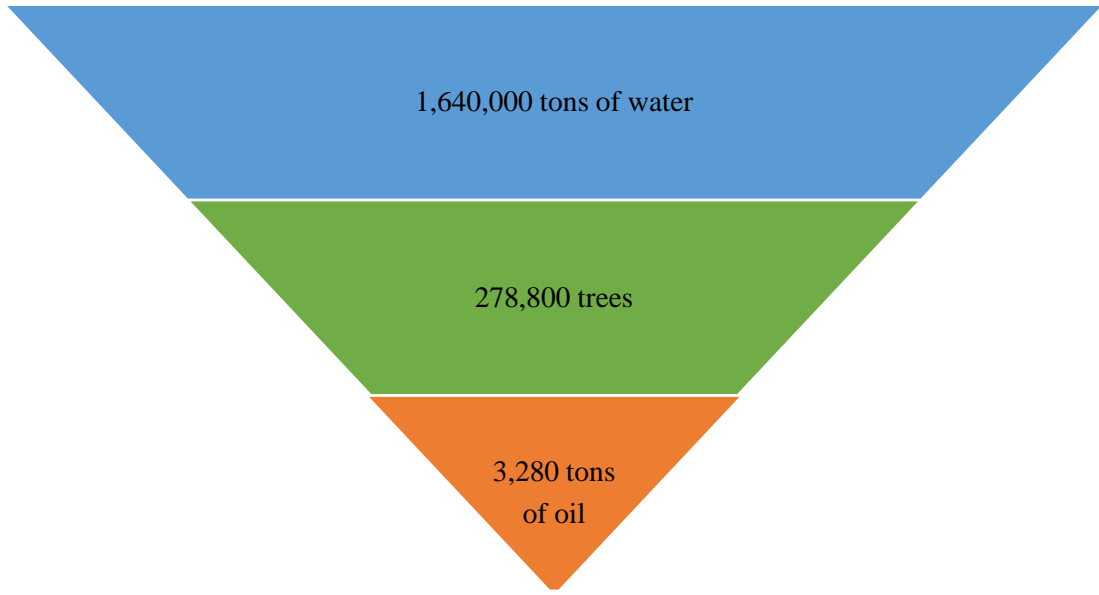
## Step 5: Quantification.

### Book collection weight target

Book Category	Reasoning	Books/paper in tons
Individuals	Every year in Greece each student (Primary - High School - Lyceum), at the beginning of the school year, receives books of approximately 12Kg (almost 20 books * almost 0,6Kg). Our aim is to collect at least 50% of each student, proportionate 6Kg. According to data of the Hellenic Statistical Authority (2014) there are 403,522 students in schools in metropolitan area of Athens.	2,400
Public Services and Libraries	Paper consumption in Greece has exceeded 1,200,000 tons a year. 350,000 tons of used paper (250,000 tons of large producers such as supermarkets, industries, printing, bookbinding, newspaper and magazine returns, and other 100,000 tons of homes, offices, etc.) are recycled every year. The highest percentage of 52% comes from industrial companies, while 10% comes from offices and the rest 38% comes from households. With a general setting reachable target of increasing recycling from 30% to 60% in Greece (700,000 tons), company estimates to enter this market and accomplish of 2% collecting.	14,000

### Ecological Benefits

Book Category	Reasoning	Oil in tons	Trees	Water in tons
Individuals	1t of recycling paper saves: ✓ 200Kg oil	480	40,800	240,000
Public Services and Libraries	✓ 17 trees ✓ 100t of water	2,800	238,000	1,400,000
		3,280	278,800	1,640,000



## Step 6: Create environmental concepts

In order to achieve and bring success to this project some practical and functional matters will be analysed. Environmental conceptualization and impacts can help and notice any anti-ecological operation. Environment and Nature must be preserved and sustained. New generation companies must have plans and targets to be eco-friendly and not causing harm to the environment itself.

Materials and ways to operate must be planned in order to reduce the cost which is occurring from the global market and all the environmental limits. Friendly environmental low cost energy from renewable materials to function is the main approach. According to eco-design principles, which will guide through the environmental conceptualisation process, what needs to be done is:

- Reduce the material intensity of the service.

This way, fewer material resources are required for the reuse, less transport is required.

- Increase the amount of recycled and recyclable materials.

This way, increasing amounts of recycled materials in the products, market demand for these materials will increase as well.

- Incorporate environmental features into the service.

New generation eco-friendly trucks will be bought for delivering the materials and at the rooftop a series of growing plants will help clean the atmosphere from the Athenian gases emissions. Furthermore, all books will be available to public through digital sale, as well.

- Signal in the service's environmental features through the physical design.

All books will be stamped in the first and the last page below the code number, to increase environmental awareness, with features visible to the user.

- Maximise the use of sustainable resources and supply chains.

This is achieved through the very strong link between the product and the low cost to reuse.

- Optimise the service's performance.

Eco-friendly, book donation bins will be placed in central places in the metropolitan area of Athens.

- Design the life cycle first and then the service.

A very good understanding of the environmentally relevant properties the service must have and its consequent development according to these properties, is crucial to the final service's likelihood to achieve optimised life cycles and environmentally sensitive profiles.



Image 2: Book donation bin



Image 3: Think Green stamp



Image 4: Eco-friendly truck

### Identification of five key environmental focus areas and impacts

1. Air recycling through ventilation system \* Air pollution impact
2. Reusable and easy separable materials \* Garbage impact
3. Electricity from solar power \* Lower the emissions and environmental costs
4. Preserve and sustain the already produced books \* The public need, impact
5. Education through marketing \* Aware for the environmental impacts



Image 5: Ideal building

- The whole process helped us realize the major problems of an urban designed company.
- Strategy, policy and terms made us evaluate the system's success through these steps.
- Future development of this concept will include ecological and new renewable energy seminars, lessons and activities for kids and adults.
- Marketing purposes will be more than friendly to environment and public

## Step 7: Develop an environmental strategy

### **Ten environmental priorities**

1. Reduce emissions and gases
2. Operate with renewable materials and methods
3. Reduction of energy consumption
4. Ecological spirit, educational activities and eco-friendly privacy and policy during operation
5. Reduction of transportation impacts
6. Recycling cost
7. Contribution in paper reuse
8. Reforestation of deforested regions, involve in new EU programs for new materials and methods
9. Sustainability in production, improved life cycle design
10. Demonstration of the company's environmental stance, prevention of future environmental concerns and requirements.

### Environmental principles of Improvements

The main and major ecological principle would be to aim in repairing and restoring natural habitat of biotic and abiotic environment, specifically targeting: Environmental sustainability and Preservation of local Fauna and Flora.

Parameters to measure environmental performance of the service while being developed, would be:

- a) Statistic programs and mathematic conclusions applied
- b) Customer services will perform qualitative research, asking the users for their suggestions and making possible the filing of complaints
- c) Constant measuring of the renewable energy used

## Specification of the Materials used

### **Bin materials**

The unit is manufactured from 2mm galvanized steel with an 8mm galvanized base welded to the walls to create a very strong, rigid and durable container. The Triple Recycling Unit features twin, hinged lockable front opening doors which allow quick and easy access to the liners inside. This makes emptying the bin much easier. The three slots will be: 1st Good condition, 2nd Medium condition and 3rd Poor condition.

Model: MM240

Construction Material: Galvanized Steel

Finish: Powder Coated

Height - mm: 1065

Width - mm: 1070

Depth - mm: 470

Capacity - liters: 240

Weight - kg: 105

Warranty: 10 Year Anti-Perforation

Characteristics from: <https://www.bin-shop.co.uk>



Image 6: Bin of Company

## Solar panel Materials

Trina Model Number TSM-290DD05A.08 (II)

STC Rating 290.0 Watts

PTC Rating 265.2

Open Circuit Voltage (Voc) 39.5 Volts

Short Circuit Current (Isc) 9.50 Amps

Frame Color Black

Power Tolerance -0 / +5W

Module Efficiency 17.7%

Area 17.65 ft<sup>2</sup>

Weight 41 lbs.

Length 65.0 in.

Width 39.1 in.

Height 1.38 in.

Characteristics from: <https://www.solarelectricsupply.com/solar-panels/trina-solar/trina-allmax-m-plus-tsm-290dd05a-08ii-290w-solar-panel-wholesale>



Image 7: Solar panel



## Ventilation System Materials

Unit ventilators and heat pumps have the advantage of reduced floor space requirements and they do not recirculate air between rooms. However, it is more difficult to assure proper maintenance of multiple units over time and they present additional opportunities for moisture problems through the wall penetration and from drain pan and discharge problems. All the system is made by Steel. Central air handling units have a number of advantages as compared to unit ventilators and heat pumps serving individual rooms. They are:

- Heating and cooling needs
- Energy efficiency
- Humidity control
- Potential for natural ventilation
- Adherence to codes and standards
- Outdoor air quantity and quality
- Indoor air quality

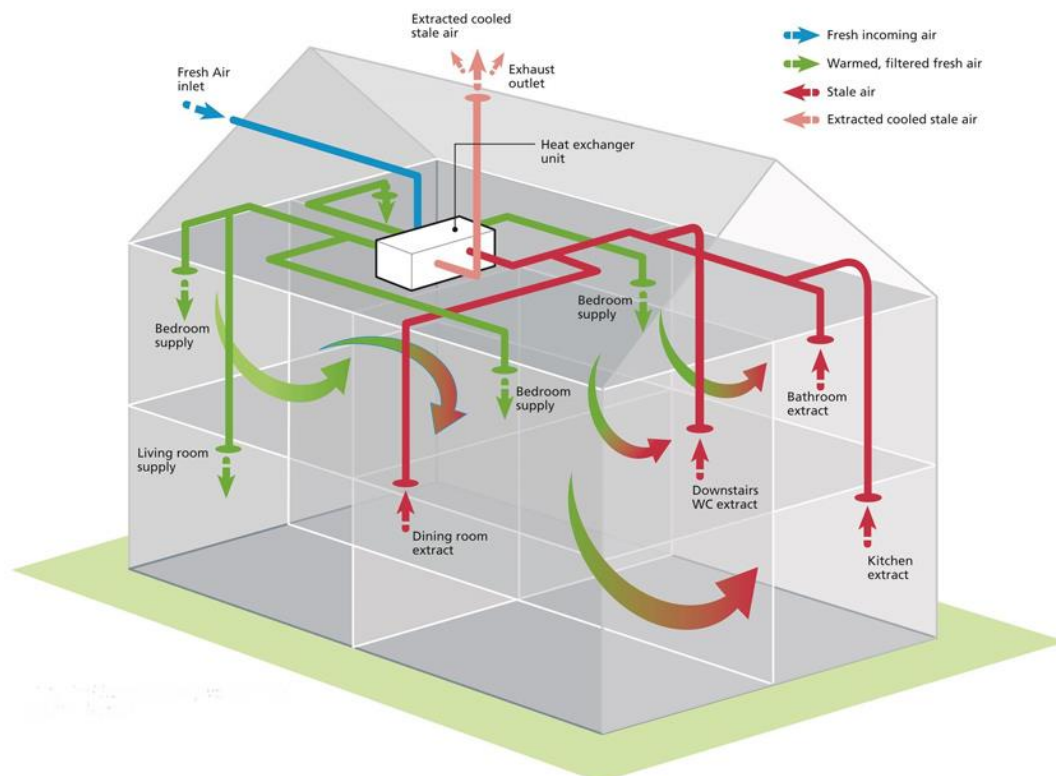


Image 8: Ventilation system

## Van Materials

Model: NISSAN e-NV200 COMBI

The 100% electric e-NV200 Combi offers unparalleled passenger comfort combined with incredible cost savings and supreme versatility for both passengers and cargo. Go 100% electric with e-NV200 Combi and never shell out money for fuel again!

Characteristics:

- 4.2 m<sup>3</sup> Cargo capacity
- 3.3kW AC on-board charger
- EVSE cable - 3 Pin, 10 Amp
- 7 Pin Cable - Type 2 Mode 3, 32 Amp
- 1.22 m between wheel arches
- 1.50 m wall-to-wall
- 1.36 m stand-up room
- Cargo maximum weight 1,5ton

Characteristics from: [https://www.nissan-cdn.net/content/dam/Nissan/gb/brochures/Nissan\\_e-NV200\\_van.pdf](https://www.nissan-cdn.net/content/dam/Nissan/gb/brochures/Nissan_e-NV200_van.pdf)



Image 9: NISSAN e-NV200 COMBI

## Building Materials

Region: Attica, Aspropyrgos

Building in the industrial area of the suburb of Athens, 1,000 meters from the Ring and the National Highway, 800 meters from the cargo train terminal, with everything you need for work shop or warehouse. Three-phase industrial power, convenient access and convenient location make it ideal for store place, work shop or warehouse.

Characteristics:

- Sunshades electrical
- Basements
- Classical building Security door
- Garden
- Area (m2): 720
- Lot Size: 600
- Total floors: 2
- Year Built: 2009

Characteristics from: <http://www.greeceinvest.gr/en/business-in-greece/buildings-in-greece/property/79-zdanie-v-afinakh-aspropirgos-720.html>



Image 10: Company's building

## Specifications of Transportation

Totally 107 bins will be placed along the city of Athens. Three Cycles will be mapped in order to help us collect and function correctly. The first big cycle will be having 37 bins. The second small cycle will be having 34 bins and the third 36 bins. The present company demonstrated these cycles, because of the citizens that are living in Athens. To face the overpopulation problem.



Image 11: Hypothetical cycles created on Google Earth (Blue dots-Places of the bins, White rows-Routes of collection).

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