Q-BIKE

CPH2015 SHARED BIKE SYSTEM

IDENTIFICATION NUMBER 11424

CPH2015: VISION

Our vision for the city of Copenhagen for 2015 is four fold. Four different future scenarios form the future world of Copenhagen.

Bicycle Heaven

First of all, the city of Copenhagen is the world's capital for cyclists. The city centre is free of motorized vehicles, there are many (covered) bike highways and scenic routes and everywhere bikers have priority over cars.

Public transport is all electric and the city centre is full of parks and trees, which results in a highly livable and emissions free Copenhagen.

Ultimate Mobility

Mobility is the keyword in Copenhagen. Public transport is free and cabs are all electric. There are many park and rides at the edge of the city and fast intercity connections provide easy access to Copenhagen for commuters.

Within the city high frequency connections between business areas and tourist hotspots and electric water transport provide maximum mobility.

Latinization

The city of Copenhagen is characterized in terms of lifestyle of its inhabitants by latinization. The green and car free city centre and many outdoor facilities and activities make them enjoy city nature by often being outside. The gardenization of the centre, the symbiotic relation between nature and the Copenhagen heritage and architecture which is highly integrated into the environment stimulates people to live the city like the 'Mediterranean of the North'.

This goes together with an increase of the use of technology. Mobile devices and free wireless internet in the city have established a structural value in the lives of Copenhageners.

Business Paradise

Copenhagen is not only the business metropolis of Denmark anymore, but also the business capital of Western Europe. With its many conferences and activities about sustainability and ecology it has become the leading city on this topic in the world.

For business people the fast intercity connections, the free public transport and free wireless internet provide a business atmosphere all over Copenhagen.

Within the puzzle of these four future scenarios the developed shared bike system will fit. We have taken into account the scenarios as our future vision in order to develop a system which is suitable for the ambitions of CPH2015 and which can be implemented within the coming five years.

Current problems

The current Copenhagen shared bike system faces several problems. The most important problems should be addressed in order to bring a distinctive improvement to the city and to ensure that Copenhagen will be considered the bicycle city of the world.

- Theft and misuse are the biggest problems. Bicycles are used outside the assigned area and are not returned to the stations. Bikes are used for personal matters and stored at home and vandalism is a common phenomenon.
- Second, stations are getting empty due to theft and vandalism. Several stations are popular and contain bikes while other stations only provide bikes and will not be refilled.

The above problems are of main concern to us while developing the shared bike system for Copenhagen 2015. The shared bike system for CPH2015 is named 'Q-BIKE' and will be presented at the following pages.

Q-BIKE: THE SYSTEM

Registered use:
- annual fee: 225 DKK
- price per hour: 2.25 DKK
- possibility to reserve a bike

COMMUTER

Incidental use:
- deposit: 150 DKK
- price per hour: 4.5 DKK

TOURIST

Incidental use:
- deposit: 150 DKK
price per hour: 4.5 DKK
- possibility to subscribe for week rental: 225 DKK

COPENHAGENER

Discount when taken from busy station or returned to empty station

Pick-up and return at any station

Up to 12 hrs use

Pay per minute

Pay with mobile phone device

Fine 9 DKK

Information pole

Remarkable looks

2000 bicycles

NFC technology

GPS tracking system

Adjustable seat and handlebars

LED lights

LEDs indicating availability

Propulsion blocking systemn

Advertisement space available

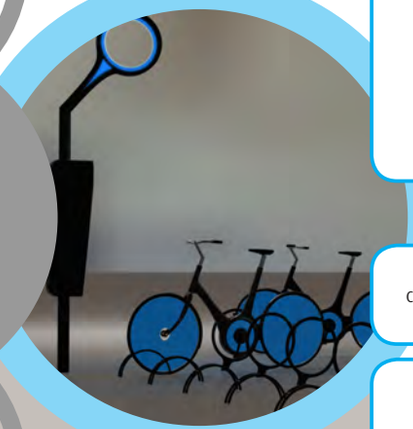
BICYCLE

USER

Q-BIKE

SERVICE

STATION



At main city entrances:
- train stations, park & rides
- tourist hotspots
- business areas
- distributed over city center

Permanent user information

LED light indicating free racks

Touchscreen

Covering larger area

Make reservations

115 stations

Availability bikes/ racks other stations

Battery charging

People: 30

Maintenance

Distribution

Storage

2 vans

Connection bike-station

Lock

Q-BIKE allows people to use a bike for a short time at a low price. The bikes are available from numerous stations. The stations are spread over the city centre and cover railway stations, transfer parks, tourist hotspots and crowded business areas. People most probable to use the system are commuters and tourists.

Getting and returning the bike

Bikes can be rented and returned at every station. Each station has a central information pole. Users can unlock a bike by sweeping their mobile phones with NFC chip over a reader in the bike. As deposit, an amount of 150 DKK (€20) is withdrawn from the user's account. Use of the bikes costs 4.5 DKK (€0,60) per hour and is charged per minute.

Bikes can be used for a maximum of 12 hours. To return the bike, the user brings the bike to a station, stalls the bike in a rack and sweeps his phone over the reader again. The bike is locked and the deposit minus the money due is credited on the user's account.

Subscription

Both registered and unregistered use is possible. Subscription to the shared bike system gives the user extra rights and a reduction on the rental fee. Registered users pay an annual fee of 225 DKK (€30) and only 2.25 DKK (€0.30) per hour.

The extra rights they benefit from are the possibility to use the bike continuously up to one week and to reserve a bike in advance. Reserving a bike guarantees the availability of a bike. It will be taken care that enough bicycles are available, based on the number of reservations. Reservations can be made online, by text messaging or at a pole in a bike station, up to seven hours in advance. If a reserved bike is not taken, a small amount is debited from the users account.

Maintenance of bikes

For the maintenance of bikes and their distribution people will be employed. These people will check all bikes regularly and repair them.

Malfunctioning of bikes can be reported by calling a service number. In case the bike is in a station, the bike will be locked, so it is not assigned again before repair. When the bike is not in a station the bike will be picked up by the service team.

Availability bikes

The poles at the bicycle stations provide information about the availability of bicycles and free racks at the other stations. This information can also be viewed online, a mobile phone application is available.

To make sure the distribution of bicycles is even, the service team of the shared bike system will relocate bikes when needed. Moreover, users will be encouraged to get bikes from packed stations and return their bikes to less frequently used stations by giving them reduction on the rental fee if they do so.

Q-BIKE: THE BICYCLE

The Q-BIKE bicycle is clearly characterized by its attractive appearance. It will be immediately recognized as the Copenhagen shared bicycle, which also prevent it from being stolen or vandalized.

Design

The bicycles of Q-BIKE are designed according to several basic requirements. Their appearance is characterized by robustness and elegance. The bikes are remarkable products in Copenhagen citylife yet they appear neutral and basic. Both business people and sporty tourists will find themselves comfortably cycling around the city.

Basic needs

The bicycle provides the user with basic necessary functions. There is only one gear since Copenhagen is basically flat and the city is provided with high quality bicycle paths. The bike is equipped with a coaster brake to make sure there are no unnecessary cables visible and damageable.

Seat and handlebars are easily adjustable in height so everyone can ride the Q-BIKE bicycle in a comfortable way. The adjustable parts are secured to prevent them from theft. Front and rear tires are covered with splash boards and the bicycle has both front and rear LED lights, of which the batteries are charged during stationing.

Technology

The bicycle is equipped with two important pieces of modern technology: GPS tracking and NFC technology. The GPS chip inside the bike makes it possible to trace it wherever it goes. It will prevent the bike from being stolen or used in an unwanted way.

The NFC technology (Near Field Communication) provides the possibility of communication between the bike, its station and the user. It will be used to make the user pay, to lock and unlock the bicycle at the stations and to lock the bike when in use anywhere in the streets.

The NFC chip is located in the tube between the circular box between the wheels and can be reached for replacement through this box. With a clear sign on the outside of the tube is indicated where users can sweep over their mobile phones.

The GPS chip is located in the circular box. This box contains the docking system to place the bike back at a station and the batteries for lights and chips as well.

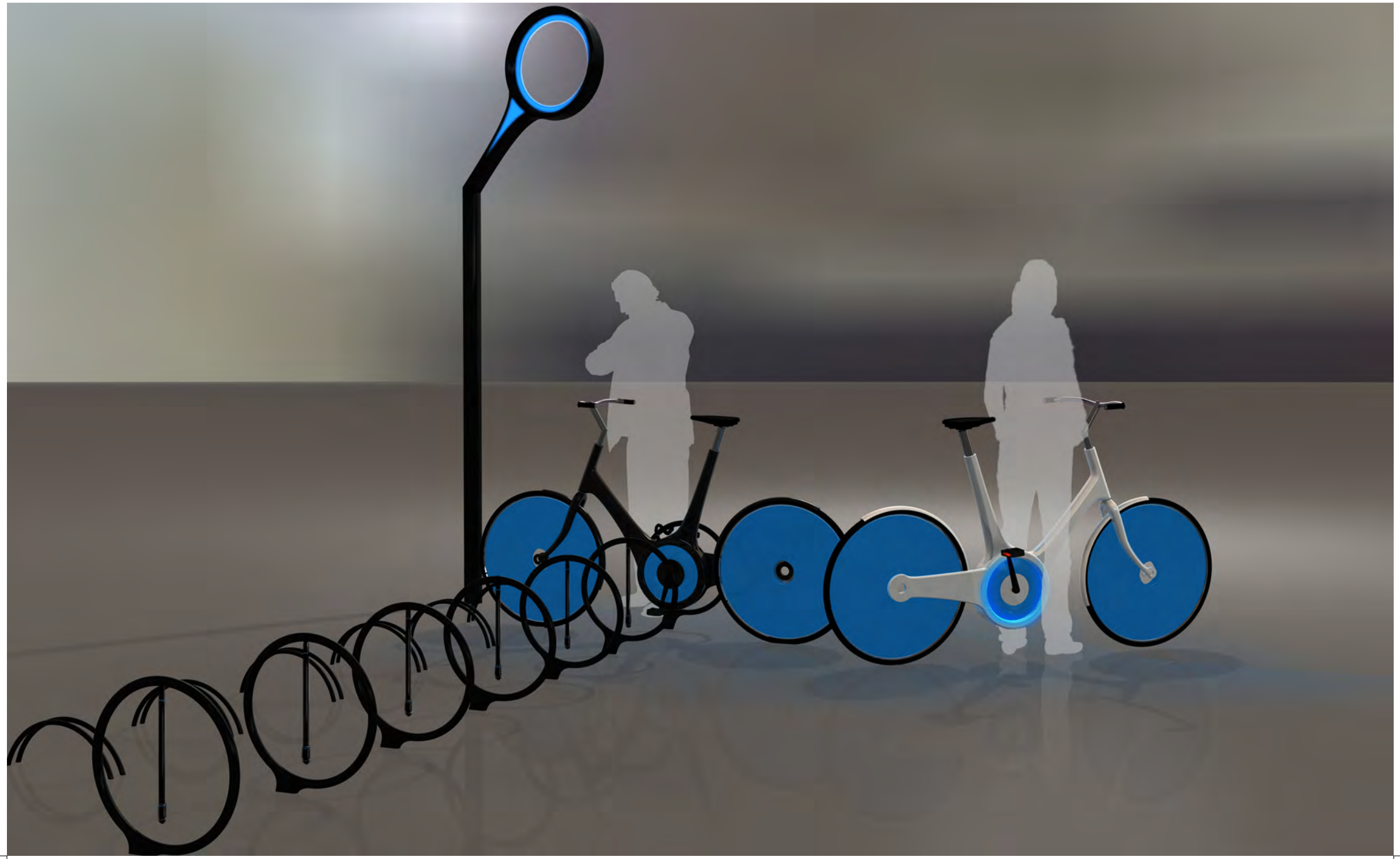
Finally the bikes show whether they are available or reserved by a circle of LED lights in the circular box. The LED lights are shining blue as soon as the bicycle is available for use.

Locking

A blocking system is integrated into the propulsion. This means that the user can block his bicycle by sweeping his mobile phone over the reader. The bike is then locked and can be stalled safely anywhere the user wants.

At the stations, the bike is placed in its rack. The user connects the bike to its dock and herewith locks the bike and ends his rental period. The connection provides a solid connection and power in order to recharge the batteries.

Q-BIKE: THE STATIONS



The stations where the bicycles are taken and returned are to be found all over the city centre. They are located at train stations and other public transport hubs, at park and rides, at touristic hotspots and in crowded business areas. We consider the current situation of 115 stations basically enough, although we would establish several stations further away from the city centre.

Docks

Large stations contain up to 100 bicycles while smaller stations can contain only 10 bikes. Therefore the stations consist of one or more information poles and several racks for the bicycles. Hence it is easy to extend or reduce a station to adjust them to changes in demand or changes in public transport logistics.

The front wheels of the bikes can be put into the racks and the circular docks provide the necessary locking system and power connection. The wire attached to the circular docks establishes a solid connection between the docks and the bicycles and contains a feed cable.

Information pole

All stations are equipped with one or more information poles which provide the necessary information for new users. The poles are connected to the system in order to provide the option of registering here, or to get to know which stations contain available bikes or empty racks. The poles are therefore equipped with a touchscreen and internet connection.

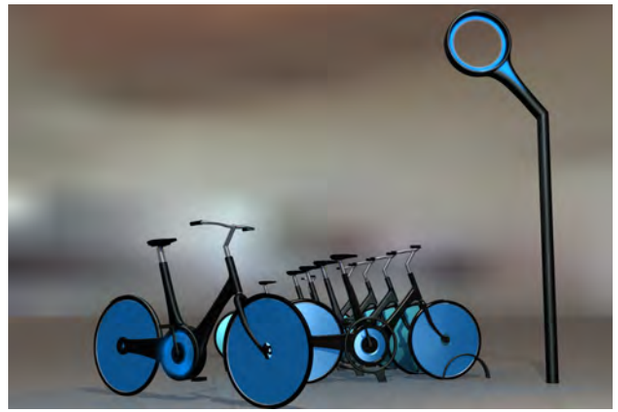
Q-BIKE is clearly recognizable in the streets due to these poles. They are attractive landmarks in the city, even when all racks are empty. Moreover, the remarkable shape of the racks provides a recognizable look and a good branding of Q-BIKE, even when the racks are empty.

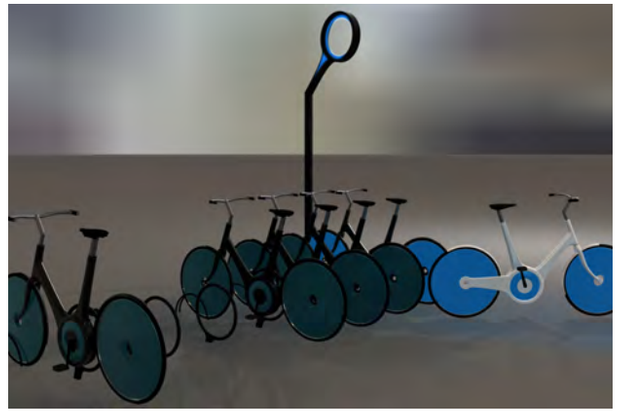
The circle on top of the pole indicates by means of the arrow shaped light whether there are free docks. The blue arrow is then lightened. If not, only the blue circular light is turned on, which always shows that a Q-BIKE station is near.

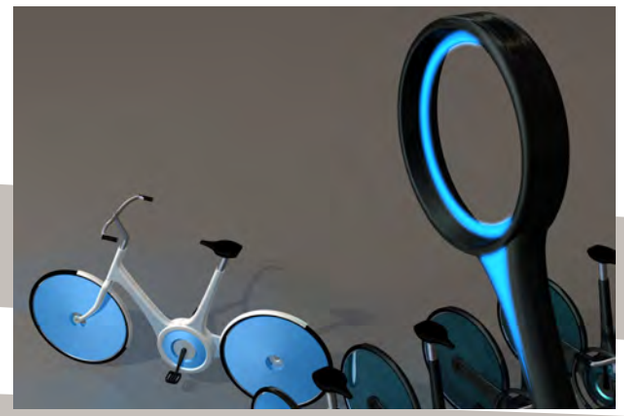
Occupation of stations

Q-BIKE provides special pay rates when users return their bikes to stations that need extra bicycles or stations which are located further away. With a small financial stimulus we expect several users to make another route or to make a detour in order to distribute the bicycles more evenly over the stations. Another discount can be obtained when a bicycle is taken from a very crowded or totally full station.

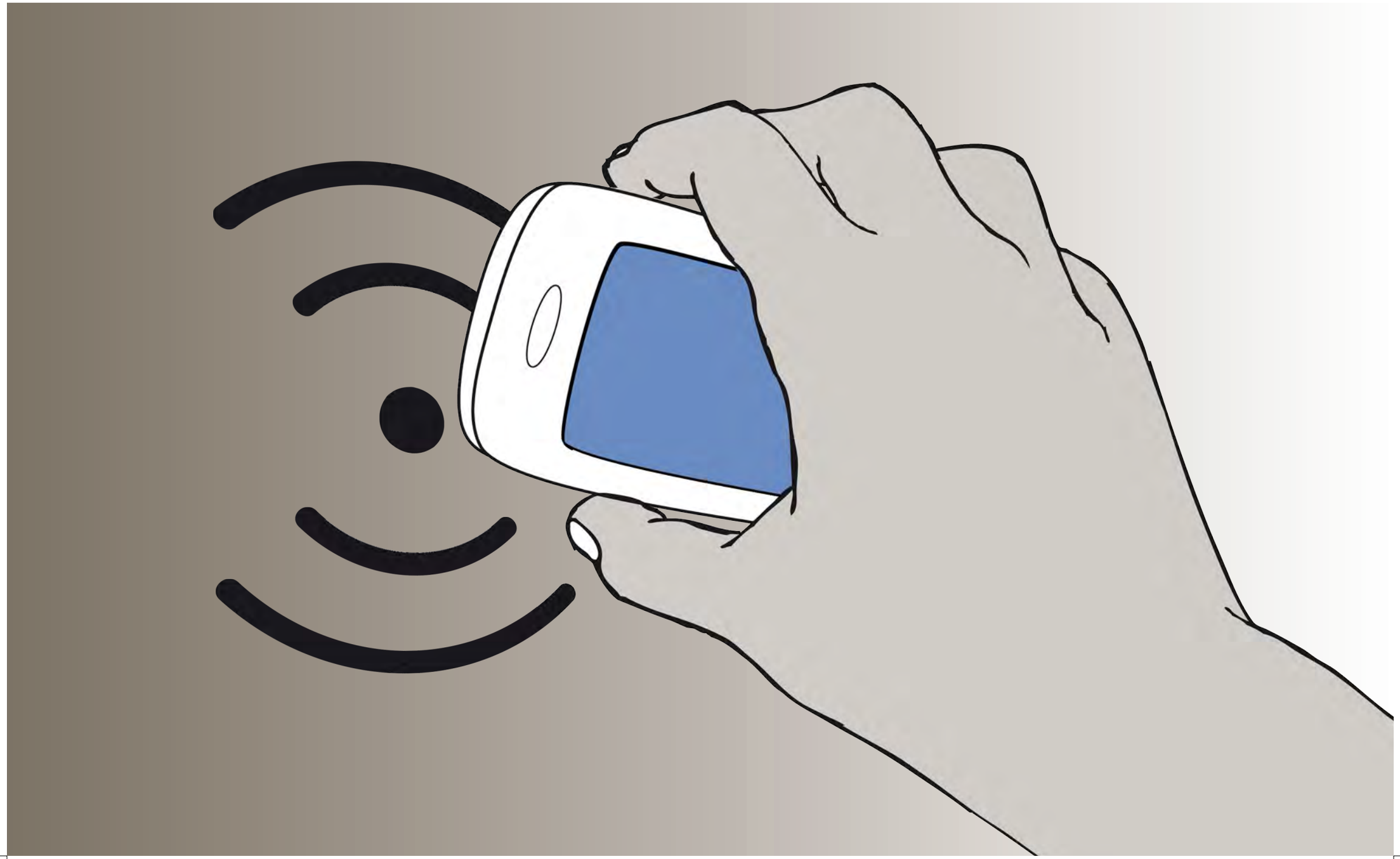
The rates of these discounts need to be defined later. This highly depends on the frequency of use and the popularity of Q-BIKE. Hence we did not consider these discounts in the costs and profits overview.







Q-BIKE: PAY SYSTEM



Q-BIKE provides registered and unregistered use. Both commuters, tourists and Copenhageners can benefit from the system in their own way.

The commuter: John Madsen

John (48, architect) works in Aarhus. Once in a while he comes by train to Copenhagen for a business meeting. To get from the train station to his destination he ususally takes a Q-BIKE.

John is subscribed to Q-BIKE. This way he benefits from the possibility to reserve a bike in advance. He may make a reservation for a bike at a station of his choice for the following day up to 12 PM. The availability of the bicycle will then be guaranteed during morning rush hours. By an SMS will be communicated which bike is assigned to him. He can just immediately unlock it by sweeping his phone over the NFC reader after arriving at the station. The system should be connected to schedules of public transport in order to take into account eventual delays.

The hourly rate is discounted to only 2.25 DKK (€0.30) and charged per minute. John may bring the bicycle to any station he wants, but will probably return it to the station he took it from after a day work in Copenhagen. He can place the bike and lock it for later use wherever he wants by using his phone and the NFC reader again.

Q-BIKE registers John's use and credits the required amount monthly from his bank account.

The tourist: Isabella

Isabella (22, Italian) is visiting Copenhagen with a friend and and stays in a hotel near Langbro. She can make use of Q-BIKE by unregistered use. Isabella reads the instructions on the screen of the information pole. She will have to find a bike which is available, indicated by a blue lightened circle. She simply sweeps her mobile phone over the indicated spot and Q-BIKE immediately charges 150 DKK (€20) from her phone. The hourly rate is only 4.5 DKK (€0.60) and is charged per minute.

When returning the bike to any station she wants the deposit will be refunded minus the costs for using it.

The Copenhagener: Harry

Harry (35) is on his way from his home to the office in the city centre when he finds out that his bike has been stolen. He wants to use Q-BIKE since he really needs a bicycle. Of course he can start using the bicycles by unregistered use. But there is also the opportunity to register for a week's rental. On the web or at the information pole he can register and pay immediately 225 DKK (€30) minus the hours that already were used from his bank account.

During this week, Harry can use the bike everywhere he wants, keep it with him and bring it home. After six days he will be reminded to return the bicycle within 24 hours to any station. The registered personal data can be deleted when the bike is returned.

Fines

In order to stimulate proper use of Q-BIKE misuse will be fined. Not using the bike when reserved will cost once 2.25 DKK (€0.30). Exceeding 12 hours use will cost 4.5 DKK (€0.60) per hour and exceeding one week will cost 9 DKK (€1.20) per hour.

Overview of costs		
Registered use		
	DKK	€
Subscription	225	30
Hourly rate (12 hours to be used)	2.25	0.30
Week rental	225	30
Unregistered use		
Deposit	150	20
Hourly rate (12 hours to be used)	4.5	0.60
Fines		
Reservation fine (once)	2.25	0.30
Week exceeding fine (per hour)	9	1.20
Use exceeding fine (per hour)	9	1.20

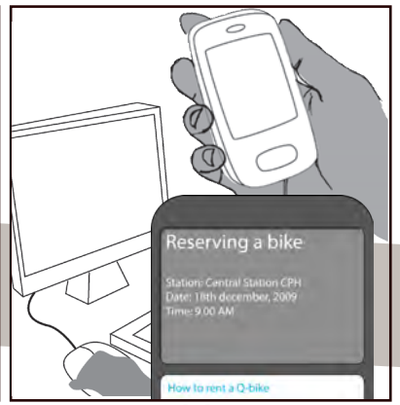
Q-BIKE: USABILITY

Q-bike knows two usage scenarios; one for unregistered use, one for registered use. These scenarios differ in the first part of the use since a registered user can reserve a bike and an unregistered user not. The two scenarios are explained in the following storyboards.

Registered use

1. Registereing

The user can register online.



2. Reserving a bike

The user can reserve a bike on the website, from his mobile phone or at the information pole at the bike station.

3. Confirmation

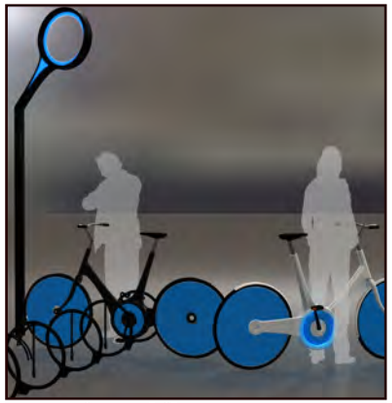
A confirmation is sent to the user's phone. The message includes the number of the rack where the bicycle can be found.

4. Taking the bike

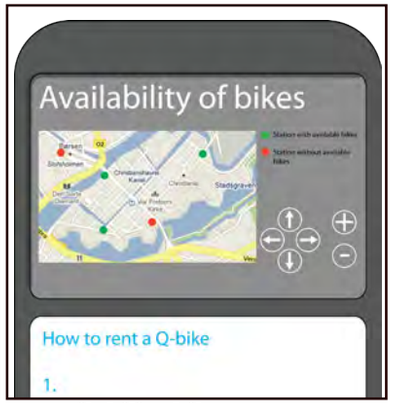
At the station where the user reserved the bike, he will find his bike in the indicated rack.

This scenario proceeds with step 3 of unregistered use.

Unregistered use

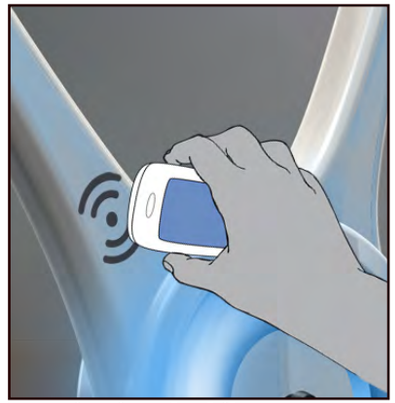


1. Getting a bike
Bikes can be taken from every station where a bike is available.

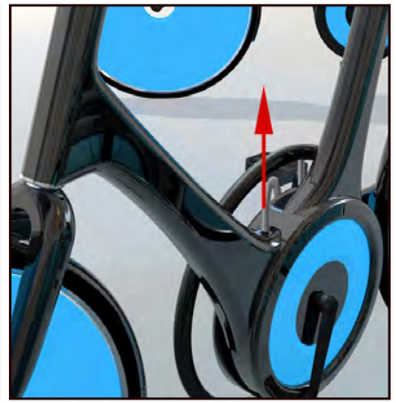


2. Availability bikes
In case no bikes are availabe, the information pole provides information about the availability at other bike stations.

2. Choosing a bike
The available bikes have burning lights. When the light is off, the bike has been reserved.



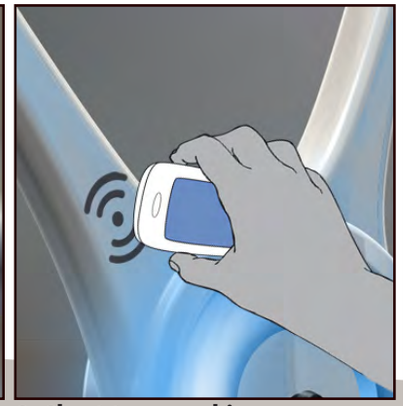
3. Activating the bike
The user sweeps his phone over the reader integrated in the bike.



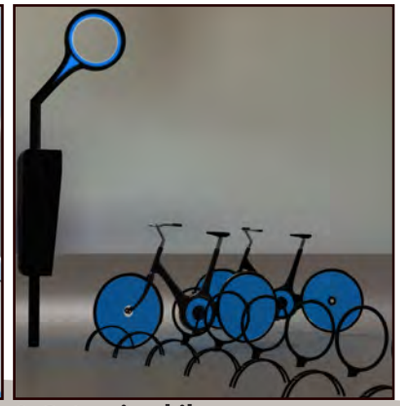
4. Unlocking the bike
The user removes the cable lock from the bike.

5. Adjusting the bike
The user can choose the height of seat and handlebars.

7. Cycling
Now the user can ride his bike.



8. Short term parking
To lock the bike temporarily, the user sweeps his phone over the reader. Propulsion blocks. Unlocking is done the same way.



9. Returning bike
Bikes can be returned at any station with free racks.
The user plugs in the lock and sweeps his phone over the reader.

10. Payment
By sweeping the phone over the reader the bill is paid. The user receives a receipt on his phone.

Q-BIKE: COSTS

Cash flows	year 0		year 1		year 2		year 3		year 4		year 5		year 6	
	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)
Cash outflows														
purchase bikes (2,000)		€ 0		€ 800.000		€ 0		€ 800.000		€ 0		€ 800.000		€ 0
maintenance bikes		€ 0		€ 300.000		€ 300.000		€ 300.000		€ 300.000		€ 300.000		€ 300.000
theft bikes (100)		€ 0		€ 40.000		€ 40.000		€ 40.000		€ 40.000		€ 40.000		€ 40.000
installation stations (115)		€ 1.150.000		€ 0		€ 0		€ 0		€ 0		€ 0		€ 0
maintenance stations		€ 0		€ 115.000		€ 115.000		€ 115.000		€ 115.000		€ 115.000		€ 115.000
installation software		€ 100.000		€ 0		€ 0		€ 0		€ 0		€ 0		€ 0
maintenance software		€ 0		€ 10.000		€ 10.000		€ 10.000		€ 10.000		€ 10.000		€ 10.000
NFC readers (2,000)		€ 0		€ 100.000		€ 0		€ 0		€ 0		€ 0		€ 100.000
theft NFC readers (100)		€ 0		€ 5.000		€ 5.000		€ 5.000		€ 5.000		€ 5.000		€ 5.000
GPS tracking devices (2,000)		€ 0		€ 30.000		€ 0		€ 0		€ 0		€ 0		€ 30.000
theft GPS tracking devices (100)		€ 0		€ 1.500		€ 1.500		€ 1.500		€ 1.500		€ 1.500		€ 1.500
employees (max 30)		€ 0		€ 900.000		€ 900.000		€ 750.000		€ 600.000		€ 450.000		€ 450.000
truck (2)		€ 0		€ 60.000		€ 0		€ 60.000		€ 0		€ 60.000		€ 0
truck use		€ 0		€ 5.000		€ 5.000		€ 5.000		€ 5.000		€ 5.000		€ 5.000
maintenance truck		€ 0		€ 3.000		€ 3.000		€ 3.000		€ 3.000		€ 3.000		€ 3.000
transport for storage		€ 0		€ 0		€ 40.000		€ 40.000		€ 40.000		€ 40.000		€ 40.000
rent storage (2,000 m3)		€ 0		€ 300.000		€ 300.000		€ 300.000		€ 300.000		€ 300.000		€ 300.000
Cash inflows														
subscriptions (5,000)	€ 0		€ 90.000		€ 105.000		€ 150.000		€ 150.000		€ 150.000		€ 150.000	
paid subscr. use (1,500,000 hr)	€ 0		€ 180.000		€ 315.000		€ 450.000		€ 450.000		€ 450.000		€ 450.000	
paid single use (157,500 hr)	€ 0		€ 37.800		€ 66.150		€ 94.500		€ 94.500		€ 94.500		€ 94.500	
week rentals (50)	€ 0		€ 900		€ 1.050		€ 1.500		€ 1.500		€ 1.500		€ 1.500	
deposit incomes (100)	€ 0		€ 2.000		€ 2.000		€ 2.000		€ 2.000		€ 2.000		€ 2.000	
fines (500)	€ 0		€ 150		€ 150		€ 150		€ 150		€ 150		€ 150	
advertising on bikes (2,000)	€ 0		€ 200.000		€ 200.000		€ 200.000		€ 200.000		€ 200.000		€ 200.000	
advertising on stations (115)	€ 0		€ 11.500		€ 11.500		€ 11.500		€ 11.500		€ 11.500		€ 11.500	
Total	€ 0	€ 1.250.000	€ 522.350	€ 2.669.500	€ 700.850	€ 1.719.500	€ 909.650	€ 2.429.500	€ 909.650	€ 1.419.500	€ 909.650	€ 2.129.500	€ 909.650	€ 1.399.500
To be paid by Copenhagen	-€ 1.250.000		-€ 2.147.150		-€ 1.018.650		-€ 1.519.850		-€ 509.850		-€ 1.219.850		-€ 489.850	

Q-BIKE will be funded by three parties: the Copenhagen government, the users and finally commercial companies that benefit from the possibilities to use advertisement space.

Costs

We expect Q-BIKE to cost on average 17.25 million DKK (€2.3 million) per year. In the table the expenses of the different aspects of the system and its revenues are further specified per year. The amount of employees to make the system running is 30 the first two years and will be lowered to only 15 within five years.

The schedule of availability of the bikes will be as the current system; from April to November bicycles will be available in stations. During winter they will be stored and maintained.

The Copenhagen government

The municipality of Copenhagen is willing to spend over 180 million DKK (€24 million) in order to increase the city's image regarding cyclists the next four years. We think that Copenhagen should spend about 50% of all costs of Q-BIKE, which will be 9 million DKK (€1.2 million) on average per year. Other costs should be paid by commercial activities and the use of the system.

The users

Subscriptions to Q-BIKE and actual use of the bikes will gain about 5.25 million DKK (€700,000) per year. We expect a maximum amount of subscriptions of 5,000 in three years and we expect to gain maximum use of Q-BIKE in three years as well. Maximum use of the system is considered 1,000 bikes for 10 hours average per day during weekdays (by commuters) and 250 bikes for 3 hours average per day for single use.

Advertisement

Bicycles as well as stations offer advertisement space. The use of these commercial activities will gain up to 1.58 million DKK (€211,000) yearly. We think of outdoor advertisement agencies like JC Decaux and CBS Outdoor to be good and high quality exploiters.

Recommendations

Our vision for CPH2015 can be completed with Q-BIKE. The system provides the city with a typical and attractive bike sharing system. All people in Copenhagen can benefit from it, business travelers, tourists and residents. Q-BIKE completes the CPH2015 image and fits easily with the strive for being the sustainability capital of the world. But we would like to add several recommendations with our shared bike system Q-BIKE:

- First of all, we would advice to implement a second way of paying for the use of Q-BIKE. Although many people will be able to pay with their mobile phones through NFC technology by 2015, it will probably be necessary to provide users with the option to pay by creditcard or PIN.
- We suggest to discount use rates when bicycles are taken from very busy or full stations and when bicycles are returned to almost empty or further located stations. The discount rates need to be defined later.
- The amount of bicycles and stations should be increased. We suggest to start Q-BIKE with 2,000 bikes and 115 stations, but in the near future more bikes and stations should be implemented.
- For the implementation of Q-BIKE, definitely cooperation with local manufacturers and service providers should be established.