

NEST

Project Documentation

A hand-shapeable MagSafe wireless charger: brief, research, concept, prototype, market and project management.

[Refill — Designing Energy Rituals](#)

9 August 2026



Overview

NEST is an industrial design project from the 2026 summer semester at ABK Stuttgart: a MagSafe wireless charger that can be shaped by hand. The upper part is a magnetic charging module, the lower part a wax and oil core, covered in knit fabric. Pressing the core changes the angle of the phone, and the core slowly warms up while charging.

This document follows the project in chronological order from brief and research to concept and prototype. The second half adds a market and user analysis, project management, and a rough estimate of production costs. The structure, calculations and manufacturing of the prototype are covered in the accompanying technical document and are not repeated here.

01 Brief and research

The research started from how electricity is perceived and narrowed down to the heat produced during charging.

Brief and starting point

The semester brief was “Refill — Designing Energy Rituals”, about charging and replenishing energy. The project’s working title was “Energie Formen”: giving energy a shape. The idea came from an everyday observation. Charging is almost always hidden behind numbers, icons, indicator lights and small screens, so people see a status but never feel the process. The project set out to turn this around and make charging something to feel rather than something to check.

Perceiving electricity

The research began with a basic question: electricity is invisible, so how do people actually perceive it? The material on the research board fell into two groups. One covered the phenomena electricity turns into: light, heat, sound and motion. The other covered the relationship between people and electricity: interfaces and symbols, absence, power supply and risk.

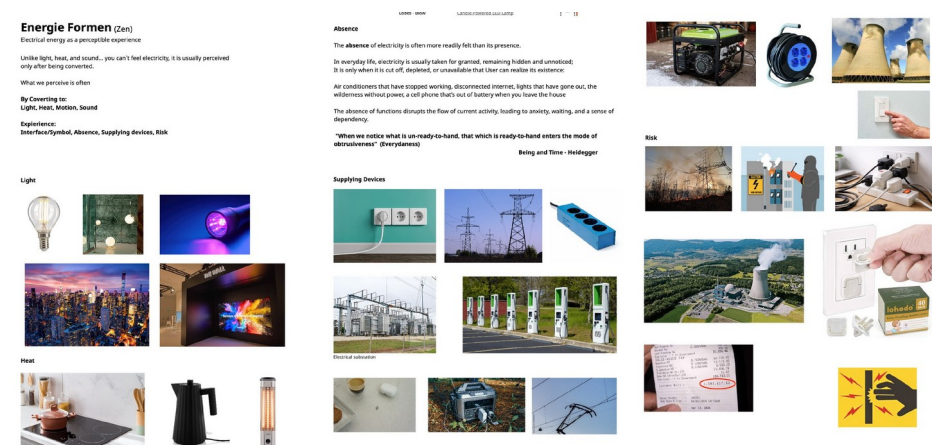


Fig. 1 Research board, excerpt: electricity as light and heat; absence and power supply; risk.

A large part of the board was about “absence”. Electricity is usually taken for granted and only noticed during a power cut, when the internet drops or when a phone runs flat. The board also quoted Heidegger’s Being and Time on “conspicuousness”: equipment draws attention to itself only when it stops being ready-to-hand.

Heat and material change

From there the research narrowed down to heat. Charging always produces heat; the question was whether that heat could cause a material change that can be seen or felt. The board includes a few simple calculations for a temperature rise of 30 °C: a 50 mm aluminium part grows by only about 0.035 mm, PE or PP by about 0.3 mm; 1 ml of alcohol expands by about 33 mm³, but in a tube with a 0.25 mm radius the liquid column would rise by about 168 mm.

The calculations showed that the thermal expansion of solids is too small to notice. To make a change visible, it takes a liquid, a thermo-sensitive material or a material that softens when warm. Material collected in the same period included thermochromic materials, infrared images of charging plugs, and wax changing state as it warms.

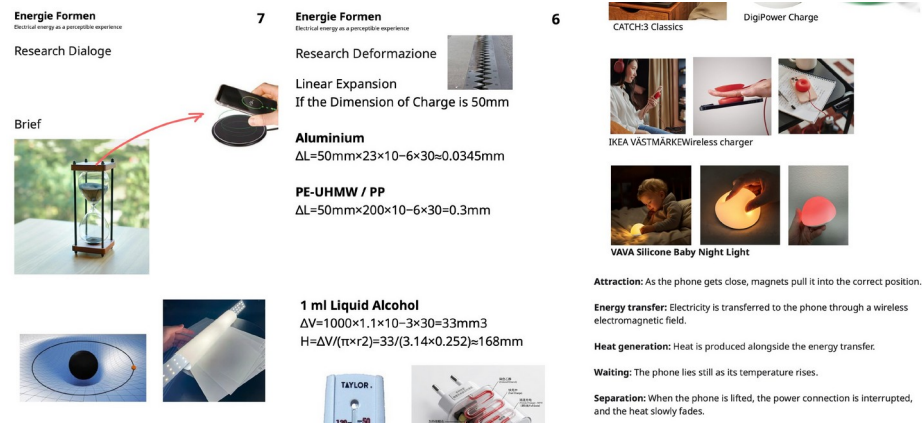


Fig. 2 Research board, excerpt: research dialogue and briefs; thermal expansion calculations; the five actions of wireless charging.

Five actions of charging

The board also broke a wireless charging session down into five actions: the phone comes close and is pulled into position by the magnet; energy is transferred through the electromagnetic field; the transfer produces heat; the phone rests and the temperature rises; the phone is lifted, the connection breaks and the heat slowly fades.

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Energie Formen

Making the process of charging and energy flow visible.

Light
Heat
Sound
Motion

- Interface
- Symbol
- Interaction
- Absence
- Supplying Devices

To see the Status
Is it Charging?
Battary Status
Speed of charging
How much time remain

Time passing
Energizing flow between devices

Dialogue**
Users are Waiting
Occupying spaces
Dependency
Energy Cost
Risk



ON : Transparent

abk—
STAATLICHE
AKADEMIE DER
BILDENDEN KÜNSTE
STUTT GART

5 ABK Stuttgart — Refill: Designing Energy Rituals

02 From brief to concept

Four briefs narrowed down to one concept: a soft MagSafe charger that reacts to heat and touch.

Four briefs

All four briefs used heat as their thread. They differed in where the heat shows up and how:

- **Brief 1, colour-changing plug:** thermochromic material makes the plug change colour as it warms up.
- **Brief 2, wax-wrapped plug:** a layer of wax around the plug that softens with the heat.
- **Brief 3, material experiments and accessories:** shapes that “melt” when warm, such as ice cubes or a block of butter, plus a small figure that sits on the wall plug.
- **Brief 4, soft stand:** a soft body that holds the phone, warms up while charging and can be pressed by hand.

Briefs 2, 3 and 4 were still open at the midterm. Brief 4 was chosen because it shows the interaction with the user most clearly: the material sits right under the phone, so the hand touches it every time the phone is put down or picked up.



Fig. 4 Sketches for briefs 2, 3 and 4 (midterm).

Mood board

The mood board collected things that are soft, warm and deformable: lava lamps, cushions pressed by a hand, mochi, soft silicone, wax surfaces and fabrics. The midterm summed this part up as follows: softness makes technology feel quieter, warmer and more approachable, and softness itself can be an interaction language.



Fig. 5 Mood board (midterm).

Concept

The concept was defined as a soft MagSafe charger that reacts to heat and touch, so that the flow of energy is felt through softness, temperature and deformation. The sketches explored two volumes, one taller and one flatter.

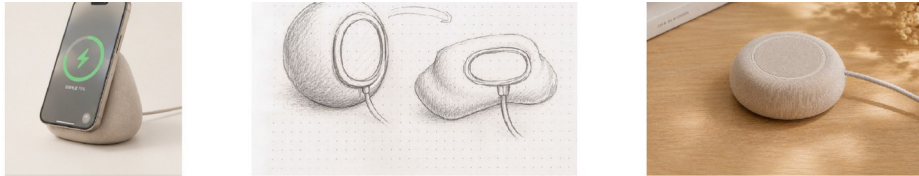


Fig. 6 Concept references and sketches (midterm).

Midterm

The midterm presented the research, the brief iterations, the mood board, the concept and the material tests so far. It also listed four open questions: the wax mixture (softening temperature and support), the skin (fabric or silicone), the internal layout (position of the MagSafe module, cable exit and electronics), and weight and stability (whether a counterweight or a non-slip base is needed). The second half of the semester was organised around these four questions.

03 Prototyping

Material tests, form iterations, the final prototype, and form and material.

Material tests

Around the midterm, samples were made for both the skin and the filling:

Table 1 Skin and filling tests.

Part	Material	Result
Skin	Latex	Walls too thick, inner mould hard to make
Skin	TPU	Easy to 3D print, but not elastic enough
Skin	Silicone	Available in different Shore hardnesses, easy to cast, suits soft deformation
Skin	Stretch fabric	Seams are visible; two-way stretch knit used in the end
Filling	Magnetic beads	Grains too large, poor flow, not soft enough
Filling	Steel balls + magnets	Magnetic force too weak to hold the phone
Filling	Viscous liquid	Flows too easily, cannot support the phone
Filling	Microcrystalline wax	Right viscosity, support and heat response; chosen, with mineral oil added to adjust softness

For the skin, the midterm comparison was that fabric feels warmer and more domestic, while silicone gives a more continuous surface and is easier to form. Fabric was chosen. The filling is a mix of microcrystalline wax and mineral oil: more oil makes it easier to shape, but the body also sinks more slowly under the phone. After adjusting the ratio, it was set at 250 g of microcrystalline wax and 30 g of mineral oil.

Iteration

The final presentation sorted the development of the form into four stages: stage 1, the wax-wrapped plug; stage 2, material objects; stage 3, combining a rigid charging

surface with the soft body and moving the USB-C port to the top; stage 4, the prototype integrating wax and fabric. The photo of parts shows several versions of the white top ring, skin samples in different materials, and an early validation model in red.



Fig. 7 Parts and iteration pieces. The red piece is an early validation model.

Final prototype

After the midterm the way of shaping changed considerably. The original idea was that the charging heat would soften the core. Instead, the core is now shaped by hand at room temperature, and the warming during charging is only a secondary change in feel. The reason is that a softer core is easier to shape but supports the phone less, and the two are hard to satisfy at once (technical document, 4.4).

At room temperature the final prototype can be pressed into different angles and holds its shape with the phone on it; during charging the core gets slightly warmer and softer. This change in feel was recorded at ambient temperatures of 15, 26 and 32 °C.

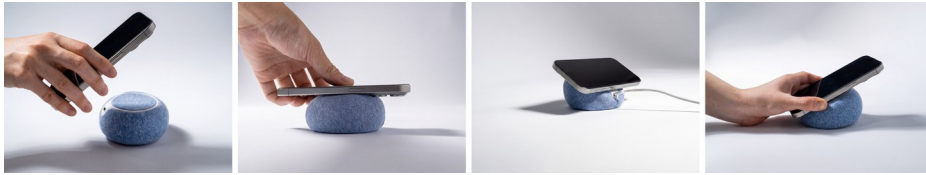


Fig. 8 The final prototype in use, matching the charging actions from the research: approach, put down, wait, pick up.

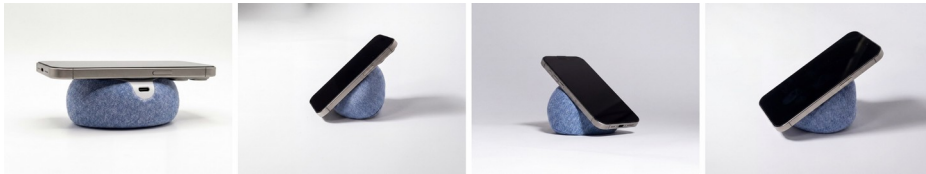


Fig. 9 One prototype pressed into different angles: flat, tilted, upright, leaning.

Form

The form follows the round soft body from the Brief 4 sketches: no edges, a flattened base, and the top closed off by the white ring and the charging module. Only the ring and the module are hard; everything else can be pressed. The prototype has no indicator light and no screen, so the charging state comes across only through temperature and feel.



Fig. 10 Form: front, three-quarter and side views.

Colour and material

The skin and the module surface use the same blue two-way stretch knit. The top ring is white PLA, sanded after printing. The module housing is white and shows only at the USB-C opening.



Final prototype

04 Market and users

Assuming NEST came to market: market, competition, users, positioning and channels.

Market overview

Wireless charging is now a standard smartphone feature. Apple introduced magnetic alignment with MagSafe, and the Qi2 standard then brought the same magnetic approach to phones from more brands, so magnetic chargers and stands have become a common accessory. The products in the table below range from 10 to 25 W; magnetic or wireless charging is a given, and the differences lie in form, materials and extra functions.

Existing products fall roughly into three groups. The first is charging pads and stands from tech accessory brands, at around €49–162, sold on power, multi-device charging and materials such as metal and glass. The second is design-led charging trays covered in home materials, such as the Courant CATCH:3 at around €186, with a fixed form. The third is products from home retailers, such as IKEA's VÄSTMÄRKE series at around €9–13, with a homely look, a soft touch and a low price.

Table 2 Retail prices of comparable products (Nomad and Courant converted from UK and US prices).

Product	Type	Price	Notes
Apple MagSafe Charger	Magnetic pad	€49	Up to 25 W, adapter sold separately
Belkin BoostCharge Pro Qi2	Adjustable magnetic stand	€51	15 W, adjustable angle
Nomad Stand One Max	3-in-1 stand	approx. €162	25 W, metal and glass, fixed angle
Courant CATCH:3 Classics	Charging tray	approx. €186	10 W, leather or linen cover, fixed form
IKEA VÄSTMÄRKE ring	Magnetic charging ring	€9	Qi2, soft-touch silicone
IKEA VÄSTMÄRKE cork stand	Angled stand	€13	Qi2, cork
NEST	Shapeable stand	approx. €59	Angle set by shaping by hand, knit fabric skin

Competitive environment

The competitive environment of the category, using the five forces model:

Table 3 Competitive environment of the category (five forces).

Force	Strength	Notes
Existing rivalry	High	Many tech brands, similar functions, prices and power easy to compare; home brands already in at low prices
New entrants	High	Certified charging modules can be bought off the shelf; low technical barrier
Substitutes	Medium	Ordinary cables, the phone's own charger and all kinds of phone stands cover part of the same need
Supplier power	Medium	Small orders leave little room to negotiate on modules, and minimum order quantities are high
Buyer power	High	Many options, easy to compare, price-sensitive users; retailer margin is about a third of the retail price

NEST is unlikely to win on function. Its difference can only come from the shapeable core, the fabric skin and the matching sales channels.

Segmentation and target users

By buying motive, users of magnetic chargers can be divided roughly into four groups:

Table 4 User segments.

Segment	Profile	Priorities	Fit with NEST
Tech-driven	Multi-device users who care about charging speed and compatibility	Power, 3-in-1, certification	Low
Price-driven	Only need basic magnetic charging	Price	Low
Home and design-driven	Care about how objects at home look and feel; willing to pay more for design	Form, material, touch	High
Gift buyers	Choosing small gifts for others; look for appearance and novelty	Appearance, packaging, easy to understand	Medium

NEST is aimed mainly at the third group, with gift buyers as a secondary group. The first two are already served by tech brands and by IKEA, and NEST has no advantage in power or price. A few intended use scenarios:

Table 5 Intended use scenarios.

Scenario	User need	How NEST responds
Bedside: overnight charging, alarm	Phone tilted to read the time; no light at night	No indicator light; the core can be pressed into a tilted angle
Desk: video calls, messages	Angle changes with posture and use	Angle set by pressing, no hinge or stand mechanism
Next to the sofa: watching videos	Lower, more reclined view; fits soft furnishings	Core can be pressed lower for a leaning phone; fabric matches home textiles

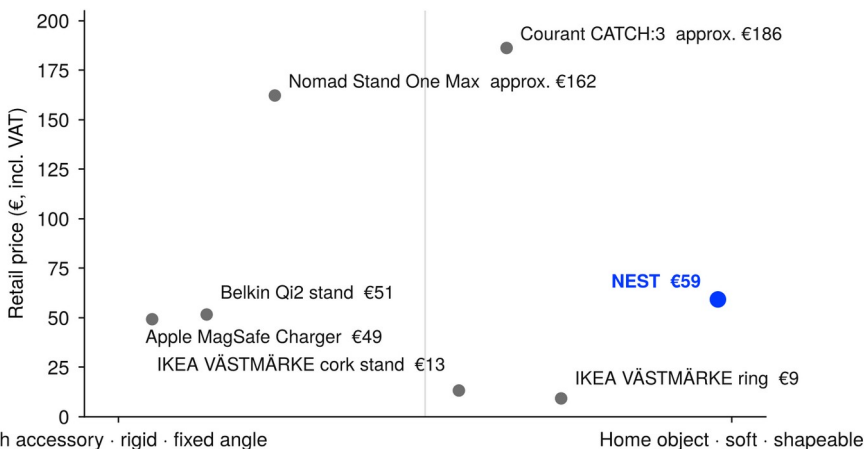


Fig. 11 Positioning by price and product character. The horizontal axis is a qualitative judgement; the vertical axis is retail price.

Positioning and price

On the positioning map, the tech brands cluster on the left and the home retailers in the lower right. NEST sits on the right, clearly above IKEA. Design products in home materials have a fixed form, and IKEA’s soft-touch charger costs only €9, so “soft” alone is not enough to stand apart. What sets NEST apart is that it can be shaped, has a fabric skin, and looks quiet without an indicator light. At around €59 it is slightly above the comparable Apple and Belkin products and below Nomad and Courant.

Business definition

Following Abell’s three dimensions, the NEST business can be defined as:

Table 6 Business definition (Abell).

Dimension	NEST
Customer groups	Users of MagSafe or Qi2 phones who care about how things at home look, and gift buyers
Customer needs	A phone angle that changes with the situation; a charger that blends in as a soft home object
Technology	Magnetic wireless charging module (Qi2 15 W in production), hand-shapeable wax and oil core, knit fabric skin (removable in production)

SWOT

Strengths, weaknesses, opportunities and threats:

Table 7 Strengths, weaknesses, opportunities and threats.

	Content
Strengths	None of the products in Table 2 offers shapeable interaction; the fabric look suits the home; the prototype has proven charging, magnetic hold and support
Weaknesses	Support weakens when warm; more expensive than Apple’s own charger; switching to Qi2 15 W in production increases heat loss, so temperatures must be retested
Opportunities	Qi2 widens the range of compatible phones; gift and home channels; skins could be sold as replaceable accessories
Threats	IKEA’s soft-touch product costs only €9; the form is easy to copy; Qi2 and CE certification add cost and time to market; the name is the same as Google Nest, so the trademark must be checked before production

Channels

The choice of channels centres on design and home settings:

Table 8 Channel comparison.

Channel	Advantages	Limits	Role for NEST
Crowdfunding launch	Tests demand before tooling; pre-orders can cover part of the moulds and first batch	Needs complete presentation material; delivery pressure is concentrated	Launch and demand test
Own webshop	Margin stays with the brand; room to tell the product story	Customers must be found directly; logistics and service handled in-house	Main long-term channel
Design and concept stores	Matches where target users shop; can be tried on the spot	Retailer margin is about a third of the retail price	Display and trying out
Mass home retail	Wide reach	Price band of €9–13, below NEST’s cost	Not suitable

05 Project management

Timeline, way of working, main decisions and budget.

Timeline

The project ran for about three months with two fixed milestones: the midterm and the final submission. The chart below divides the process into five phases, following the order of the research board, the Steckbrief, the midterm and the technical document, and lists the output of each phase. The weeks were reconstructed afterwards from these documents; they are not a schedule set at the time.

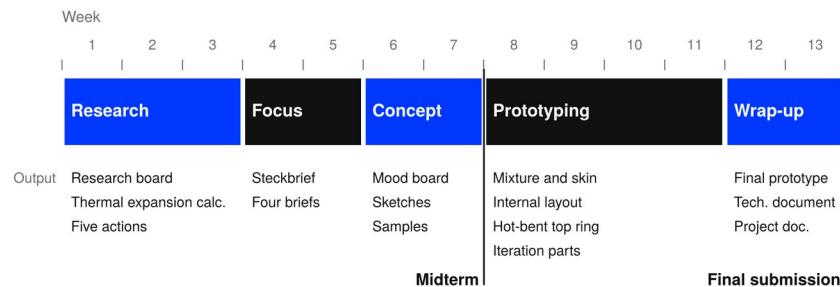


Fig. 12 Project phases and outputs (by week).

Way of working

Three working documents carried the project forward:

- **Research board:** collected material from the open research phase, including the thermal expansion calculations and infrared images of charging plugs.
- **Steckbrief:** placed the research directions and the four briefs side by side on one A3 sheet, to make them easy to compare and choose from.
- **Midterm question list:** the four questions to be solved in the second half of the semester.

Decision log

The main decisions and the reasons behind them:

Table 9 Decision log.

Stage	Decision	Reason
After research	Heat as the thread	Charging produces heat; during wireless charging the phone surface reaches about 40–45 °C, within the range where wax changes state (midterm)
Steckbrief	Develop four briefs in parallel	They cover four ways of showing heat: colour change, softening, melting forms and pressing
Before midterm	Choose Brief 4, the soft stand	Shows the interaction with the user most clearly
Material tests	Stretch fabric for the skin	Latex inner mould hard to make, TPU not elastic enough; fabric feels more domestic
Material tests	Microcrystalline wax filling	Beads, steel balls and liquids could not be both soft and supportive
After midterm	Shape by hand at room temperature	A softer core is easier to shape but supports the phone less
Prototyping	USB-C port moved to the top of the module	Layout change after combining the rigid charging surface with the soft body (final presentation, stage 3)
Prototyping	Hot-bend the top ring	Calculation showed that bending to a 6 mm arc at room temperature would exceed the flexural strength of PLA

Budget

The prototyping phase cost about **€150** in total, covering material tests and prototype parts: latex, TPU, silicone, magnetic beads, steel balls, magnets, microcrystalline wax and several liquids, plus the charging board, PLA prints, fabric and glue. Costs were not tracked item by item, so only the total is recorded here.

06 Production and cost

If NEST were produced: unit cost, one-off investment and break-even.

Unit cost

The prototype charges, holds the phone magnetically and can be shaped, but it is still some way from a product that can be manufactured. This chapter is a rough estimate. Based on a production design, the landed cost per unit for a first batch of 1,000 is about €20:

Table 10 Landed cost per unit, first batch of 1,000 (approx., €).

Item	Amount
Charging module (Qi2 15 W, incl. coil, magnets and housing)	9
Core and skin materials (wax, mineral oil, inner bag, fabric)	3
Labour (sewing, filling and sealing, assembly, inspection)	5
Packaging	1
Shipping, duties and losses	2
Total	20

One-off investment

A one-off investment of about €31,000 is also needed, mainly for two injection moulds and for Qi2 and CE testing. At this cost NEST cannot compete in the €9–13 mass-market band and fits better in the design product range of around €50–60.

Break-even

At a retail price of €59, removing 19 % VAT leaves about €50. Through design stores, the retailer takes about a third, so the brand receives about €33 per unit; after the €20 cost about €13 remains, and around 2,400 units are needed to recover the one-off investment. Through the brand's own webshop about €30 remains per unit, and around

1,050 units break even (before payment and shipping fees). The first batch of 1,000 therefore relies mainly on crowdfunding pre-orders and the own webshop.