Human Capital Agenda Green PowerNL

Bridge to the future

Photo Tineke

December 2021

Foreword and reader's guide

Several months ago, the Green CapabilityNL Writing Team was commissioned to elaborate and operationalize the Human Capital Agenda (HCA) for the program.
It was asked to do so by 2022 and to outline a multi-year perspective.

This document provides that elaboration, based on the first steps from the original proposal by GroenvermogenNL. Further use was made of various background reports, the recent report by RHDHV on hydrogen skills and the recently completed study by Bureau Berenschot (Hydrogen transition and human capital). In it, the prioritization of the various program components of the HCA was examined, among other things, via some 40 interviews in the field. The report of this exploration is attached as an appendix.

This HCA GroenvermogenNL first positions the human capital approach in the overall ambition of GroenvermogenNL and explains the nature of the HCA (chapters 1, 2, 3 and 4). Then, in chapter 5, the workflows of the HCA are explained and the priorities from Bureau Berenschot's exploration are conveniently 'plotted' on these workflows.
Chapter 6 details the work streams. This first discusses the multi-year perspective and then the concrete activities for 2022 with associated KPIs. Chapters 7, 8 and 9 discuss successively the planning and phasing, the organization of the HCA and the budget.

The entire GroenvermogenNL program has a duration of 8 years. At the time the proposal was drafted, it was decided to bring forward the HCA activities and set a four-year lead time of 2022-2025 for them. As stated in the NGF proposal itself, human capital activities are prerequisites for success and have therefore been moved to the first phase of the program. However, should it become apparent during this period that activities require longer lead times or that a more long-term commitment is needed, this should certainly be considered. In addition, further decision-making will have to take place on how the (knowledge) yields and knowledge transfer of the overall GroenvermogenNL program will continue to be secured in the period after 2025. It is recommended to discuss this in more detail during the midterm review of the HCA, which is scheduled for late 2023, based on experience and substantiation available at that time.

In the Guidance Group and the recent Sounding Board Group with various representatives from the field, the present elaboration of the HCA GroenvermogenNL has been received very positively. Together with the recently completed broad exploration that underlies this HCA, we are confident that its implementation can count on strong support from all actors.

December 2021,

Marsha Wagner Top
Sector Energy

Henk van Terwisga
Bureau VanAdvies

Content

Appendix: Berenschot, *Building blocks for an HCA for hydrogen transition*, December 2021

1. HCA as intersecting urgency in Green PowerNL

- In 2021, the NGF Advisory Committee positively assessed the GroenvermogenNL proposal. Ambition is to achieve a strong national innovation ecosystem for hydrogen production and -application. This will build on the innovation networks already present in energy, chemistry and industry. Specifically, the objective is to achieve large-scale application of hydrogen to contribute to making the energy system more sustainable and exploiting the economic opportunities for hydrogen.
- To this end, the entire GroenvermogenNL program has three program lines (each of which has subdivisions):
    - rapid and substantial economies of scale;
    - research and innovation program (TRL 2-8);
    - human capital agenda.
- The prerequisite for success is the adequate availability of professionals with knowledge and skills of hydrogen and its application. This will require new and necessary knowledge to be made readily available both in regular education and for the education and training of professionals already working. Education and training will also need to pay more attention to learning to innovate and renew as a basic competency. Given the task, these programs will have to be able to operate with scale. And they will have to be agile in terms of content and design because of the rapid developments in the field of hydrogen. Finally, they will have to be connected to already existing regional hydrogen knowledge clusters, so that they can be demand-oriented and achieve results and scale quickly.
- The human capital agenda is thus one of the essential (intersecting) components of the Green CapabilityNL program. In it, the following sub-activities have been distinguished:
    - A National Knowledge Platform for knowledge exchange and training opportunities;
    - Strengthening regional Learning Communities with the participation of education, innovation & research institutions, industry and other public and private organizations;
    - A National Package of Educational Programs on Hydrogen and Green Chemistry at all levels (mbo to wo) with regional interpretation, linked to existing and new specializations.
    - Push for applied innovation and training (through Learning Communities) for business (especially SMEs).
- The Human Capital Agenda (HCA) will explicitly seek synergy on this through the region with the investments from the *EU Just Transition Fund*. These funds will be made available regionally, using the implementing organizations of the ERDF programs. This will be periodically monitored and acted upon in coordination with the Regional Liaisons who will become regionally active in the HCA GroenvermogenNL (see sections 6.1 and 6.2).
- The full Green PowerNL proposal has a term of 8 years. During the development of the NGF proposal, it was chosen at the time to bring forward the HCA activities because of the high urgency. They will be implemented in the first 4 years. This elaboration provides insight into the multi-year approach on the one hand and a translation into concrete activities in 2022 on the other.
- Should it become apparent during this period that the HCA activities need longer lead times or that a more long-term commitment is needed, this should certainly be considered. In addition, further decision-making will need to take place on how the (knowledge) yields and knowledge transfer of the overall GroenvermogenNL program will continue to be secured beyond 2025. It is recommended to discuss this in more detail during the midterm review of the HCA, which is scheduled for late 2023, based on experience and substantiation available at that time.
- Based on this document, the board of GroenvermogenNL will be asked to authorize the deployment of the M€ 5 in funds for 2022. At the end of 2022, an assessment will be made on the deployment of the remaining funds (M€ 45) for 2023, 2024 and 2025. Incidentally, this does mean that no multi-year commitments in excess of M€ 5 can be made in 2022 for the time being.

2. Purpose and content of the memorandum and its creation

- This memo operationalizes the human capital agenda for GroenvermogenNL into concrete activities and actors involved in this implementation in different roles. It also discusses the planning and phasing, the organization and provides a detailed budget.
- In principle, the HCA describes the ambition over the course of four years, so that the dot on the horizon becomes clear. Because of the assignment to operationalize the first year, the intended results at the end of 2022 will be discussed separately.
- Coordination in the development of this memorandum took place from the Top Sector Energy in close cooperation and coordination with the Top Sectors Chemistry and HTSM and NWO, Regieorgaan SIA and RVO.
- Input was provided by the parties most involved in the field. Through a Sounding Board Group, broader probing and coordination took place.
- In addition, a number of input documents were used, including the NGF's Green PowerNL proposal with the HCA paragraph, Berenschot's report and RHDHV's memo "Hydrogen skills, need and development.
- This plan has been commissioned by the GroenvermogenNl writing team and will be submitted by them to the GroenvermogenNL Board of Trustees so that decisions can be made in early 2022 on the funds set aside for 2022. On this basis, a flying start can then be made in early 2022.

3. The position of the HCA in the entire program

- In the GroenvermogenNL proposal, the Human Capital Agenda is positioned as an enabler for the ambitious activities related to the production and transport, storage & transshipment of hydrogen and its (large-scale) application in industry and other application areas such as mobility & transport and the built environment.
- The question of what knowledge and capacity is needed, and in what areas in particular, thus stems from the three domains shown colored below.
- This articulation will be a result of regional exploration of what is needed on the one hand and national alignment and coordination on the other, so that a transparent offer can be developed.
- Important input for this comes from Berenschot's exploration. This provides a good picture of the challenges in the relevant areas. Also, the periodic regional analyses of the Regional Liaisons will provide permanent input for the dynamic Knowledge Map for Hydrogen (see Chapter 6).

4. HCA Green PowerNL: an agenda in movement

- The HCA GroenvermogenNL is a supported agenda with concrete outputs and is agile to adapt based on real-world experience during its term.
- It also wants to start a 'movement': to mobilize people and organizations. A change process that also involves a corresponding investment in 'changing together'. At the same time, it wants to contribute to the broader human capital issue of energy transition through knowledge development and sharing.
- Therefore, in addition to concrete KPIs and deliverables, attention is also paid to strengthening the existing public-private partnerships within which hydrogen has or will have its place, the involvement of parties and the further expansion of a solid and interconnected network of education, business and research. It is precisely this that sticks and is sustainable.
- In the National Knowledge Platform workflow, this is the main focus. The chapter "Organization" discusses what this agility and "creating movement" means for the organization of the program, the consultation structures and the working methods that will be used.

5. The approach detailed in workflows

- As already indicated, parallel to the development of the HCA GroenvermogenNL, the exploration of priorities and key (regional) developments for the HCA was conducted by Bureau Berenschot. The results of this were recently presented in draft form to the Sounding Board Group. The results broadly confirm the program components already included in GroenvermogenNL's original proposal for the HCA.
- With this input, a multi-year approach has been developed for the HCA Green Capacity is a number of related work streams. These are shown schematically below and are operationalized in Chapter 6.
- For ease of recognition, the following shows how the building blocks from Bureau Berenschot's exploration are reflected in the distinct work streams of the HCA.
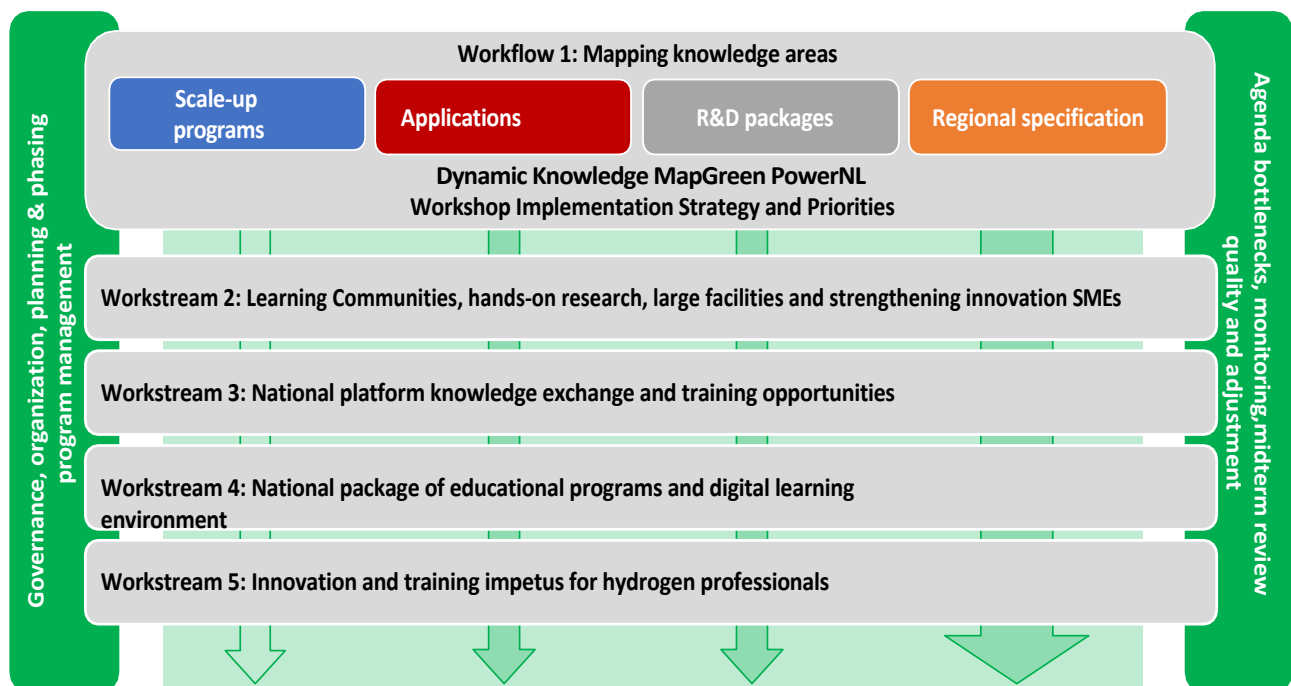
Building blocks for the HCA

Based on the interviews with training institutions, partnerships and companies, we arrive at the following priority building blocks for an HCA for the Hydrogen Transition. We explain the building blocks in the remainder of this report.
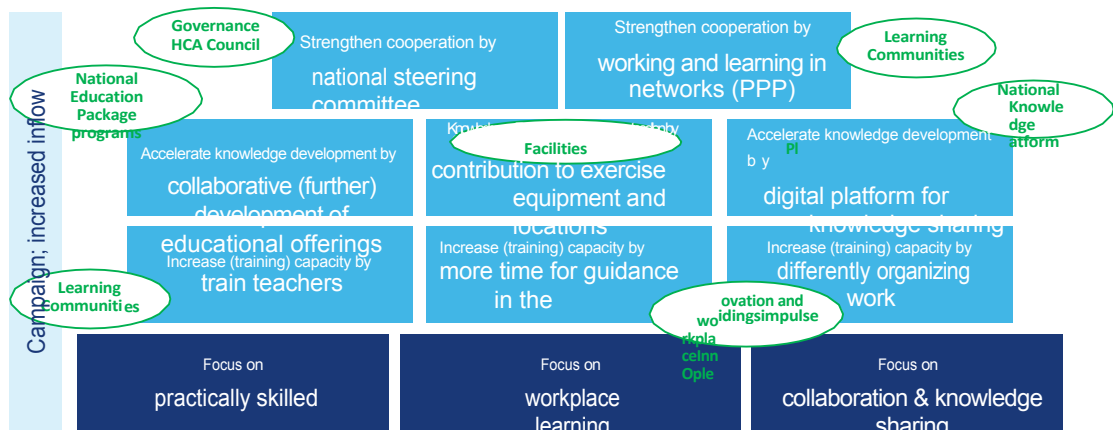
Berenschot

6. Elaboration of work streams HCA Green PowerNL

This chapter details the individual work streams. It first shows the perspective for 2025 and then elaborates for 2022 what the steps and activities will be. Each section concludes with intended outcomes and KPIs.

6.1 Workstream 1 Knowledge Areas Mapped (Dynamic Knowledge Map GreenPowerNL)

Perspective 2025

- Over the life of the program, this work stream will evolve into the systematic mapping of hydrogen knowledge needs and knowledge development. Analyses and explorations will be carried out periodically. This will include a fundamental look at the required knowledge and competence development, using the knowledge and expertise on labor market dashboards developed by Dialogic on behalf of the Top Sector Chemicals:
    - What are new or specific areas of knowledge and occupations or functions within the "hydrogen economy.
    - what are knowledge elements that apply more as a generic part of already existing occupations and functions (adapting profile and competencies within existing occupations);
    - What are other types of knowledge needs, e.g., security, legal, etc.?
- Part of this will include mapping potential transition paths in the labor market. This will use the expertise of parties such as e.g. Centerdata, which was developed on behalf of the Top Sector Energy. These make clear how the demand for hydrogen knowledge is developing and which professions in which sectors this concerns. This approach also maps out the professions and sectors from which it is relatively easy to make the transition to professions and jobs related to the hydrogen economy ('side' inflow).
- Task within this work stream is to connect with the human capital agendas of the Energy, Chemical and HTSM Top Sectors and the overarching Roadmap Human Capital Top Sectors, so that approaches are created in a broader perspective.
- In order to contribute to strengthening the inflow into relevant studies and training programs, this work stream will, based on this knowledge map and occupational perspectives, provide a

efforts will be made to develop appealing information and teaching materials with secondary schools and universities. This will also make use of the results of the ongoing experiment commissioned by the Top Sector Energy to make the professions in the energy transition transparent.

Activities 2022

- In a pragmatic manner, it identifies the areas in which knowledge and capacity strengthening are needed to realize the ambitions of GroenvermogenNL. The Berenschot study helps determine priorities in this regard. Both the regional need and the various knowledge and application domains were considered:
  - Large-scale production, storage and transportation;
  - Application areas: Industry; Mobility; Built environment;
  - R&D.

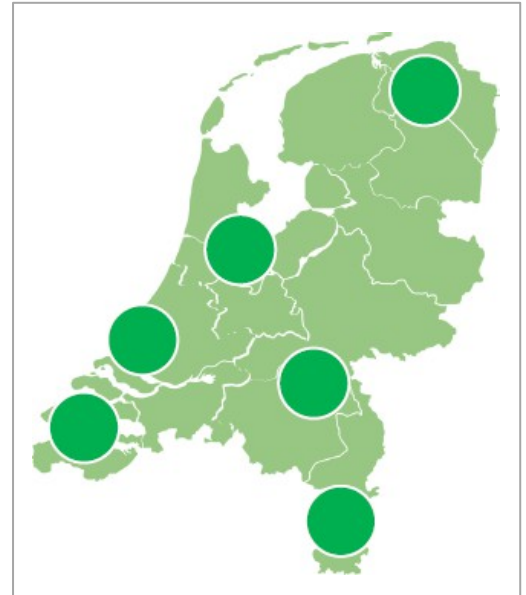*Thought exercise (Question: 'is it true that .....') serving sharpness and focus in the HCA*

- It is important to align the HCA with the "*implementation strategy*" of GroenvermogenNL. It is also important for the HCA to have a sharp focus on those themes and domains that are critical success factors for the success of GroenvermogenNL in the 4-5 year time frame.
- In that context, a 'foundation' could be drawn up for the HCA of domains and activities in which activities should be set up as a priority. This could be done along the following lines:
  - The Innovation Roadmap Hydrogen (TKI New Gas) shows that with regard to the hydrogen transition there will be an important focus in the first years on (a) the large-scale production, storage and transport and
    (b) application in industry. For private application (mobility, built environment), it is estimated that this will not come on stream in larger volumes until later. Nevertheless, a parallel development will be taken into account, also considering the deployment and infrastructure already realized.
  - In the first phase, this could lead to the next reasoned focus (including with respect to regions):
    - manufacturing and production sites;
    - regions and locations with energy-intensive industries, such as North Holland, Rijnmond, Zeeland, Eindhoven and South Limburg;
    - storage and transshipment in Rotterdam
  - In addition to this, there is e.g. EU legislation in arrival that sets requirements for the minimum density of charging infrastructure. This domain, too, could then develop into a priority.
  - It is possible that more urgencies will surface in this way.
  - Then consider what that means in those regions and application areas for the demand for skilled people, such as:
    - designers of installations and designers of processes;
    - engineers for plant construction and production;
    - operators;
    - maintenance engineers;
    - etc.
- If indeed such a view of the 'implementation strategy' of GroenvermogenNL exists or can be recognized, it will guide the choices to be made within the HCA (sufficient available human capital as an enabler for the transition). This can then be translated relatively clearly into (regional) agendas and Roadmaps. And these in turn guide the prioritization of HCA activities and the criteria for the instruments.
- Whether this leads to workable prioritization can be tested in a well-prepared joint *implementation workshop* (January 2022) .
- In parallel, the development of the demand for hydrogen knowledge in vacancies is surveyed annually by Centerdata. This can provide a complementary picture, e.g. on sectors that will experiment independently of the national strategy.
- Hydrogen is not "equally new" in all application areas. For example, in industry there is already a lot of experience and the additional knowledge needs will probably be limited. In other areas, such as mobility & transportation and built environment, the application is much more innovative and jobs and professions will be more strongly affected. Therefore, it is good to make such an analysis more fundamental at the outset.

- In parallel with this dynamic knowledge map, six Regional Liaisons will be appointed from within the regions. These will have an important driving role in developing Learning Communities in their own region and in translating regional knowledge needs into programs. They also agenda priorities from the region to the "national table" and the (national) implementation strategy.
- The following regions have been identified in GroenvermogenNL:
  - Northern Netherlands: Northern University, Colleges and Energy College (MBO) and the New Energy Coalition;
  - Rotterdam-Rijnmond: H2EnergyLab (RDM Innovation Dock) & Campus Green Chemistry;
  - Zeeland: Hogeschool Zeeland-University of Applied Sciences, Delta Power lectureship. The Delta Power lectorate conducts research in the areas of "Energy from Water," "Energy Storage," Aquathermy and Hydrogen;
  - Amsterdam: Department of Energy Transition; HCA VTi Amsterdam (Vakschool Technische installaties); and the Energy Resilience Research Group (Inholland).
  - Arnhem/Brainport: HAN H2Lab, Energy Vehicles Fueling Station (NeFuSta), SEECE, Enowatts (ENergieOpslag in WATerstof: Applications and Scenarios) and the honored SPRONG application with HAN and Saxion (developing H2 research and innovation infrastructure)[1] ;
  - Chemelot: Brightsite, Chill (MBO Vista, Zuyd University of Applied Sciences and Maastricht University).
- For each region, under the direction of the Regional Liaison, a Roadmap will be drawn up with an analysis and initial elaboration of regional consortia and activities. This Roadmap will be the 'foundation' for the application to realize multi-year capacity for this liaison function. For 2022, this will be done through a (one-time) application to NWO/SIA. An important starting point is that these Regional Liaisons have a regional mandate from public and private parties.
- The **_Roadmaps_** address topics such as:
  - What are the knowledge areas where reinforcement is needed;
  - Is there any indication of the overall size in capacity that will be needed in the coming years (how many jobs are we talking about?);
  - Who are relevant actors in this (potential consortium partners);
  - What are already "proven" hotspots that can be built upon;
  - How does this play out for the different regions (what are accents and focus areas; are specific regional elaborations needed (e.g. with regard to actors or knowledge areas);
  - what are our ambitions and focus areas;
  - What are necessary actions both in regular education and for training and education of professionals;
  - What requires deployment and scale-up through one or more dedicated Learning Communities;
  - Which requires adjustment of curriculum resp. knowledge development of teachers;
  - Where can innovative education (e.g., digital forms and application of AR/VR) quickly achieve adaptation and scale.
  - What other actions are needed and what instruments are being "targeted.
- These Roadmaps are part input for the calls and tenders that will be issued on the various components of the HCA during 2022. The input applies to both content and criteria and also provides a picture of what parties are with an already proven track record.
- National and regional linkages will be made with other NGF applications, such as the "LLO Catalyst" and the large-scale investment impulse in PPPs (through Katapult), as they come into implementation and will be at a more advanced stage.

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[1] https://www.han.nl/nieuws/2021/10/forse-impuls-voor-waterstofinnovatie-oost-nederland/index.xml

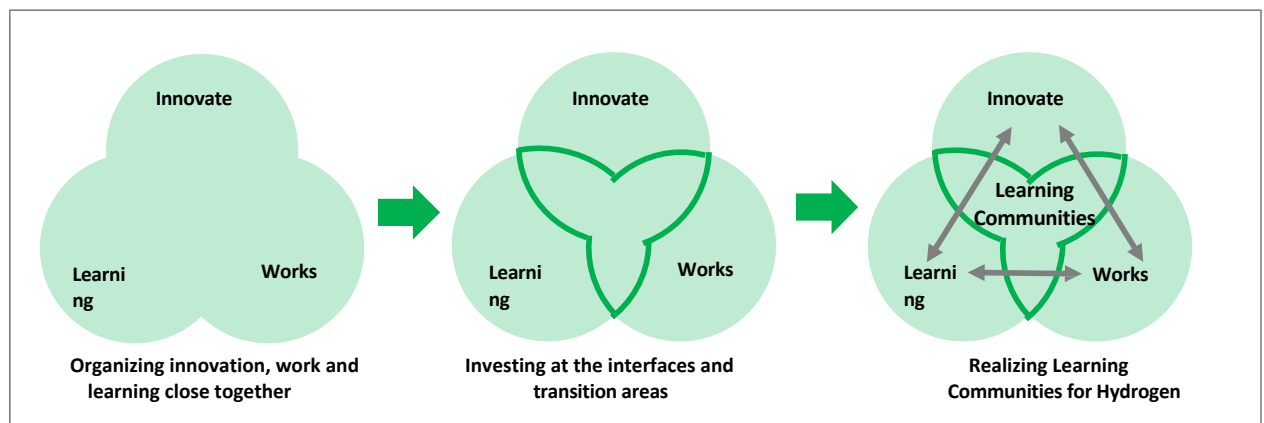| Results and kpi's for work stream 1.	
Perspective 2025	• An approach that systematically identifies knowledge needs for hydrogen. • Knowledge needs are broadly formulated: specifically on hydrogen (applications) transition knowledge, hydrogen as part of a broad set of professional competencies needed for energy transition. • On the National Knowledge Platform, this analysis is transparently disclosed. • It is also compared to the existing supply of training and education and any knowledge gaps are identified • Through the hydrogen "community," knowledge is shared about this. • A start has been made on the development of appealing professional images that will be disseminated in cooperation with mainstream education to leading mainstream education (vmbo, havo, vwo) and training for "side" entry. • A link is established with the NGF application LLO Catalyst and proposing large-scale PPP. • Trends in the demand for hydrogen knowledge have been examined and transition paths between sectors in the labor market have been systematically identified
End of 2022	• 'Green PowerNL Implementation Workshop' setting investment priorities 2022 (see text box). • A scheme has been opened so that regional Liaisons can be appointed. • Knowledge needs have been translated into regional Roadmaps for the six distinct regions. • Insight into knowledge and capacity needs in the R&D work package of GroenvermogenNL. • Total knowledge map initially prepared and disclosure through the National Knowledge Platform is likely to happen in 2023. • Established process to structurally update the dynamic hydrogen knowledge requirements in later years.

6.2 Workstream 2 Realize and scale up Learning Communities and mobilize region

Learning Communities

- The realization of Learning Communities is necessary because new knowledge from innovations must be translated more quickly into educational programs and training for professionals. This requires the close organization of innovation, work and learning in order to establish a solid foundation for the years after GVNL.
- Thereby, innovation and research institutes, with business and education work closely together on rapid transfer of knowledge, development of new training and education programs, hybrid settings of (informal) learning, up-to-date competencies of teachers and through practice-based research, business processes are adapted and entrepreneurs and employees are trained *on the job* through demand-driven cooperation with SMEs.
- It also shares (large-scale) facilities and maximizes the use of rapidly scalable training and education concepts, with a digital learning environment and deployment of AR/VR.
- In terms of vision, working method and concept, it is in line with the framework of concepts and principles as formulated in the context of Roadmap Human Capital Top Sectors[2] . It also uses the knowledge and tools from the national Learning Communities network and the research programming on Learning Communities through NWO. Important to underline is that Learning Communities:
  - Public-private partnerships are between research/innovation, education and business, which have a shared mission and ownership.
  - Have concrete outputs and products, such as practice-based research resulting in innovations in practice, education and training programs, and volumes in educated students as well as professionals.
  - Working on the basis of the Key Enabling Methodology (KEM) of Learning Communities, as developed in the NWO/SIA context.

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[2] https://humancapitaltopsectoren.wijzijnkatapult.nl/learning-communities/concept/

| Organizing innovation, work and learning close together | Investing at the interfaces and transition areas | Realizing Learning Communities for Hydrogen |

- The essence of Learning Communities is that they are an important catalyst in the rapid translation of newly developed knowledge from research and innovation into educational program and innovation and workplace learning. This is therefore not only about the 'roll-out' of already present and available knowledge, but also precisely about new knowledge developed in the R&D programs of GroenvermogenNL and requiring rapid application. It is therefore of great importance that a close connection is realized within GroenvermogenNL between the demo projects and the R&D programs and this human capital agenda.

Perspective 2025

- During the total duration of GroenvermogenNL, Learning Communities in the six regions will grow into full carriers of the human capital ambitions of GroenvermogenNL. Powerful consortia have been formed in the relevant knowledge areas. For energy transition, there are already a large number of Learning Communities (in the making) on which to build (for Energy, Chemistry and HTSM). These are also already involved in the planning around the HCA of GroenvermogenNL.
- The HCA Groenvermogen obviously makes use of these built-up networks and infrastructure (for speed, quality and the fact that hydrogen must find its bed in professions relevant to the top sectors involved). For example, from the Multi-Year Mission Driven Innovation Programs (MMIPs) and the HCAs created in that context. For example, the TKI Energy & Industry is working on its own HCAs for some of these MMIPs as part of the HCAs of Top Sectors Energy and Chemistry. A similar approach is conceivable for the MMIPs on Built Environment for example (via TKI Urban Energy) and System Integration. And a broadening is conceivable to the infrastructure of the Top Sector Logistics, once the prioritization in the implementation strategy of GroenvermogenNL would also move more towards mobility.
- Within the Learning Communities being further developed within the framework of GroenvermogenNL, the prioritized knowledge areas will be given form and substance:
  - Practice-oriented research in collaboration with innovative SMEs. Here, new applications are developed in close cooperation between practical researchers and the companies. Employees are trained *on the job* in the new application (think for example of the Innovation Traineeship SME of Regieorgaan SIA as part of the KIC). Developed concepts are generalized and where possible scaled up nationwide with matching training programs. Also consider KIEM as a booster of innovation projects between universities of applied sciences and SMEs. The goal is to support the regions with building a rich and broad SME network as an important basis for the hydrogen transition.
  - New knowledge is translated into (accredited) new educational programs for the regular routes and into (certified) training and education programs for professionals. Here we can connect to formal routes (SBB/choice parts) through national platform and informal routes through PPPs in vocational education. LLO Catalyst is

interesting to make the connection with training professionals, as well as national knowledge organizations such as ISSO that develops teaching materials for the Installation Sector and O&O funds as financiers of development of teaching materials for professionals.

- Together with private trainers, these training programs are "rolled out" for the purpose of training professionals so that the required scale can be achieved (see workstream 5)

• The programs developed are realized as much as possible in a digital form so that rapid sharing and scaling are possible. This also enables rapid adaptation to current developments or specific situations.

• It will be made possible for Learning Communities to set up large-scale facilities (plants, eletrolysers, ship engines, etc.) to educate and train students and professionals. Maximum use will be made of hybrid forms where facilities are available for both business and education. Where Learning Communities have these large-scale facilities, the programs will also provide digital variants (*'digital twins'* through AR/VR). This will enable more institutions to offer this type of education and training and make a greater impact with the large-scale facility.

Photo Edwin

• The development of these digital education and training p[rograms] to a large extent from the resources available from Work Stream 4 (National Package for Education Programs and Digital Learning Environment).

• Of course, here too, as much use will be made of already existing instruments and pathways, such as the HCA activities under the MOOI scheme and the hca module o f NWO. Also, the Learning Communities Tracking System has already been developed (Dialogic on behalf of TSE). This may be applicable to or expand upon this domain.

• Doing research on how to strengthen the functioning of Learning communities themselves will be part of the intended investment. Consider, for example, the research project Gas erop! resulting from NWO's call 'Learning in Learning Communities' (2019). But also the Top-up program that the Top Sector Energy wants to develop in 2022. This type of research contributes to strengthening the learning capacity of regions and public-private parties. This may include, for example, attention to forms of guidance on the shop floor, one of the focal points of the Berenschot study. Investment in this will be coordinated in collaboration with the national Learning Communities network.

• Formalizing learning and learning outcomes is important to achieve scale-up. Thus, within Learning Communities, there is also work on recognition of skills (EVC, micocredentials), certification and certification appropriate to the sector.

Activities 2022

• To realize these Learning Communities in a pragmatic way for the ambitions in Green PowerNL, a push and pull strategy will be implemented in the knowledge areas for the hydrogen ecosystem.

- Push: national preparation of calls for Learning Communities;
- Pull: regional mobilization of the already active "regional learning communities" to come up with appealing proposals with their partners (through the Regional Liaisons).

• Preparing, publishing, reviewing and honoring tenders and calls for L e a r n i n g Communities (push)

- With NWO/SIA, the tenders will be completed properly in terms of content, criteria, financial scope, grant rates, matching requirements, etc.
- The Advisory Committee evaluating the applications will be composed by NWO/SIA in good consultation with GroenvermogenNL.

- NWO/SIA will publish and communicate the final call and wide publicity will be given to the call through available channels.
- Within NWO/SIA, applications will be reviewed and honored.

- Mobilize parties and actors in the region (pull)
    - Meanwhile, work is underway with the field to prepare high-quality applications. The Regional Liaisons are explicitly tasked with arriving at a coherent approach (Roadmap) and consortia with the region (see work stream 1). These will lay the foundation for the Learning Communities to be developed. Here the best use can be made of the already available Action Scan Learning Communities[3] developed by the Top Sectors.
    - Innovation and learning require physical as well as digital facilities. In the first year (2022) the bottlenecks (and white spots) can be mapped and how the business community can contribute to the removal of those bottlenecks, resp. under what conditions an impulse from the NGF could be justified here. Preferably, this physical set-up will be an integral part of Learning Community applications. Proposals will be explicitly challenged to achieve this synergy (*'comply or explain'*). The masterclass physical infrastructure (developed i.c.w. Top Sector Energy/De Uitdaging, Katapult, VTi and Bouwend Nederland) can be used to make the Learning Communities proficient in arriving at sound investment decisions.

- Initial activities within the relevant Learning Communities: Building on the existing initiatives and infrastructure, which have already manifested themselves strongly such as Centres of Expertise, Centers for Innovative Craftsmanship, Fieldlabs, lectureships and praxis.

- To 'secure' the building on the existing infrastructure, this will explicitly be part of the criteria for the tenders and calls. It is important, however, that where desirable and necessary, these initiatives further strengthen themselves with an expansion into research and academic education; respectively, further strengthen themselves on the market side with frontrunner companies and innovative SMEs. Cooperation with private educators will also be a new element in further expanding regional ecosystems.

Results and kpi's for work stream 2.	
Perspective 2025	• In all six regions, mature Learning Communities are fully operational in the knowledge areas relevant to hydrogen. • Together with their regional and national partners, they provide the necessary infrastructure and have the relevant programs for both regular education and the education and training of professionals (with private trainers). • There are high-quality innovation and training programs that support SMEs in the development of new processes and concepts while supporting the entrepreneur and his employees in (informal) training and education To instill the required competencies.
End of 2022	• Information materials on Green PowerNL (ambitions and context) and the role/meaning of Learning Communities (what are they, how does it work etc). • Liaisons have been recruited and active; regional Roadmaps have been created, regional consortia have been formed. • Open first call for Learning Communities no later than Q3, preferably earlier if possible. Honor first proposals Q4. • Depending on the choices that remain to be made by early 2022, six regions are in a "zero" phase of starting their Learning Communities. • Regions that may not have been able to submit their plans for Learning Communities by 2022 are at an advanced stage with their plans based on the Roadmap and will be able to accelerate their start in 2023.

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[3] https://www.wijzijnkatapult.nl/files/topsectoren/HCTS%20Actiescan.pdf

6.3 Workstream 3 National Knowledge Platform knowledge exchange and training opportunities

Perspective 2025
- A robust and widespread network of parties (and people) from industry, research/innovation, education, governments, active in the development and transfer of hydrogen knowledge will be realized. This network will be supported by a digital platform.
- On the one hand, the network serves as a (digital) community: knowledge is exchanged and new issues and knowledge fields are put on the agenda. People can go there with their questions; referral to solutions can take place. Proposals for new initiatives can be launched and parties can be matched on ambitions and plans.
- On the other hand, it has an important core function in unlocking and sharing knowledge, programs, tools, etc., that have been developed regionally and can be scaled up nationally. (See also National Package Educational Programs in work stream 4).
- Of course, it will build on already existing networks and platforms. After all, much has already been invested in them in recent years. Therefore, during the life of the program a connection will be made with all these platforms with a transparent structure so that the investments already made will not be lost. Examples of such networks and platforms include:
  - the Regieorgaan Praktijkgericht Onderzoek (SIA);
  - the network of practical chairs in MBO and lectorates in hbo (such as LEVE and UE);
  - research schools, including the ECCM Graduate school;
  - the various platforms from industry, such as from WijTechniek, OOF, VNCI, HTSM;
  - Katapult's networks with CoEs, CIVs and Fieldlabs;
  - Regional public-private parties and collaborative networks.

> One of the interesting initiatives here is the broad cooperation in vocational education. It is a nascent collaboration, which the parties themselves describe as follows: "*The starting point for the collaboration between 15 MBOs, 5 universities of applied sciences and 3 CoEs is that we can strengthen each other on the theme of hydrogen. That we can use our available resources more efficiently, that we can avoid duplication of effort and that by dividing tasks and bringing knowledge together we can work together more effectively on the development of knowledge and education on the H_2 theme. In other words, that by working together on a structural basis, we can make a much more solid contribution in the current transition to a sustainable, reliable and affordable energy supply on the broad field of H_2. In other words, "Alone you go faster, together you go further. Ultimately, this will allow us to better serve both our students and our (business) partners. "*

- Of course, there will be an important connection to the digital learning environment that the National Education Programs Package will unlock (see workstream 4).
- A highly professional "hosting" will be in place for the digital platform, structuring information, connecting to other and new platforms, keeping information current and moderating discussions.
- For the communication network (community), there will be active mobilization, events and meetings, news releases and announcements that can be provided through existing channels of parties, and there will be an active functionality to connect parties and people.

Activities 2022
- As one of the first activities to arrive at a National Knowledge Platform, a program of wishes and requirements will be started in 2022. This will be done through a brief inventory among potential users. The same inventory will include what already exists and what functionalities are already provided for and what use value existing infrastructures already have for the various parties.
- Based on this program of wishes and requirements, a supported plan will be drawn up and a consortium will be formed of parties who will jointly commit to an (integrated) platform. This consortium will act as 'client' for the platform to be developed.

develop National Knowledge Platform. This will also link to the R&D program of GroenvermogenNL.

- Based on these preparations, a formal request for proposal will be drawn up in collaboration with the RFO, followed by the selection of one or more parties who can realize such a 'connected' platform. Important criteria here are dynamism and flexibility, because this functionality is also part of the movement that needs to be set in motion. As that movement gets underway, other and new wishes and requirements will arise; also from new parties that become connected. It is therefore important to proceed gradually and modularly.
- In addition, a start will be made with the content development that will be offered via the platform, or a selection will be made of existing content that the consortium believes deserves to be made available via the National Platform. A good example of this are the optional subjects for secondary vocational education that have already been developed.

Results and kpi's for work stream 3.	
Perspective 2025	- There is a National Knowledge Platform for Human Capital in Hydrogen, with broad functionality both to unlock knowledge and programs and to dynamically facilitate interaction and help initiate new developments and consortium formation. - It connects parties from various backgrounds, research/innovation, education, business and provides both formal and informal transfer of knowledge and offers functionality for retraining and re-training of lateral entrants. - Important actors in the Knowledge Platform are the Learning Communities and the (regional) parties around them. - There is connection to the digital learning environment and the National Education Programs Package.
End of 2022	- Program of requirements and inventory of existing platforms and functionalities. - Consortium as potential client and plan of action (room for growth and momentum). - Solicitation and assignment. - Initial selection of content. - Setting up support structure and communication for community building - Indicators are established for such things as intended use, reach, impact, degree of knowledge sharing, network development, etc)

6.4 Workstream 4. National Package of Educational Programs Hydrogen

Perspective 2025

- For the duration of the program, a transparent and structured range of relevant (and recognized) education and training programs will be developed. These are both for regular education (mbo, hbo, wo), and for the training of professionals as well as for retraining and refresher courses for those who come in later. This offer also includes continuing education for the teachers and trainers themselves, so that they too can keep their knowledge up to date.
- The offerings may consist of full courses or educational programs, or they may be minors, ad programs, modules, refresher courses, etc. These offerings have broad origins:
  - regular education, mbo, hbo and wo
  - business: industry education and training
  - private training sector
- Within the offer, 'accreditation' and 'certification' will also be worked with and, where possible, it will be possible to work with 'reviews' so that parties have insight into the quality and value of the education and training courses. On the basis of this accreditation and certification, private training providers, for example, can then provide scale and mass in terms of

for the rapid and targeted training of larger groups of professionals (see also workstream 5 as regards the voucher system for the training and education of professionals). This could tie in with the concepts of "microcredentials" and badges already initiated by SURF. This has been supported by hbo and mbo. Furthermore, it will be explored how to link up with existing skill passports.

- To make this possible, an insightful training structure for hydrogen will be provided at the end of the term, making clear what "degree requirements" are set for which positions and what training and/or experience pathways provide for them.

Thought exercise National Package Educational Programs Hydrogen

- By analogy with other NGF proposals, work can be done to develop an initial set of courses from one central sender:
  - National Hydrogen Course, outlining from the perspective of GroenvermogenNL what the hydrogen economy is all about, its impact on society, its imminent applications and what it means for entrepreneurs, workers and consumers.
  - In-depth courses focused on the various "application areas": hydrogen production; hydrogen transportation; hydrogen storage and transfer; hydrogen in industry (one or more variants); hydrogen in the professional transportation sector (one or more variants); hydrogen in the built environment; hydrogen in consumer mobility; etc.
  - A number of thematic courses focusing on important topics such as safety, climate, legislation.
  - Awareness courses for a wide audience that provide a basic understanding of perspectives of the hydrogen economy and its potential impact.
- To arrive at an orderly approach and classification of trainings and courses, one can also consider the target groups for which they are intended. For example:
  - Expert training, intended for completely new functions and professions or functions and professions that are going to change to a great extent or have completely new requirements.
  - Application-oriented training focused on functions and occupations, where working with and applying hydrogen represents an important new development that must be mastered and applied safely (additional skill and competence).
  - Teacher training, aimed at trainers and teachers in regular educational institutions and in the market for professionals. For this, e.g. *train the trainer* concepts can be applied.
  - For lateral entrants, an important link can be made to the transition pathways explained in Workstream 1. On that basis, modules can be mapped out that provide the specific competency or skill gaps.
  - It is also conceivable to include here an option for teaching packages that can be used in vmbo, have and vwo, so that secondary school teachers can quickly find supporting teaching materials here if they want to pay attention to hydrogen in their teaching.
- Programs and elective units have already been developed (such as the MBO-4 Elective Units Hydrogen). These are an important input for the inventory of what is already available.

- Within this national package is room for the so-called 'digital twins'. These 'digital twins' are a digital copy of large-scale facilities that have limited availability and are often hosted by a Learning Community in a particular region. Through the use of AR and VR, these large-scale facilities can be digitally simulated and recreated, and by linking training and instruction to them, a much larger target group can make use of them.
- It is conceivable to include here specifically an option for teaching packages that can be used in vmbo, have and vwo, so that teachers can quickly find supporting teaching materials here if they want to pay attention to hydrogen in secondary education.
- A digital learning environment for the hydrogen has been set up that is available to a broad target group of users. This will not only provide access to the courses or offer them digitally, but will also make maximum use of digitization of the learning process, tracking systems, interaction and feedback, use of AR and VR, keeping track of results, chat functions with teachers, group learning, portfolios can be maintained partly in relation to learning paths, etc. The expertise of TU Twente in this regard will be utilized as well as the knowledge developed on behalf of the Top Sector Energy on the development of a digital learning environment.

Activities 2022

- For the short term (2022), the focus is on developing a number of "national" and sectoral courses:
    - National Hydrogen Course;
    - Course Hydrogen for production, transport, storage and transshipment[4] ;
    - Hydrogen for Industry Course.
- Together with relevant parties (including the Learning Communities), parties determine an initial relevant format and content for the National Package of Educational Programs, distinguishing between regular (vmbo, mbo, hbo and wo) and training for professionals.
- Prepare a formal request for the development of such a National Education Program Package (together with NWO/SIA/RVO) that can also be accessed digitally and has a connection to the National Knowledge Platform (work stream 3).
- Maintenance and update is provided by "subject groups. It is important to provide for keeping such a package current. So again, investing in the infrastructure and mobilizing the movement.
- Mobilize parties that can form a coalition for a digital learning environment for Hydrogen. By 2022 the outlines for such a coalition should be in place and it should be possible to produce a first charcoal sketch for such an environment. Conceivable parties are: educational institutions, private trainers, industry/O&O funds.

Results and kpi's for work stream 4.	
Perspective 2025	• Transparent package of education, training and training opportunities with insight into learning paths and pathways, for the different professions and positions in (expert or limited application). • National package of basic courses for all application areas • Certification and accreditation of courses (incl. degree requirements, etc.) • Digital learning environment for the Hydrogen to which all relevant parties are connected both in terms of use and "feeding" with relevant (certified) training. • Elaborated offerings of "digital twins" for courses using the large-scale facilities.

End of 2022	• Three courses:
	  - National Hydrogen Course
	  - Hydrogen Production, Storage, Transportation & Transshipment Course
	  - Hydrogen for Industry course (one or more variants).
	• Inventory relevant parties and content for the National Package of Educational Programs.
	• Formal solicitation to arrive at such a package.
	• Consortium and charcoal sketch for the Digital Learning Environment Hydrogen.

6.5 Work stream 5. Innovation impulse SMEs and training impulse business community

Perspective 2025

- According to the RHDHV report 'Hydrogen skills, need and development' (based on studies by Ecorys), the labor market shortages in the energy transition (i.e. broader than the hydrogen economy) will reach (gross) 23,000 to 28,000 jobs by 2030. Certainly in the short term, regular education will only be able to make a limited contribution to this with additional inflow and outflow.
- It thus becomes clear that much of the effort within the population already working will have to take place through continuing education and training of professionals and through retraining and lateral entry.

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[4] A hydrogen course for college professionals already exists: https://www.han.nl/opleidingen/cursus/waterstof/

- The ambition is to train and educate people in the areas relevant to hydrogen with the necessary competencies and skills during the course of the program. The target groups can be largely identified on the basis of the dynamic knowledge map (work stream 1) and the transition paths defined within it (retraining from adjacent sectors).
- The idea here is to develop recognized and certified education and training programs based on PPP agreements (including within the context of Learning Communities) that private parties in the market can roll out with scale and pace. Regional Liasons track the use of the programs in terms of number of participants.
- For many SMEs, this will also take place within a context of practice-based innovation (switching processes in practice with *learning on the job* on the shop floor). The concept of Learning Communities (see work stream 2) can provide important support and structure to this.
- But even more broadly - using the National Education Programs Package, including certified training and the digital learning environment for hydrogen - results can be achieved here relatively quickly with a focused effort.
- Through a system of innovation and training vouchers, a flywheel will be realized, whereby not only education and training programs are developed, but at the same time a purchasing power is created. Of course, this will require co-financing from the market parties, including through the sectoral Education and Development Funds (R&D funds). This will have to be worked out in more detail.

Photo by Valerie

- As the inventory by Bureau Berenschot also shows, the parties in the field indicated during the interviews that there are an important focus will have to be on "practically skilled and workplace learning. It is precisely in this work stream in combination with the aforementioned research on Learning Communities/guidance in the workplace itself that this will be given form and substance. On-the-job coaching and supporting entrepreneurs in terms of new knowledge and skills in the business are essential components for a successful transition process

Activities 2022
- It is conceivable that this will be a phased approach (especially for SMEs) in which companies can go through a number of steps:
    - What does hydrogen mean for my market and the product/process in my company?
    - What can/should I do to adapt processes and products accordingly?
    - what impact will it have on my business and my people?
    - what steps should/could I take to achieve this?
    - Who can help/support me in this?
- In 2022, the most promising approach can be further developed into an incentive instrument. A voucher system is being considered that would enable a combination of hands-on innovation and training/traineeship for SMEs.
- It is important that the support structure (experts, advisors, etc.) is in place when the voucher instrument is published. For example, the National Platform for Knowledge Exchange and Training Opportunities will already have to be able to offer an initial referral function, the Learning Communities will have to be addressable on this, and the National Education Package will also have to have an initial operationalization.
- E.g., this requires a well-aligned and coherent approach that will be figured out and operationalized in 2022 in good consultation with RFO (and possibly NWO/SIA).

Results and kpi's for workflow 5	
Perspective 2025	• SMEs are supported in practical innovation and the training of people (including informal training) in their relevant application areas. • A total of 300-500 SMEs were able to adapt their business processes in a combination of innovation and training, through a structural collaboration with a Learning Community. • In doing so, they can also use the large-scale facilities realized at the Learning Communities or the "digital twin" based on them. • these facilities may, of course, also become available through the companies participating in the relevant Learning Community

End of 2022	• Develop the guidance and support approach for SMEs (what).
	 • Operationalize incentive instrument and voucher system (how)
	 • Base in place when it comes to support infrastructure:
	   - Experts are available;
	   - Referral function through National Knowledge Platform is operational;
	   - Initial positioning Learning Communities is ready;
	   - Overview of training opportunities through the National Package of Educational Programs is ready.

7. Planning and phasing

7.1 Multi-year planning and phasing

- The entire GroenvermogenNL program has a term of 8 years. For HCA activities, a duration of 4 years was adopted at the time. As stated in the NGF proposal itself, human capital activities are prerequisites for success and have therefore been moved to the first phase of the program.
- Should it become apparent in the course of that period that certain activities require a longer lead time or that a longer-term commitment is needed, then a different decision may be taken. Further decisions will also have to be made about how the (knowledge) yields and transfer of knowledge from the GroenvermogenNL R&D programs will be secured in the period after 2025. The midterm review scheduled for late 2023 will take a closer look.
- An initial multi-year phasing of activities is outlined below; it will be reviewed annually based on progress and priorities.

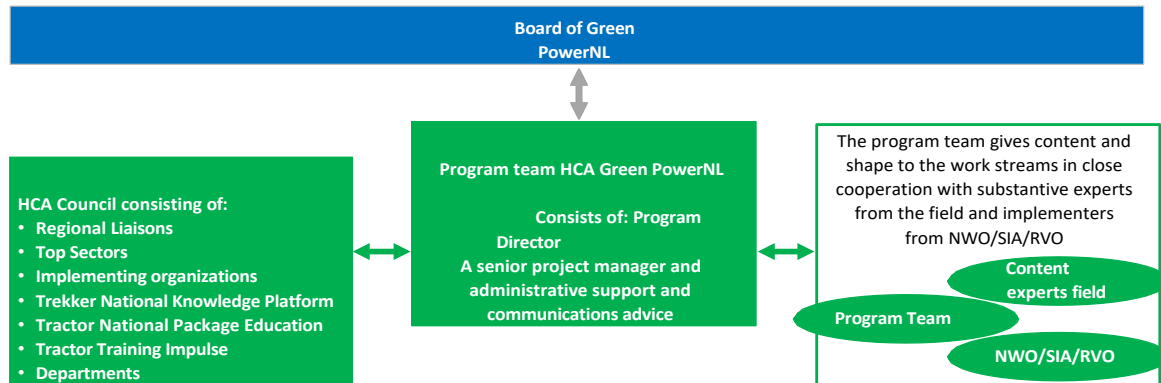|	2022				2023				2024				2025			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
General																
Decision board, establishment program																
Monitoring			'22				mt									end
Workstream 1 National Knowledge Map																
Regional Roadmaps																
National Hydrogen Knowledge Map				Continuous updating and publication National Platform												
Transition paths																
Materials for secondary education																
Workflow 2 Learning Communities																
1ste requesting Learning Communities			1													
2de query Learning Communities						2										
3de query Learning Communities							3									
4de query Learning Communities													4			
Allocation of large-scale facilities						*			*				*			
Incentive Professionalization Teachers		*				*			*				*			
Incentive Practical Research		*				*			*				*			
Workstream 3 National Knowledge Platform																
Preparation, assignment, delivery																
Hosting, moderation and development																
Loading with National Knowledge Map																
Loading with Regional Roadmaps																
Loading with National Education Package																
Loading with digital learning environment																
Communications, events and community																
Work Stream 4 National Package Educational Programs.																
National and basic courses																
National Education Package			Assignment		Continuous updating and publication National Platform											
Develop digital twins (facilities)																
Design and elaboration of certification			Setup		Elaborate				Apply							
Development of digital learning environment					Develop				Use and development							
Workstream 5 Innovation and Training Impulse																
Outline roadmap SME																
Elaborate voucher system																
Basics in order																
Publications voucher scheme					1			2			3			4		
Support and guidance																
(*) The queries preferably open along in the integral calls for Learning Communities (scenario 2) see section 9.1																

7.2 Planning and phasing 2022

Based on the above multi-year planning, concrete activities and planning have been developed for 2022.

Planning and phasing 2022	jan	Feb	Mar	Apr	May	Jun	jul	aug	sep	Oct	Nov	Dec
General												
Decision of the board of GroenvermogenNL	■											
Setting up organization and program	■											
Adoption HCA Council		■										
Kick-off meeting			■									
Setting up monitoring system								■	■	■	■	■
Workflow 1 Knowledge mapping												
Implementation strategy workshop		■										
Dynamic knowledge map completed	■											
Disclosure via National Platform											■	■
Determining investment priorities		■										
Regional Liaisons plan & appointment	■	■	■	■								
Regional Roadmaps			■	■	■	■						
Transition paths labor market for H2						■	■	■	■	■	■	■
Workflow 2 Learning Communities												
Information materials LCs and GV.NL	■	■	■									
Prepare 1ste call			■	■	■							
Opening up and communication						■	■	■				
Mobilize parties (see also Roadmaps)			■	■	■	■						
Review and honor proposals								■	■	■		
First LCs take off											■	■
Other regions ready for 2023 filing						■	■	■	■	■	■	■
Opening up Professionalization Teachers						■	■	■	■	■	■	■
Opening up Practical Research						■	■	■	■	■	■	■
Workstream 3 National Knowledge Platform												
Inventory of existing structures		■	■									
Program of requirements & plan			■	■	■							
Invitation to parties; assignment				■	■	■						
Selection and development of content							■					
Start development of National Platform								■	■	■		
Support structure										■	■	■
Community & communication			■	■	■	■	■	■	■	■	■	■
Work Stream 4 National Package Educational Programs.												
National Hydrogen Course				■	■							
Basic Production, Transportation, Warehousing Course				■	■							
Basic course on hydrogen in industry				■	■							
Market inventory of content and parties				■	■	■						
Consortium commissioning							■	■				
Invitation and assignment National Package							■	■	■	■	■	■
Plan certification system training H2										■	■	■
Charcoal sketch digital learning environment										■	■	■
Workstream 5 Innovation and training impulse												
Development roadmap for SMEs				■	■							
Elaborate voucher instrument						■	■	■	■	■	■	
Base in place for support										■	■	■

8. Organization

Below is an initial outline for the organizational structure for implementing the HCA Green PowerNL.

Role/Function	Short description
Program Team	Implementation of the HCA will be carried out by the HCA Program Team. This consists of a program director, a senior project advisor and administrative and communications support. • The Program Director falls under the governance of GroenvermogenNL, in part because human capital is an essential and cross-cutting theme. He/she will manage the members of the team and will also take on the implementation of one or more work streams. Coordination with the implementing organizations and the HCA Council. The portfolio also includes monitoring progress, monitoring and evaluation (such as the midterm) and administrative agenda-setting of possible bottlenecks. He/she will also maintain external and administrative contacts and has the task of realizing synergy with other programs and bodies, such as the Task Force Labor Market & Training, other HCAs of top sectors, in particular Energy (HCA-TSE team), Chemistry and HTSM and consultation Roadmap Human Capital Top Sectors. • Senior project advisor who will do the operational execution of the remaining work streams. Among other things, working out the calls and tenders together with experts from the field and implementing organizations. Managing the deployed assignments, such as the (digital) platforms, taking care of content and activating and mobilizing the field. • Support: communications, website, newsletters, organization of events (and digital meetings) administrative support.
HCA Council	• The HCA Council includes actors (national and regional) who are actively involved in the implementation of the HCA. • They provide input to implementation and periodically reflect on progress and plans. • Members are also expected to take an active role in communication and promotion and with stakeholder mobilization. • Regional Liaisons participate in regional cluster committees for optimal cross-fertilization regional activities ihkvNL.
Implementing organizations	• NWO, SIA and RVO implement the calls and tenders. They bear responsibility for professional and proactive preparation and execution of the calls, tenders and assignments. • Once honored, based on agreements between the implementing organizations and the Program Director, there will be a division of labor in managing the portfolio and monitoring financial progress and depletion

9. Budget

9.1 Multi-year budget and budget 2022

- The assessment of GroenvermogenNL indicated that the funds for the HCA activities have been "released" for the first year only, i.e. M€ 5. After a positive monitor at the end of 2022, the remaining funds may become available (multi-year), i.e. M€ 45.
- An initial tentative multi-year budget is shown below. It will be updated and completed in the coming period.
- Also, the multi-year budget will most likely be adjusted during the term of the HCA program based on experience, progress and findings and any updated priorities. The program team may submit a reasoned updated budget to the GroenvermogenNL Board for this purpose.
- The entire GroenvermogenNL proposal has a term of 8 years. For the HCA activities, a duration of 2022 to 2025 has been retained at this stage. As also indicated in the NGF proposal itself, human capital activities are prerequisites for success and have therefore been pushed to the first phase of the program. Should it become apparent during that program period that activities need a longer lead time or that a longer-term commitment is needed, a different decision can be made during the term. At the mid-term review scheduled for 2023, this will be further considered.
- <u>Note</u>: The budget below is the budget for the stimulus resources available from the National Growth Fund. Further consideration will be given as to whether, and if so how, there will be co-financing from the business community or the region, among others. Proposals for and decisions on this will be made in the course of 2022.

Prior

Two scenarios are conceivable for the realization and scaling up of Learning Communities in terms of the design of the support tools.

Scenario 1:

The most ideal form would be a robust form of support in which regions submit integral plans based on their own Roadmap (drawn up by the Regional Liaison in close cooperation between the regional partners) and also receive an integral budget for this. This does justice to the ambition to work with Learning Communities in an integral way between the three silos of innovation, working and learning. And it prevents the integrated plans from having to be divided up again 'at the back' into various partial instruments, each with its own submission procedures and accountability, for financial/administrative reasons. A more robust design of the support will also significantly reduce the implementation burden (and thus the implementation costs) at the national level.

Scenario 2:

Starting from the individual incentive instruments and asking regions to set up the integrated plans in such a way that individual instruments and schemes can be used and thus financially "cut up" to the different instruments.

In preparing the budget below, scenario 2 has been assumed for now. This is because of the fast start we want to make in 2022. After all, designing and publishing new regulations requires considerable preparation time. During 2022 a more integral approach will be examined with the implementing organizations and the regions. For the period 2023 and beyond, the commitment is to start from scenario 1 with a robust and integral approach and financing.

Multi-year budget of grant funds - Amounts in M€.		2022	2023	2024	2025	-Expenses including VAT	
Working current		2022	2023	2024	2025	Total	Total
1	Mapping knowledge areas	€ 0,4	€ 0,5	€ 0,5	€ 0,5	€ 1,9	€ 3,0
1	Promotion inflow/professional images	€ 0,1	€ 0,1	€ 0,1	€ 0,1	€ 0,4	€ 3,0
1	Monitoring and transition paths	€ 0,1	€ 0,2	€ 0,2	€ 0,2	€ 0,7	€ 3,0
2	Regional Liaisons	€ 0,6	€ 0,6	€ 0,6	€ 0,6	€ 2,4	€ 21,0
2	Learning Communities	€ 0,6	€ 2,3	€ 2,3	€ 2,3	€ 7,5	€ 21,0
2	Physical investments		€ 1,6	€ 1,6	€ 1,6	€ 4,8	€ 21,0
2	Professionalization of teachers	€ 0,2	€ 0,4	€ 0,4	€ 0,4	€ 1,4	€ 21,0
2	Encourage hands-on research	€ 0,4	€ 1,5	€ 1,5	€ 1,5	€ 4,9	€ 21,0
3	National Knowledge Platform	€ 0,2	€ 0,3	€ 0,3	€ 0,3	€ 1,1	€ 3,0
3	Digital Knowledge Platform	€ 0,4	€ 0,5	€ 0,5	€ 0,5	€ 1,9	€ 3,0
4	National Education Programs Package	€ 0,5	€ 2,5	€ 2,5	€ 2,5	€ 8,0	€ 11,0
4	Digital learning environment	€ 0,3	€ 0,9	€ 0,9	€ 0,9	€ 3,0	€ 11,0
5	Innovation and Training Incentive	€ 0,5	€ 2,5	€ 2,5	€ 2,5	€ 8,0	€ 8,0
	Subtotal	€ 4,3	€ 13,9	€ 13,9	€ 13,9	€ 46,0	€ 46,0
	Implementation costs NWO/SIA/RVO (4%) (*)	€ 0,2	€ 0,6	€ 0,6	€ 0,6	€ 2,0	€ 2,0
	Coordination, organization, communication	€ 0,4	€ 0,4	€ 0,4	€ 0,4	€ 1,6	€ 2,0
	Out of pocket	€ 0,1	€ 0,1	€ 0,1	€ 0,1	€ 0,4	€ 2,0
	Total	**€ 5,0**	**€ 15,0**	**€ 15,0**	**€ 15,0**	**€ 50,0**	**€ 50,0**

(*) Further consultations will be held with the implementing organizations about the implementation costs. It is important here for both the region and the implementing parties to work with incentive packages that are as robust as possible and unambiguous accountability. This increases effectiveness and synergy and reduces implementation costs considerably.

- ■ W-1 Knowledge Communities
- ■ MapW-2 Learning
- ■ W-3 National Knowledge Platform
- ■ W-4 National Program Management
- ■ Education PackageW-5 Innovation and Training
- ■ Implementing organizations
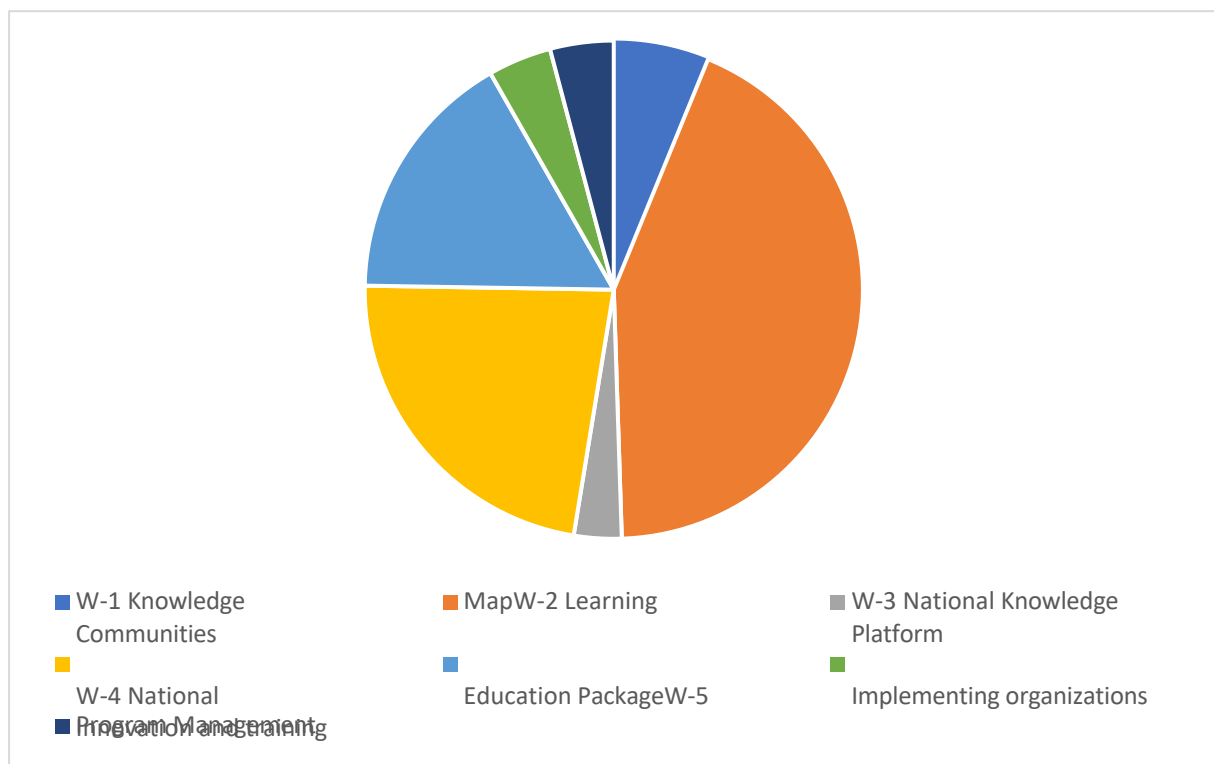
Explanation
With reference to the activities and kpi's in section 6 for the relevant work streams

Workflow 1. Dynamic Knowledge Map Green PowerNL.
For the entire duration of the HCA, an amount of M€ 3 is available for this purpose
- Periodic analysis of the evolving knowledge needs and knowledge supply for hydrogen will be done. This will be done through research, regional inventories and national implementation workshops. For this purpose K€ 400 in 2022 and K€ 500 annually thereafter.
- For promotion and greater awareness of hydrogen and its applications, K€ 100 is budgeted annually. This will be used for increased attention in secondary education (vmbo, havo, vwo). Together with PTvT (and other organizations such as C3 in chemistry) we will look for effective approaches. The material can also be used to stimulate lateral entry.
- Monitoring of the HCA will make use of existing tools (such as the Learning Communities Tracking System and the Top Sector Chemicals labor market dashboard). Also, *Centerdata*'s research on transition paths will be conducted periodically. Collectively, €100k is budgeted for this in 2022 and €200k annually thereafter.

Work stream 2. Realization and scaling up Learning Communities and mobilizing region
For the entire duration of the HCA, an amount of M€ 21 is available for this As
indicated, this provisionally assumes an approach via the fragmented instruments (see
text box above).
- Regional Liaisons will be appointed in all six regions with the role and task as defined. Each Liaison is budgeted an annual amount of K€ 100. For a four-year period and six regions, this commitment amounts to M€ 2.4.
- With the implementing organizations NWO and SIA, tenders will be issued for the realization and scaling up of Learning Communities. The goal is for the six regions (coordinated by the Regional Liaisons) to prepare high-quality proposals and form consortia for this purpose. Calls should be prepared, issued and the best plans honored. It is expected that 2022 will still be a start-up year and later years all regions will come up with mature plans. An average amount of M€ 1.25 is budgeted per region over the entire four-year period. Of course, it will depend on the quality and scope of the plans whether or not they will be honored and to what extent.
- An amount of M€ 1.6 is budgeted annually from 2023 for the realization of large-scale physical infrastructure. This will pay for facilities such as large-scale learning facilities in the field of electrolysers or other facilities (e.g. engines and installations for inland navigation or trucks that run on hydrogen). Naturally, there will be co-financing from industry here. Preferably this will be combined with the Learning Communities proposals. If not, the proposals will require explanation and justification (*comply or explain*). The starting point is that at the national level there is an optimal investment towards regions.
- Teacher education and training programs will be developed within Learning Communities (but also around them) so that education and training are provided by teachers with up-to-date knowledge. Preferably, the possibility of hybrid lectureships will be encouraged, with lecturers working partly in education and partly in industry. An annual budget of K€ 400 has been budgeted for this, with a start-up budget of K€ 200 for 2022. Of course, as much use as possible will be made here of existing inflow trajectories for hybrid lecturers, such as, for example, the Hybrid Technology Trainer of the Hogeschool van Amsterdam.

Work stream 3. National Knowledge Platform for knowledge exchange and training opportunities
For the entire duration of the HCA, an amount of M€ 3 is available for this purpose

- As described, the National Knowledge Platform will have a physical and a digital format.
- In terms of supporting physical knowledge activities, these include:
  - Support of existing knowledge platforms (e.g. platforms for professorships and practorates)
  - regional knowledge platforms of education and business;
  - national exposure and exchange of knowledge and results of Learning Communities;
  - organization of events and communication to all stakeholders within the hydrogen ecosystem

  An amount of M€ 200k is budgeted for this in 2022 and an annual amount of M€ 300k thereafter.
- The National Knowledge Platform will be supported with a digital platform. A program of requirements will be drawn up and a call for tenders issued for this in 2022. One party or a consortium will be commissioned to develop this platform, realizing maximum connectivity and accessibility of existing platforms. For the construction and (continued) development of the digital platform, an amount of EUR 400k is available in 2022 and EUR 500k annually thereafter. This digital platform will be linked 1:1 to the digital learning environment and the digital accessibility of the National Education Package (see work stream 4).

Workstream 4: National Package of Educational Programs Hydrogen
For the entire duration of the HCA, an amount of M€ 11 is available for this purpose

- To compile a National Hydrogen Education Program Package, a number of steps will be taken (see work streams 1 and 4). First, based on the dynamic knowledge map, a first insight will be created into the knowledge need (also future) and the existing supply of programs. It is important that the existing supply be made suitable for wider use (also by other target groups). White spots will be identified and on this basis, targeted teaching materials can be developed and compiled (including through the Learning Communities). An assignment will be given to one or more consortia to give form and content to this for the duration of the program. A budget of €500k is available for this in 2022 and thereafter M€ 2.5 annually. Here we are working towards a subsidy scheme that invites parties to develop material based on specific criteria. The development of the 'digital twins' of the large-scale facilities will also be financed from this budget.
- Disclosure of the National Hydrogen Education Program Package will take place in a digital learning environment. In this environment not only are the packages and tools available, but also assessments can take place (where do I stand as a company, what impact does it have on my profession and what does that mean for me). Guidance and feedback based on AR/VR can also take place, in part, digitally. In 2022, a program of requirements will be drawn up for this digital learning environment. In the years that follow, the digital learning environment will be developed and equipped, supported and further developed and supplemented based on demand and need of users. For this digital learning environment an annual amount of K€ 900 has been retained, with 2022 as a start-up year (K€ 300).

Workstream 5: Innovation and training impulse
For the entire duration of the HCA, an amount of M€ 8 is available for this purpose

- A voucher system is envisaged for the Innovation and Training Impulse, which SMEs can apply for when they want to explore the possibilities and consequences of the transition to hydrogen for their company and the competencies and skills of their employees.
- Further support provides workers with guidance on informal learning and "adapting" work situations to enable this learning.
- finally, it is envisaged that companies and professionals follow education and training based on training and courses developed through Learning Communities in cooperation with private trainers. In this case, co-financing from O&O funds will certainly also be an issue.

- For 2022, a run-up is foreseen, for which a budget of K€ 500 is provided. For subsequent years, a more massive effort of k€2.5 million per year is estimated.

Implementation costs for implementing organizations NWO, SIA, RVO
- For the preparation and implementation for the various tenders and calls by NWO, SIA and RVO, an average percentage of 4% is calculated over the relevant program costs. As indicated in the multi-year budget, this comes out to an amount of M€ 2 for the entire program period of 4 years.

Organization and coordination and out of pocket costs
- For the coordination and organization of the program (including communications, website, etc.), a project team will be used, consisting of a program director, a senior project leader and administrative and communications support.
- An annual amount of EUR 400k is budgeted for this and EUR 100k for out of pocket costs.

9.2 Budget and tools

The instruments used for the realization of the HCA GroenvermogenNL are indicated below for 2022. As indicated, during the course of 2022, further consideration will be given to the possibility of moving toward more integrated funding with corresponding benefits for both regional partners and national implementing organizations.

	Sub-activity	Intended Implementer	Intended Instrument	Amount 2022
1	Mapping knowledge areas	RFO	Assignments	€ 0,4
	Promotion influx /professional images	PTvT (evt C3)	Assignment	€ 0,1
	Monitoring and transition paths	PM, Dialogic, Centerdata	Assignments	€ 0,1
2	Regional Liaisons	NWO/SIA	One-time support grant	€ 0,6
	Learning Communities	NWO/SIA	New regulation coming out?	€ 0,6
	Physical investments	NWO/SIA	Regulation	
	Professionalization of teachers	NWO/SIA	Grant/customization	€ 0,2
	Practice-oriented research	NWO/SIA	Regulation	€ 0,4
3	National Knowledge Platform	NWO/SIA	Connection to current platforms Custom	€ 0,2
	Digital Knowledge Platform	RFO	Contract based on demand	€ 0,4
4	National Education Package	RFO	Grants	€ 0,5
	Digital learning environment	RFO	Contract based on demand	€ 0,3
5	Innovation and Training Impulse (preparation).	NWO/SIA	KIEM - scheme Innovation Traineeships	€ 0,5
		RFO	Vouchers	
	Implementation NWO/SIA/RVO	NWO/SIA/RVO	Own costs	€ 0,2
	Program Team	TKI Energy	Assignment	€ 0,4
	Out of pocket tbv execution			€ 0,1